RRB JE 2019 (CBT 2) (ME) Previous Year Paper (19 Aug 2019)

Total Time: 2 Hour **Total Marks:** 150

Instructions

Sl No.	Section Name	No. of Question	Maximum Marks	Negative Marks	Positive Marks
1	2nd Stage CBT	150	150	0.33	1

1.) A total of 120 minutes is allotted for the examination.

2.) The server will set your clock for you. In the top right corner of your screen, a countdown timer will display the remaining time for you to complete the exam. Once the timer reaches zero, the examination will end automatically. The paper need not be submitted when your timer reaches zero.

3.) There will, however, be sectional timing for this exam. You will have to complete each section within the specified time limit. Before moving on to the next section, you must complete the current one within the time limits.

2nd Stage CBT

1. When was 'Antyodaya Anna Yojana' launched? **(+1, -0.33)**

   a. October 2000

   b. December 2000

   c. August 2001

   d. October 2002

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2. The ratio between net work for one cycle in a process and displacement volume is - **(+1, -0.33)**

   a. Mean effective pressure

   b. Temperature ratio

   c. Volume ratio

   d. Pressure ratio

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3. Calcium oxide and water combine to form calcium hydroxide. This is an example of _ _ _ _ _ _ _ _ _ _ reaction. **(+1, -0.33)**

   a. Exothermic reaction

   b. Combination reaction

   c. Both combination reaction and exothermic reaction

   d. Endothermic reaction

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4. To measure which of the following is an ammeter used? (+1, -0.33)

a. Electric current

b. Potential difference

c. Resistance

d. Electric charge

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5. With which of the following sports is Black Pearl associated? (+1, -0.33)

a. Snooker

b. Soccer

c. Golf

d. Horse Racing

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6. The brain interprets the frequency of an emitted sound called - (+1, -0.33)

a. Wavelength

b. Wave velocity

c. Pitch

d. Oscillation

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7. A ray of light passing through principal focus of a convex lens after refraction will emerge - (+1, -0.33)

a. Through the centre of curvature

b. Through the principal focus

c. Parallel to the principal axis

d. Without any deviation

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8. The operation involving light and rapid hammering on the weld soon after welding, to relieve stress is called - **(+1, -0.33)**

a. Straightening

b. Peening

c. Annealing

d. Heat treatment

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9. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ is a weld where the size of the weld is the same as the thickness of the thinner object joined together. **(+1, -0.33)**

a. Continuous intermittent fillet weld

b. Staggered intermittent fillet weld

c. Full fillet weld

d. Chain intermittent fillet weld

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10. Odisha shares its border with _ _ _ _ _ _ _ _ Indian states. **(+1, -0.33)**

a. Six

b. Three

c. Four

d. Five

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11. The ratio of brake power to indicated power is called - (+1, -0.33)

a. Indicated thermal efficiency

b. Relative efficiency

c. Mechanical efficiency

d. Volumetric efficiency

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12. A typical S-N curve for a material is related to _____ failure assessment. (+1, -0.33)

a. Fatigue

b. Creep

c. Shear

d. Impact

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13. Convert 373^0 C into Kelvin scale. (+1, -0.33)

a. 746 K

b. 846 K

c. 546 K

d. 646 K

14. With the increase in atomic number in period - (+1, -0.33)

a. Chemical reactivity decreases

b. Metallic character increases

c. Metallic character decreases

d. Chemical reactivity increases

15. Galvanization is the process of coating a metal with - (+1, -0.33)

a. Enamel

b. Tin

c. Red oxide

d. Zinc

16. Nuclides which have same mass number are called - (+1, -0.33)

a. Isotones

b. Isotopes

c. Isomers

d. Isobars

17. With which sport is the term 'Beamer' associated? (+1, -0.33)

a. Chess

b. Football

c. Hockey

d. Cricket

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18. A group of stars, which has a recognisable shape is called as - (+1, -0.33)

a. Comet

b. Meteoroid

c. Meteorite

d. Constellation

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19. Which of the following is difficult without friction? (+1, -0.33)

a. Moving a heavy box from one place to another

b. Holding a glass tumbler

c. Playing carrom

d. The movement of the door

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20. _____ is known as balanced flame. (+1, -0.33)

a. Oxidising flame

b. Carburising flame

c. Neutral flame

d. Reducing flame

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21. Which great personality of the world was also known as 'Fuehrer'? **(+1, -0.33)**

a. Adolf Hitler

b. Vladimir Lenin

c. Joseph Stalin

d. Napoleon Bonaparte

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22. What is the name of world's first robot citizen created in October 2017? **(+1, -0.33)**

a. Stella

b. Michael

c. Dennis

d. Sophia

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23. Who is the present CBI Director? **(+1, -0.33)**

a. Alok Verma

b. Rishi Kumar Shukla

c. Sanjay Mathur

d. Rakesh Asthana

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24. The rate of change of momentum of an object is - **(+1, -0.33)**

a. Equal to displacement of the object

b. Directly proportional to the resultant force applied

c. Equal to its mass

d. Inversely proportional to the resultant force applied

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25. In 2019, which country launched a new export route to India through the Chabahar Port? **(+1, -0.33)**

a. Afghanistan

b. Pakistan

c. Nepal

d. Bhutan

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26. Which type of paint is manufactured by dissolving asphalt or vegetable bitumen in oil or petroleum? **(+1, -0.33)**

a. Bituminous paint

b. Cement paint

c. Enamel Paint

d. Synthetic rubber paint

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27. Which of the following is a physical property of a metal? **(+1, -0.33)**

a. Reduction

b. Melting point

c. Corrosion
×
duplicate options found. English Question 1 options 2,3

d. Oxidation

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28. The first Chairperson of the National Green Tribunal (NGT) was - **(+1, -0.33)**

a. Justice A K Ganguly

b. Justice Markandey Katju

c. Justice A.S. Naidu

d. Justice Lokeshwar Singh Panta

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29. Which country is the host of ICC Women's T20 World Cup 2020? **(+1, -0.33)**

a. West Indies

b. Australia

c. England

d. India

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30. Which of the following is a ferrous material? **(+1, -0.33)**

a. Cast iron

b. Copper

c. Nickel

d. Aluminium

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31. Which of the following materials has the lowest melting point? **(+1, -0.33)**

a. Tungsten

b. Wrought iron

c. Zinc

d. Magnesium

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32. When was the Gandhi - Irwin pact carried out? **(+1, -0.33)**

a. 1930

b. 1931

c. 1941

d. 1940

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33. The ocean covers _ _ _ _ _ _ _ _ percentage of Earth's surface. **(+1, -0.33)**

a. 71%

b. 51%

c. 91%

d. 61%

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34. _____ is a solid state welding process in which coalescence is effected by high - velocity movement together of the parts to be joined produced by a controlled detonation. (+1, -0.33)

a. Friction welding

b. Explosion welding

c. Forged welding

d. Diffusion welding

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35. When did India first take part in the Olympic Games? (+1, -0.33)

a. 1920

b. 1972

c. 1974

d. 1928

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36. A rectangular channel that carries a discharge of 5 m^3/sec is 2 m wide. The critical depth of the flow is - (+1, -0.33)

a. 1.25 m

b. 1.07 m

c. 0.565 m

d. 0.86 m

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37. Which of the following animals was under the category of "critically (+1, -0.33)

endangered species" till 2008, later upgraded to "endangered species"?

a. Panda

b. Asiatic Lion

c. Sumatran Rhinoceros

d. Indian Tiger

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38. How many zones are there in neutral flame? **(+1, -0.33)**

a. 5

b. 3

c. 4

d. 2

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39. The ratio of the electrode diameter to core diameter is - **(+1, -0.33)**

a. Weld ratio

b. Coating factor

c. Coating efficiency

d. Core factor

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40. Who has been appointed as the Chairman of India's Lokpal or anti-corruption ombudsman? **(+1, -0.33)**

a. Mehr Chand Mahajan

b. Pinaki Chandra Ghose

c. Bijan Kumar Mukherjee

d. Sudhi Ranjan Das

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41. The important pass that links Kerala with Tamil Nadu is - **(+1, -0.33)**

a. Thalghat

b. Palghat

c. Bhor Ghat

d. Aramboli

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42. 'Swing over carriage' of a lathe refers to which of the following? **(+1, -0.33)**

a. Diameter of hole through lathe spindle

b. Maximum job length that can be held between the centres

c. Largest diameter of work that will revolve over the lathe saddle

d. Height of the centres measured over the lathe bed

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43. Which of the following is used as energiser in pack carburising? **(+1, -0.33)**

a. Barium carbonate

b. Sodium phosphate

c. Hydrogen peroxide

d. Sodium carbonate

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44. The binary equivalent of the decimal number 10 is _ _ _ _ _ _ _ _ _ _. **(+1, -0.33)**

a. 0010

b. 10

c. 010

d. 1010

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45. The crystal structure of α-iron is - **(+1, -0.33)**

a. Close packed hexagonal

b. Body centered cubic

c. Simple cubic

d. Face centered cubic

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46. Which of the following is NOT involved in five M's in production or operations management? **(+1, -0.33)**

a. Materials

b. Motion

c. Men

d. Machines

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47. The ratio of specific heat of air at constant pressure to the specific heat of air at constant volume is equal to - **(+1, -0.33)**

a. 1.41

b. 1.89

c. 1.01

d. 2.2

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48. A Bell - Coleman cycle is a reversed - **(+1, -0.33)**

a. Brayton cycle

b. Ericsson cycle

c. Carnot cycle

d. Atkinson cycle

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49. When a structural member is strained due to external imposed loads, the energy stored is called - **(+1, -0.33)**

a. Yield point

b. Strain energy

c. Elastic limit

d. Endurance limit

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50. A circular cylinder partly filled with a liquid is rotated about its axis at ω rad/s without spilling. At the walls, the rise of liquid surface above the **(+1, -0.33)**

original level will be -

a. $\omega^2 r^2 / 8g$

b. $\omega^2 r^2 / g$

c. $\omega^2 r^2 / 4g$

d. $\omega^2 r^2 / 2g$

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51. A material which fails suddenly without any plastic deformation is said to be - **(+1, -0.33)**

a. Ductile material

b. Elastic material

c. Plastic material

d. Brittle material

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52. The term PAN in chemical refers to - **(+1, -0.33)**

a. Peroxyacyl nitrogen

b. Peroxyacyl nitrolic

c. Peroxyacyl nitrite

d. Peroxyacyl nitrate

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53. MAC address is of : **(+1, -0.33)**

a. 24 bits

b. 36 bits

c. 48 bits

d. 42 bits

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54. The ruby rod used in lasers is made of - **(+1, -0.33)**

a. Copper

b. Silicon

c. Duriron

d. Aluminium oxide

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55. Which of the following statements is TRUE about anodising? **(+1, -0.33)**

a. It is a zinc diffusion process

b. It is a process used for making thin phosphate coating on steel to act as a base or primer for enamels and paints

c. It is an oxidising process used for aluminium and magnesium articles

d. It is a process of coating of zinc by hot dipping

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56. The B-H curve for _ _ _ _ _ _ will be a straight line passing through the origin. **(+1, -0.33)**

a. Silicon steel

b. Soft iron

c. Air

d. Hardened steel

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57. A Mcleod gauge is used to measure - **(+1, -0.33)**

a. The acidity of a solution

b. Vacuum pressure

c. Diameter of fine particles

d. Discharge through a river

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58. The distance transversed by a particle along the straight line in t seconds is represented by $x = t^3(t - 6)$, the acceleration of the particle will be given by the equation : **(+1, -0.33)**

a. $12t^2 - 36$

b. $4t^3 - 18t^2$

c. $9t^2 - 18t$

d. $12t^2 - 36t$

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59. In M - L - t - T system, the dimension of thermal diffusivity is - **(+1, -0.33)**

a. ML^2t^{-1}

b. L^2t^{-1}

c. $M^2L^2T^{-1}$

d. $L T^{-2}$

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60. If the zero of the vernier scale is on the right of zero of the main scale, then the - **(+1, -0.33)**

a. Zero correction will be negative

b. Both zero error will be positive and zero correction will be negative

c. Zero error will be positive

d. Zero error will be negative

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61. Rutherford's alpha particle scattering experiment was responsible for the discovery of - **(+1, -0.33)**

a. Neutron

b. Atomic nucleus

c. Electron

d. Proton

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62. The 3 R principle in waste management involves - **(+1, -0.33)**

a. Reduce, Reuse, Recycle

b. Reduce, Reform, Reset

c. Reduce, Regain, Reuse

d. Reduce, Retain, Regain

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63. The range of a projectile is maximum, when the angle of projection is - **(+1, -0.33)**

a. 60°

b. 45°

c. 90°

d. 30°

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64. Capillary tube viscometers used for measurement of viscosity are based on - **(+1, -0.33)**

a. Hagen - Poiseuille equation

b. Stoke's Law

c. Chezy equation

d. Darcy - Weisbach equation

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65. For a column of length (L) and flexural rigidity (EI) which has one end fixed and other end free, the expression for critical load is given as - **(+1, -0.33)**

a. $P = \pi^2 EI/L^2$

b. $P = 4\pi^2 EI/L^2$

c. $P = 2\pi^2 EI/L^2$

d. $P = \pi^2 EI/4L^2$

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66. Which of the following type of layout is suitable for automobile manufacturing concern? **(+1, -0.33)**

a. Product layout

b. Combination layout

c. Process layout

d. Fixed position layout

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67. In source data entry devices, what is full form of OMR? **(+1, -0.33)**

a. Open Mark Recognition

b. Optical Mark Recognition

c. Optical Message Reader

d. Open Message Recognition

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68. Single point thread cutting tool should ideally have: **(+1, -0.33)**

a. Zero rake

b. Positive rake

c. Negative rake

d. Normal rake

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69. The three forces of 100 N, 200 N and 300 N have their lines of action parallel to each other but act in opposite directions. These forces are known as - **(+1, -0.33)**

a. Non - concurrent non - parallel forces

b. Coplanar concurrent forces

c. Like parallel forces

d. Unlike parallel forces

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70. For grade IT 7, value of tolerance is equal to - **(+1, -0.33)**
(where IT - International Tolerance and i - standard tolerance unit/factor)

a. 8 i

b. 16 i

c. 24 i

d. 10 i

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71. Centre of buoyancy is - **(+1, -0.33)**

a. Centre of gravity of the body

b. Centre of mass of displaced fluid

c. Mid point between Centre of gravity and metacentre

d. The point of intersection of buoyant force and centre line of the body

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72. In MS - Excel, what is the shortcut key you can press to Select the entire row? **(+1, -0.33)**

a. Ctrl + Shift + Space

b. Ctrl + Home

c. Ctrl + Space

d. Shift + Space

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73. In the number drill series, the largest drill size is _ _ _ _ _ _ _ _ _. **(+1, -0.33)**

a. 5.613 mm

b. 5.791 mm

c. 5.410 mm

d. 4.523 mm

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74. In Gmail, the email address of the recipients can be entered in _ _ _ _ _ _ _ _ _ _ field. **(+1, -0.33)**

a. From

b. Message

c. Subject

d. To

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75. Moment of inertia of a rectangular section having width (b) and depth (d) about an axis passing through its centre of gravity and parallel to the depth, is- **(+1, -0.33)**

a. $bd^3/36$

b. $db^3/36$

c. $bd^3/12$

d. $db^3/12$

76. The dodo was extinct due to - (+1, -0.33)

a. Invasion of non-native species

b. Over-exploitation of resources

c. Pollution

d. Global environmental change

77. Identify the non - renewable source of energy from the following. (+1, -0.33)

a. Fuel cells

b. Wind power

c. Wave power

d. Coal

78. Rails of railway track are welded by - (+1, -0.33)

a. Thermit welding

b. TIG welding

c. Carbon dioxide welding

d. SAW

79. In a thick cylinder pressurized from inside, the hoop stress is maximum at : (+1, -0.33)

a. The outer radius

b. The inner radius

c. Both the inner and the outer radii

d. The centre of the wall thickness

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80. Which material has the highest value of Poisson's ratio? **(+1, -0.33)**

a. Rubber

b. Wood

c. Copper

d. Steel

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81. Aeroplane and certain automobile parts are usually made of - **(+1, -0.33)**

a. Duralumin

b. German silver

c. Magnalium

d. Aluminium bronze

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82. A shaft of 50 mm diameter and 0.7 m long is subjected to a torque of 1200 Nm. Calculate the shear stress. **(+1, -0.33)**

a. 33.3 MPa

b. 67.7 MPa

c. 93.2 MPa

d. 48.9 MPa

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83. Which of the following lines is known as the trend line? **(+1, -0.33)**

a. Least square line

b. End point line

c. Terminal line

d. Best - fit line

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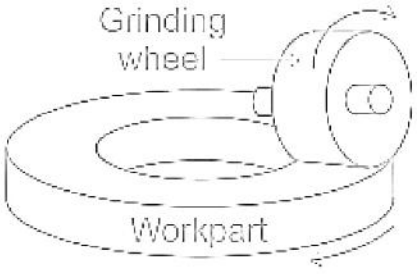
84. Which industry flourishes in Nepanagar? **(+1, -0.33)**

a. Paper Industry

b. Chemical Industry

c. Sugar Industry

d. Cement Industry



85. **(+1, -0.33)**

The above given diagram is _ _ _ _ _ _ _ _ surface grinding machine.

a. Horizontal spindle and rotary table

b. Horizontal spindle and reciprocating table

c. Vertical spindle and reciprocating table

d. Vertical spindle and rotary table

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86. Silica is - **(+1, -0.33)**

a. A ceramic material

b. A metallic alloy

c. An organic polymer

d. A composite material

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87. Two forces of magnitude 6 N and 10 N are inclined at an angle of 60° with each other. The magnitude of the resultant force is - **(+1, -0.33)**

a. 6 N

b. 16 N

c. 14 N

d. 5 N

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88. In an iron - carbon alloy, the content of carbon is stated to be 4.3 percent. Such a cast iron is known as - **(+1, -0.33)**

a. Hypo eutectic cast iron

b. Hyper eutectic cast iron

c. Eutectic cast iron

d. Such a nomenclature does not exist

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89. The letter K in the conventional abrasive wheel specified by 51 A 60 K 5 V 05 denotes the - **(+1, -0.33)**

a. Hardness of the wheel

b. Type of abrasive

c. Bond material

d. Structure of the wheel

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90. Which of the following statements is FALSE about CPM? **(+1, -0.33)**

a. It is an activity oriented technique

b. It is mainly used for construction programme

c. It ignores chance element

d. It is an event oriented technique

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91. In inventory control theory, the Economic Order Quantity is **(+1, -0.33)**

a. Capacity of a warehouse

b. Lot size corresponding to break-even analysis

c. Optimum lot size

d. Average level of inventory

92. Cutting ratio is the ratio of - (+1, -0.33)

a. Cutting velocity to chip velocity

b. Chip velocity to cutting velocity

c. Depth of cut to cutting velocity

d. Chip thickness to depth of cut

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93. Sherardizing is a corrosion resistant coating of _____ on the surface of iron. (+1, -0.33)

a. Copper

b. Aluminium

c. Zinc

d. Nickel

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94. For laminar flow through a pipe, the friction factor - (+1, -0.33)

a. Varies linearly with the Reynold's number

b. Is exactly equal to the square of Reynold's number

c. Is independent of Reynold's number

d. Varies linearly with the inverse of Reynold's number

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95. The Moment of Inertia of a body does not depend upon - (+1, -0.33)

a. Shape of the body

b. Mass of the body and its distribution within the body

c. Angular velocity of the body

d. Axis of rotation of the body

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96. Which of the following planers are specially designed for cutting the edges of heavy steel plates, pressure vessels and armoured plates? **(+1, -0.33)**

a. Double column planer

b. Plate planer

c. Open side planer

d. Pit type planer

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97. _ _ _ _ _ _ _ _ _ _ is the process used to shine metal, wood, or composites using a cloth wheel impregnated with cutting compounds or rouges. **(+1, -0.33)**

a. Honing

b. Nitriding

c. Lapping

d. Buffing

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98. Chatter in machine tools is caused due to - **(+1, -0.33)**

a. Transient vibration

b. Self - excited vibration

c. Free vibration

d. Forced vibration

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99. Negative slack occurs when - **(+1, -0.33)**

a. Events stick to their schedule

b. Dummy activities are large in number

c. Activities lie in critical path

d. There is deficiency of resources

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100. _ _ _ _ _ _ is the process used for applying a protective finish to metallic objects. **(+1, -0.33)**

a. Embossing

b. Engraving

c. Lacquering

d. Etching

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101. The output is high only if one of the input is high. The above statement represents _ _ _ _ _ **(+1, -0.33)**

a. NAND gate

b. OR gate

c. AND gate

d. EX - OR gate

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102. Which of the following theorem states that the algebraic sum of the moments of a system of coplanar forces about a moment centre in their plane is equal to the moment of their resultant force about the same moment centre? **(+1, -0.33)**

a. Varignon's theorem

b. Triangle law of forces

c. Lami's theorem

d. Parallelogram law of forces

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103. Which of the following is known as the Hermaphrodite caliper? **(+1, -0.33)**

a. Inside caliper

b. Odd leg caliper

c. Outside caliper

d. Transfer caliper

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104. Which of the following types of medicine is used for treating indigestion? **(+1, -0.33)**

a. Antacid

b. Analgesic

c. Antiseptic

d. Antibiotic

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105. The specific speed of a centrifugal pump is defined as the speed of geometrically similar pump which would - **(+1, -0.33)**

a. Deliver unit discharge at unit power

b. Produce unit power with unit head

c. Deliver unit discharge at unit head

d. Require unit power to develop unit head

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106. The ratio of specific weight of a liquid to the specific weight of pure water at a standard temperature is called - **(+1, -0.33)**

a. Density of liquid

b. Surface tension of liquid

c. Specific gravity of liquid

d. Compressibility of liquid

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107. Dalton's law states that the total pressure of the mixture of gases is equal to - **(+1, -0.33)**

a. Sum of the partial pressures of all multiplied by the average atomic weight

b. Sum of the partial pressures of all the gases

c. Average of the partial pressures of all the gases

d. Product of the partial pressures of all the gases

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108. An email address consists of _ _ _ _ _ parts. **(+1, -0.33)**

a. 2

b. 3

c. 4

d. 5

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109. Piston compression rings are made of - **(+1, -0.33)**

a. Cast iron

b. Aluminium

c. Brass

d. Spring steel

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110. Stress at any point in a material is defined as - **(+1, -0.33)**

a. Load per unit time

b. Young's modulus of elasticity per unit strain

c. Modulus of rigidity

d. Resisting force per unit area

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111. When work piece is fed in the same direction as that of the cutter tooth at **(+1, -0.33)**

the point of contact, that type of milling is known as -

a. Down milling

b. Slot milling

c. Up milling

d. Slab milling

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112. In PERT analysis, the possible number of time estimates for activities linking up two events are - **(+1, -0.33)**

a. Four - time estimates

b. Two - time estimates

c. Three - time estimates

d. One - time estimate

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113. When a peripheral device needs immediate attention from the operating system, it generates a(n) : **(+1, -0.33)**

a. Spool

b. Interrupt

c. Page File

d. Stack

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114. The pour point of any specific fuel is defined as - **(+1, -0.33)**

a. The minimum temperature at which it gives sufficient quantity inflamable vapours to ignite in contact with the flame

b. The temperature at which it freezes

c. The temperature at which fuel catch fire

d. The temperature below which it becomes plastic and will not flow

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115. The relationship between tool life (T) and cutting speed (V) m/min is given as - **(+1, -0.33)**

a. $V^n/T = C$

b. $VT^n = C$

c. $V^nT = C$

d. $T^n/V = C$

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116. Which of the following is NOT a stylus probe instrument? **(+1, -0.33)**

a. Taylor Hobson Talysurf

b. Tomlinson surface meter

c. Microscope

d. Profilometer

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117. In ABC analysis, the C items are those which represents - **(+1, -0.33)**

a. Small percentage of closing inventory value

b. Small percentage of total consumption value

c. High percentage of closing inventory value

d. High percentage of total consumption

---

118. Silver article become black on prolonged exposure to air. This is due to formation of **(+1, -0.33)**

a. Ag_2SO_3

b. Ag_2S

c. Ag_2O

d. Ag_3N

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119. The value of modulus of elasticity for steel is - **(+1, -0.33)**

a. $2 \times 10^5 kgf/cm^2$

b. $2 \times 10^6 kgf/cm^2$

c. $1 \times 10^6 kgf/cm^2$

d. $0.5 \times 10^6 kgf/cm^2$

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120. Which of the following beams is likely to have the point of contraflexure? **(+1, -0.33)**

a. Beam fixed at both ends

b. Cantilever beam

c. Simply supported beam

d. Beam with over hangs

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121. Which of the following is NOT a part of micrometer? **(+1, -0.33)**

a. Spindle

b. Beam

c. Anvil

d. Sleeve

---

122. A fine grained steel is - **(+1, -0.33)**

a. More ductile and has a less tendency to distort during heat treatment

b. Less tough and has a greater tendency to distort during heat treatment

c. More ductile and has a greater tendency to distort during heat treatment

d. Less tough and has a less tendency to distort during heat treatment

---

123. Which of the following is a scalar quantity? **(+1, -0.33)**

a. Impulse

b. Torque

c. Momentum

d. Energy

---

124. "Ozone Hole" is a - **(+1, -0.33)**

a. Hole in the atmosphere

b. Hole in the troposphere

c. Destruction of ozone layer

d. Hole in the hydrosphere

---

125. What is the standard unit for luminous intensity? **(+1, -0.33)**

a. Tesla

b. Candela

c. Steradian

d. Radian

---

126. Which of the following is used to cut any text or field in MS-Excel? **(+1, -0.33)**

a. Ctrl + A

b. Alt + C

c. Ctrl + X

d. Ctrl + C

---

127. Which of the following instruments is used to measure the surface **(+1, -0.33)**

roughness?

a. Profilometer

b. Auto - collimator

c. Clinometer

d. Optical square

---

128. Bin cards are used in keeping record of - **(+1, -0.33)**

a. Machine utilization

b. Entry/exit time of workers

c. Material storage

d. Man power

---

129. A cantilever beam is one which is - **(+1, -0.33)**

a. Fixed at one end and free at the other end

b. Fixed at both ends

c. Supported at its ends

d. Supported at more than two points

---

130. Which of the following parameters indicates the spacing between the abrasive grains of a grinding wheel? **(+1, -0.33)**

a. Structure

b. Both grade and bond

c. Bond

d. Grade

---

131. Which of the following fits is classified under transition fit? (+1, -0.33)

a. Loose fit

b. Wringing fit

c. Side fit

d. Running fit

---

132. Bauxite is used for - (+1, -0.33)

a. Manufacture of aluminium

b. Refining gold

c. Extracting magnesium

d. Making of nuclear fuels

---

133. Which of the following describes the orificemeter? (+1, -0.33)

a. A pipe has contra, throat and divergent portion

b. A tunnel section with a large reservoir

c. A pipe has a circular plate with a hole inside it

d. A large tank with a small hole at one of its ends

---

134. The process of removing dull grains in order to make grinding wheel sharp is known as - **(+1, -0.33)**

a. Trueing

b. Loading

c. Dressing

d. Glazing

---

135. The size of a planer is generally specified by - **(+1, -0.33)**

a. Table size and height of cross rail

b. Stroke length

c. Table size

d. Number of tools provided

---

136. Euler's formula is not valid for mild steel column when slenderness ratio is - **(+1, -0.33)**

a. Less than 80

b. More than 80

c. More than 120

d. More than 30

---

137. Which of the following points is NOT found on iron-carbon equilibrium diagram? (+1, -0.33)

a. Peritectic point

b. Curie point

c. Eutectic point

d. Eutectoid point

---

138. If one mole of carbon atoms weighs 12 gram, what is the mass in gram of 1 atom of carbon? (+1, -0.33)

a. 3×10^{-23} g

b. 1.99×10^{-23} g

c. 2×10^{-22} g

d. 1×10^{-23} g

---

139. Which of the following is NOT a world heritage site? (+1, -0.33)

a. Kaziranga National Park

b. Periyar National Park

c. Manas Wildlife Sanctuary

d. Nanda Devi National Park

---

140. Minati Mishra is associated with - (+1, -0.33)

a. Odissi

b. Manipuri

c. Bharatanatyam

d. Kathakali

---

141. The thermal efficiency of a standard Otto cycle for a compression ratio of 5.5 will be - **(+1, -0.33)**

a. 75%

b. 100%

c. 25%

d. 50%

---

142. In P - system of inventory control - **(+1, -0.33)**

a. Reorder point is fixed

b. Time between orders is constant

c. Production rate remains constant

d. Order quantity remains constant

---

143. _____is the process of removing exhaust gases from the cylinder after combustion and replenishing the cylinder with fresh air. **(+1, -0.33)**

a. Supercharging

b. Knocking

c. Detonation

d. Scavenging

---

144. In a differential manometer, a head of 0.5 m of fluid A in limb 1 is found to balance a head of 0.3 m of fluid B in limb 2. The atmospheric pressure is 760 mm of mercury. The ratio of specific gravities of A to B is- **(+1, -0.33)**

a. 0.25

b. 2

c. 0.6

d. 4

---

145. Darcy Weisbach equation is used to find loss of head due to - **(+1, -0.33)**

a. Friction

b. Sudden contraction

c. Sudden enlargement

d. Obstruction

---

146. In a Capstan lathe, turret is mounted on - **(+1, -0.33)**

a. Headstock

b. Copy turning attachment

c. Compound slide

d. A short slide of ram sliding on the saddle

---

147. Which of the following is an example of chlorinated hydrocarbon insecticide? (+1, -0.33)

a. Oxamyl

b. Fenthion

c. Toxaphene

d. Allethrin

---

148. During manufacture of cement, the handling of lime stone is done by - (+1, -0.33)

a. Bucket conveyor

b. Belt conveyor

c. Fork lift crane

d. Overhead crane

---

149. Impulse gives a measure of the product of - (+1, -0.33)

a. Force and velocity

b. Force and time

c. Force and displacement

d. Mass and acceleration

150. Which of the following is an example of popular antivirus? **(+1, -0.33)**

a. Bitdefender

b. Worms

c. Sasser

d. Encrypted virus

Answers

1. **Answer: b**

Explanation:

The correct answer is **December 2000**.

- **The 'Antyodaya Anna Yojana' was launched in December 2000.**

Key Points

- Antyodaya anna yojana was launched to help the poorest of the poor .
  - It is implemented for providing rice and wheat at a low rate through the public distribution system.
  - Antyodaya anna yojana launched on 25 th December 2000.
  - Launched by the former Indian prime minister A. B Vajpayee.
  - Introduced during the 9 th five-year planning in India.
  - It was implemented by union food and civil supplies ministry.
  - This scheme was first implemented in the Rajasthan.
  - The food grains allocated through this scheme are 35 kilograms of rice and wheat at ₹ per kilogram of rice and ₹ per kilogram of wheat.
  - Initially, it provided only 25 kilograms of food grains and it was increased to 35 kilograms in 2002.
  - Antyodaya ration card is the identification card issued to the beneficiaries of this scheme.

---

2. **Answer: a**

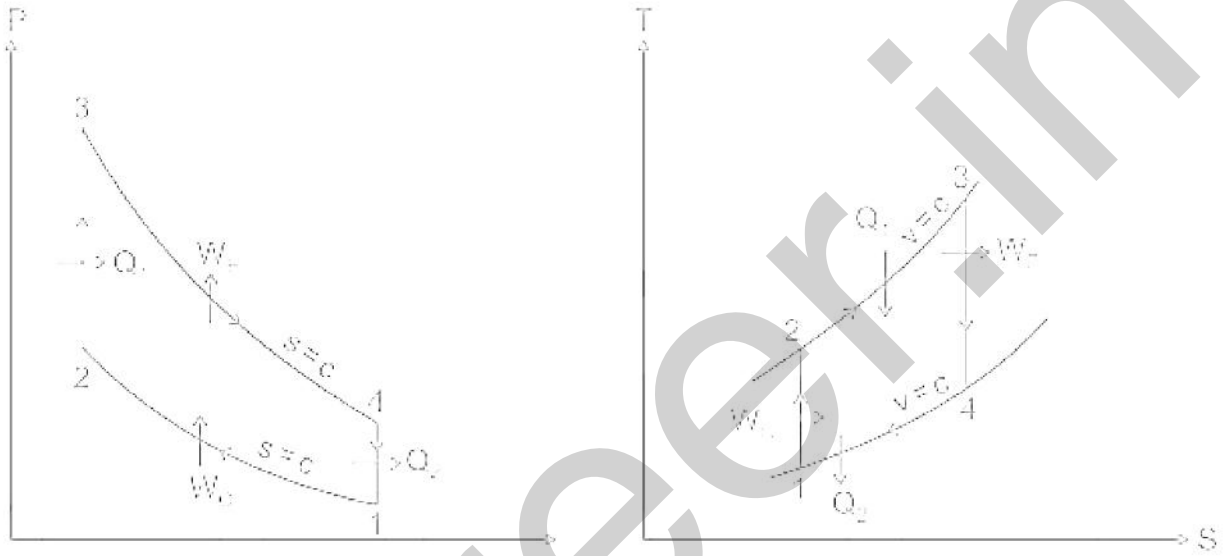
Explanation:

Explanation:

Mean effective pressure is the ratio of the net work done to the displacement volume of the piston.

$mep = \frac{W_{net}}{V_s}$

For Otto cycle:



$W_{net} = Q_1 - Q_2 = mC_v\left[(T_3 - T_2) - (T_4 - T_1)\right]$

$V_s = V_1 - V_2 = V_1\left(1 - \frac{V_2}{V_1}\right) = V_1\left(1 - \frac{1}{r}\right)$

$V_s = V_1\left(\frac{r-1}{r}\right) = \frac{mRT_1}{P_1}\left(\frac{r-1}{r}\right) = \frac{mC_v(r-1)T_1}{P_1}\left(\frac{r-1}{r}\right)$

$mep = \frac{W_{net}}{V_s} = \frac{mC_v\left[(T_3 - T_2) - (T_4 - T_1)\right]}{\frac{mC_v(\gamma-1)T_1}{P_1}\left(\frac{r-1}{r}\right)}$

---

3. **Answer: c**

Explanation:

Explanation:

Chemical reaction: The chemical reaction is said to be the change that brings new products.

Type of reaction:

Combination Reaction:

- The reaction in which two or more substances combine to form one product is called a Combination reaction.

$A + B \rightarrow C$

$CaO + H_2O \rightarrow Ca(OH) + Heat$.

Decomposition Reaction:

- The reaction in which one reactant decomposes or breaks into two or more products is called a Decomposition reaction.

$A \rightarrow B + C$

Displacement Reaction:

- The reaction in which cations or anions are displaced is called displacement reaction.

$A + BC \rightarrow AC + B$

Exothermic Reaction:

- The reaction in which heat is evolved is called an exothermic reaction.

$A + B \rightarrow C + Heat$

$CaO + H2O \rightarrow Ca(OH) + Heat$.

Endothermic Reaction:

- The reaction which takes place by absorbing heat energy is called an endothermic reaction.

$A + B + Heat \rightarrow C + D$

---

4. **Answer: a**

Explanation:

Explanation:

- Electric current is defined as the rate of flow of charge or electron, so its direction is the flow of positive charge.
- SI unit of electricity is Ampere(A) and it is a scalar quantity.
- Resistance is the opposition delivered by the conductor through which the current flows.
- **A device that is used to measure electric current in a circuit is called ammeter.** The resistance of an ideal ammeter is always Zero and is always connected to the circuit in series.
- A voltmeter is a device which is used to measure the potential difference between the two points in a circuit. The resistance of an ideal voltmeter is infinite.
- A galvanometer is a device that is used to detect and measure small electric currents in any circuit. It can measure current up to 10 -6 Ampere.
- Now, the interesting fact is:
  - We can convert a Galvanometer into an ammeter by connecting a shunt parallel to it.
  - A shunt is a small wire having very low resistance
  - We can also convert a Galvanometer into a voltmeter by connecting a very high resistance in series.

---

5. **Answer: b**

Explanation:

Explanation:

- Black Pearl:
  - Pele is a Brazilian football (soccer) player , in his time probably the most famous and possibly the best-paid athlete in the world.
  - He was part of the Brazilian national teams that won three World Cup championships (1958, 1962, and 1970).
  - He is honored with the tag of Black Pearl.
  - Pele was the recipient of the International Peace Award in 1978.

- In 1980 he was named Athlete of the Century by the French sports publication L'Equipe , and he received the same honour in 1999 from the International Olympic Committee.
- Football is an outdoor game played between two teams having 11 players on each side.
- In 2014 the Pele Museum opened in Santos, Brazil.
- In addition to his accomplishments in sports, he published several best-selling autobiographies and starred in several successful documentary and semi-documentary films.
- He also composed numerous musical pieces, including the soundtrack for the film Pele (1977).

Additional Information

- Golf:
  - Golf is an outdoor game in which a player strikes a small ball with various clubs from a series of starting points (teeing grounds) into a series of holes on a course.
  - Golf can be played between any number of players.
  - The player who holes his ball in the fewest strokes wins.
  - The origins of the game are difficult to ascertain, although evidence now suggests that early forms of golf were played in the Netherlands first and then in Scotland.
- Snooker:
  - Snooker is an indoor billiards game of British origin that is played on a table similar in size and markings to that used in English billiards.
  - The game arose in India as a game for soldiers in the 1870s.
  - Snooker is played in tournaments between 7 players.
  - Players try to pocket first the red and then the nonred balls , scoring one point for each red and the number value of the others.
- Horse riding:
  - Equestrianism is commonly known as horse riding or horseback riding.
  - It includes the disciplines of riding, driving, and vaulting.
  - It is played between two teams of four players each who use mallets with long, flexible handles to drive a wooden ball down a grass field and between two goal posts.

- This broad description includes the use of horses for practical working purposes, transportation, recreational activities, artistic or cultural exercises, and competitive sport.

---

6. **Answer: c**

Explanation:

Explanation:

- **The way in which the brain interprets the frequency of an emitted sound is called its pitch**
- The faster the vibration of the source, the higher is the frequency and the higher is the pitch
- Objects of different sizes and conditions vibrate at different frequencies to produce sounds of different pitch
- Hence, Pitch is a characteristic of sound that depends upon its frequency

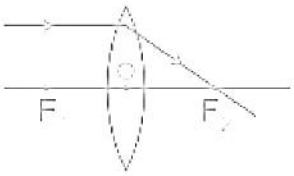
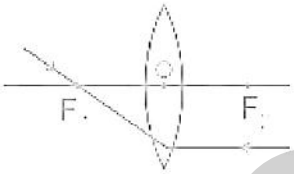
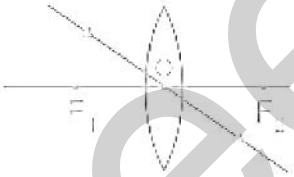
---

7. **Answer: c**

Explanation:

CONCEPT :

- All the cases for the ray of light emanating from the source and refracting through a convex lens are shown in the table:

	Light ray from object is	Ray diagram	How it appears after refraction
1.	Parallel to the principal axis		After refraction from a convex lens, passes through the principal focus on the other side of the lens
2.	Passing through a principal focus		After refraction from a convex lens, will emerge parallel to the principal axis
3.	Passing through the optical centre of a lens		After refraction from a convex lens will emerge without any deviation

EXPLANATION :

- From the above diagram, it is clear that a ray of light passing through the first principal focus of a convex lens emerges parallel to the principal axis after refraction. Therefore option 2 is correct.

---

8. **Answer: b**

Explanation:

Explanation:

Peening:

- **Peening involves light and rapid hammering on the weld soon after welding to relieve stress.**
- Peening is the mechanical working of metals by means of **impact blows.**
- Various specifications and codes allow the use of peening on intermediate weld layers for reducing the distortion and residual stresses, however the prohibit the

use of peening on the first and last layer.

- Peening in the first layer may conceal cracking or it could actually pierce the weld.
- Peening the last layer is prohibited largely on the belief that cold working would reduce notch toughness of the weld metal, since there is no subsequent application of heat to anneal it.

---

9. **Answer: c**

Explanation:

Explanation:

A fillet weld joins two surfaces at an approximate right angle to each other. There are several types of fillet weld:

- Full fillet weld**is a weld where the size of the weld is the same as the thickness of the thinner object joined together.**
- Staggered intermittent fillet weld refers to two lines of intermittent welding on a joint. An example is a tee joint (see below) where the fillet increments that are in one line are staggered in comparison to the other line.
- Chain Intermittent fillet weld refers to two lines of intermittent fillet welds in a lap joint or T where the welds in one line are approximately opposite those in the other line.

Additional Information

Other terms associated with fillet welds include:

- **Boxing** refers to the continuation of a fillet weld around a corner of a member. It is an extension of the principal weld.
- **Convexity** : Refers to the maximum perpendicular distance from the face of a convex fillet weld to a line joining the weld toes.

Groove Welds:

- The second most popular type of weld is the groove weld. There are seven basic types of groove welds, which are shown in figure.
- The groove weld refers to beads that are deposited in a groove between two members to be joined.

Surfacing Weld:

- These are welds composed of one or more strings or weave beads deposited on an unbroken surface to obtain desired properties or dimensions.
- This type of weld is used to build up surfaces or replace metal on worn surfaces. It is also used with square butt joints.

Plug Weld:

- Plug welds are circular welds made through one member of a lap or tee joint joining that member to the other.
- The weld may or may not be made through a hole in the first member; if a hole is used, the walls may or may not be parallel and the hole may be partially or completely filled with weld metal.

Slot Weld:

- This is a weld made in an elongated hole in one member of a lap or tee joint joining that member to the surface of the other member that is exposed through the hole.
- This hole may be open at one end and may be partially or completely filled with weld metal

Flash Weld:

- Flash welding is referred to as a resistance welding process where fusion is produced over the entire abutting surface.
- Heat is created by the resistance to the current flow between two surfaces and by the application of pressure after heating is mostly complete.
- Flashing is accompanied by the expulsion of metal from the joint.

Seam Weld:

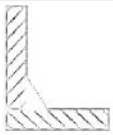
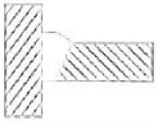
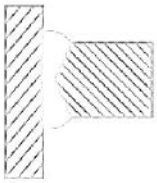
- A weld made by arc seam or resistance seam welding where the welding process is not specified.
- This term infers resistance seam welding.

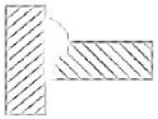
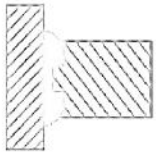
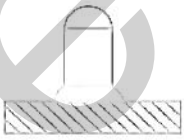
Spot Weld:

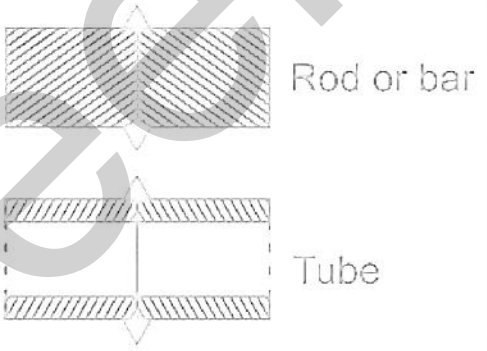
- A spot weld is a weld made by arc spot or resistance spot welding where the welding process is not specified.
- This term infers a resistance spot weld.

Upset Weld:

- An upset weld is a resistance welding process where fusion occurs progressively along a joint of over the entire abutting surface.
- The application of pressure before heating is required and occurs during the heating period.

S. No.	form of weld	Sectional representation	Symbol
1.	Fillet		
2.	Square butt		
3.	Single-V butt		
4.	Double-V butt		
5.	Single-U butt		
6.	Double-U butt		
7.	Single bevel butt		
8.	Double bevel butt		

9.	Single-J butt		
10.	Double-J butt		
11.	Bead (edge or seal)		
12.	Stud		
13.	Sealing run		
14.	Spot		
15.	Seam		

16.	Mashed seam		
17.	Stitch		
18.	Projection		
19.	Flash		

10. **Answer: c**

Explanation:

The correct answer is**four**.

- **Odisha shares its border with four Indian states.**

Key Points

- Odisha is an eastern coastal state that has its capital in Bhubaneshwar.
- Odisha is surrounded by 4 states: **Andhra Pradesh** from the south, **Chhattisgarh** from the west and **Jharkhand and West Bengal** from the north.

- Odisha:
  - Governor-Ganeshi Lal.
  - Capital- Bhubaneshwar

- Chief Minister-Shri Naveen Patnaik

---

11. **Answer: c**

Explanation:

Explanation:

Mechanical efficiency is defined as the ratio of brake power (delivered power) to the indicated power (power provided to the piston).

$\eta_m = \frac{bp}{ip} = \frac{bp}{bp+fp}$

Mechanical efficiency takes into account the mechanical losses in an engine.

Indicated thermal efficiency :

It is the ratio of IP to fuel power.

$\eta_i = \frac{ip}{\dot{m}_f \times CV}$

Volumetric efficiency:

The volumetric efficiency of an engine

- It is defined as the ratio of the actual air capacity to the ideal air capacity.
- It is also the mass of air that enters in suction stroke to the mass of free air equivalent to the piston displacement at intake temperature and pressure conditions.

$\eta_{vol} = \frac{V_{actual}}{V_{swept}}$

which can be further written as

$\eta_{vol} = \frac{\dot{m} \times V_1}{\frac{\pi}{4} D^2 L \times \frac{N}{60} \times K}$

where $\frac{\pi}{4} D^2$ represents the area of the piston.

Relative Efficiency:- It is defined as the ratio of indicated thermal efficiency to the thermal efficiency of a theoretically reversible cycle

$$\text{Relative efficiency} = \frac{\text{Indicated thermal efficiency}}{\text{Thermal efficiency of reversible cycle}}$$

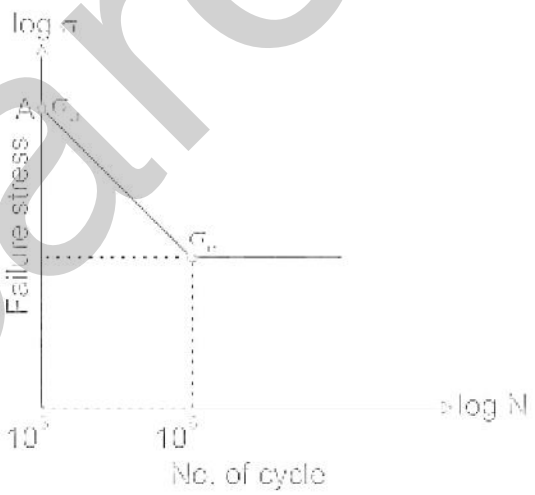
---

12. **Answer: a**

Explanation:

Explanation:

The common form of presentation of fatigue data is by using the S-N curve, where the total cyclic stress or fatigue stress (S) is plotted against the number of cycles to failure (N) in a logarithmic scale.



the fatigue life reduces with respect to the increase in stress range and at a limiting value of stress, the curve flattens off. The point at which the S-N curve flattens off is called the 'endurance limit'.

The line between 10 3 and 10 6 cycles is taken to represent high cycle fatigue.

From the S-N curve, we can see that the curve becomes asymptotic nearly at 10 6 cycles.

---

13. **Answer: d**

Explanation:

Explanation:

- Anders Celsius is the scientist who discovered the Celsius scale of temperature.
- Lord William Thomson Kelvin is the scientist who invented the Kelvin scale of temperature.
- The common unit of measuring temperatures is (' degree Celsius ').
- Even in the clinical thermometer which we use for measuring human body temperature is calibrated on the Celsius scale of temperature.
- The melting point of ice on the Celsius scale of temperature is 0°C .
- The boiling point of water on the Celsius scale is 100°C .
- The SI unit of temperature is Kelvin .
- The melting point of ice on the Kelvin scale of temperature is 273K .
- The boiling point of water on the Kelvin scale is 373K.
  - so, 0°C = 273 K
- The relation between the Kelvin scale and Celsius scale of temperature can be written as:
  - Temperature on Kelvin scale = Temperature on Celsius scale + 273

⇒ 373^0 C + 273 = 646 K

---

14. **Answer: c**

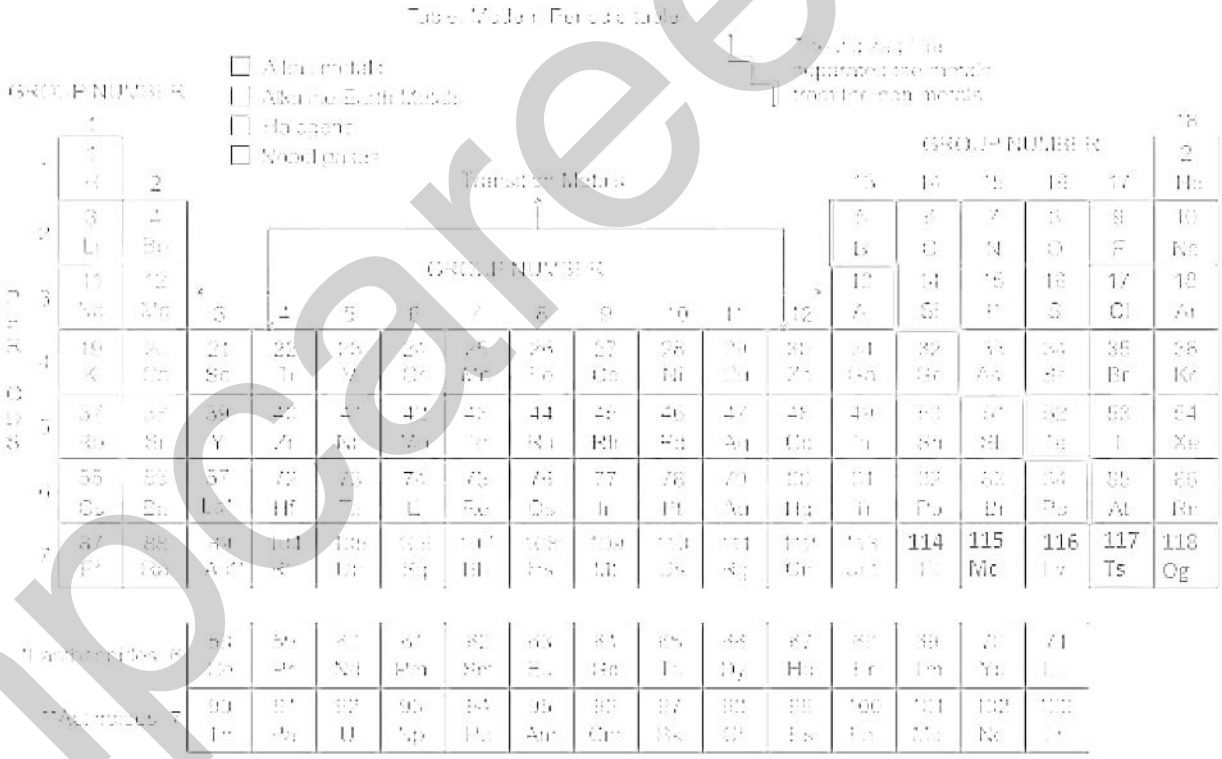
Explanation:

The correct answer is**Metallic character decreases.**

Explanation:

- **Metallic character decreases as atomic number increases** in period in a periodic table.

- As you move from **left to right across the periodic table, the metallic character decreases.**
- This happens because atoms prefer to accept electrons to fill a valence shell rather than lose them to remove the unfilled shell.
- As you **move down the periodic table, the metallic character increases.**
- This is due to the fact that as the atomic radius increases, the electrons become easier to lose.
- As the atomic radius increases, the attraction between the positive nucleus and the negative electrons weakens, causing the electrons to be held more loosely.
- In a group, **metallic character increases with increasing atomic number** , whereas **it decreases from left to right in a period.**



15. **Answer: d**

Explanation:

Explanation:

Galvanization

- The process of putting a protective zinc coating to iron to prevent rusting is known as galvanization .
- It extends the life of iron parts by establishing a membrane between the metal and the air, which prevents iron oxide from developing on its layer.
- Galvanization also provides greater corrosion protection to parts that are exposed to air.
- Galvanizing protects against rust and corrosion in several ways:

1. It acts as a barrier, preventing corrosive chemicals from reaching the iron beneath.
2. The zinc acts as a sacrificial anode, meaning that even if the coating is damaged, the exposed steel is still protected by the zinc that remains on it.
3. The zinc surface reacts with the environment to generate a dense, adhering patina that is impervious to moisture.

---

16. Answer: d

Explanation:

Explanation:

- Isotopes : The atoms of an element having the same atomic number but a different mass number are called isotopes .
- Example: of Isotopes are C - 12 and C - 14 (Both having same atomic number 6 but different mass numbers of 12 and 14.
    - All isotopes have the same chemical properties .
- Isobars : The nuclei which have the same mass number (A) but a different atomic number (Z) are called isobars .
- Examples of Isobars are 14 C 6, 14 N 7
    - From above it is clear that the nuclei which have the same mass number (A) but a different atomic number (Z) are called isobars .
    - Isobars occupy different positions in the periodic table so all isobars have different chemical properties, but same physical properties .

- Isotones : The nuclei having an equal number of neutrons are called isotones .
  - For them both the atomic number (Z) and mass number (A) are different , but the value of (A – Z) is the same .

---

17. **Answer: d**

Explanation:

Explanation:

- The term beamer is associated with Cricket.
- It is a kind of ball delivered when a bowler delivers a high full toss ball that goes over the waist height of the batsman benchmarked when he is standing inside the crease.
- It is extremely dangerous as it can cause injury to the batsman.
- It is referred tono ball by the umpire.

---

18. **Answer: d**

Explanation:

The correct answer is a **constellation**.

- **A group of stars, which has a recognisable shape is called Constellation.**

Key Points

- Constellation:
  - A constellation is a group of stars that appears to form a pattern or picture like Orion the Great Hunter, Leo the Lion, or Taurus the Bull.
  - Constellations are easily recognizable patterns that help people orient themselves using the night sky.
  - There are 88 "official" constellations.

Additional Information

- Meteoroids are small pieces of rocks that move around the sun.
  - Meteoroids are smaller than Asteroids and some are as small as dust grains.
  - A meteor is a meteoroid that has entered the Earth's atmosphere
- A Meteorite is a meteor that has fallen to earth.
- Asteroids
  - Asteroids are numerous tiny bodies that also move around the Sun apart from the stars, planets, and satellites.
  - They are found between the orbits of Mars and Jupiter.
- Comet
  - Comets are cosmic snowballs of frozen gases, rock, and dust that orbit the Sun.
  - When a comet's orbit brings it close to the Sun, it heats up and spews dust and gases into a giant glowing head larger than most planets.

---

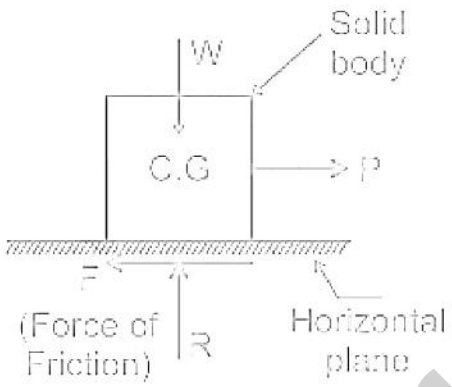
19. **Answer: b**

Explanation:

Explanation:

Friction:

When a solid body slides over a stationary solid body, a force is exerted at the surface of contact by the stationary body on the moving body. This force is called the force of friction.



Laws of Dry Friction:

The friction that exists between two surfaces which are not lubricated is known as dry friction .

The following are the laws.

- The limiting frictional force is independent of the shape and area of the surface in contact.
- The force of friction acts in the opposite direction in which the surface is having a tendency to move.
- The frictional force acts tangentially to the contacting surfaces.
- The force of friction is equal to the force applied to the surface, so long the surface is at rest.
- When the surface is on the point of motion, the force of friction is maximum and this maximum frictional force is called the limiting friction force.
- The limiting frictional force bears a constant ratio to the normal reaction between two surfaces.

In Moving a heavy box from one place to another, Playing carrom, The movement of the door We try to reduce the friction. Hence Holding the glass tumbler is is difficult without friction.

---

20. Answer: c

Explanation:

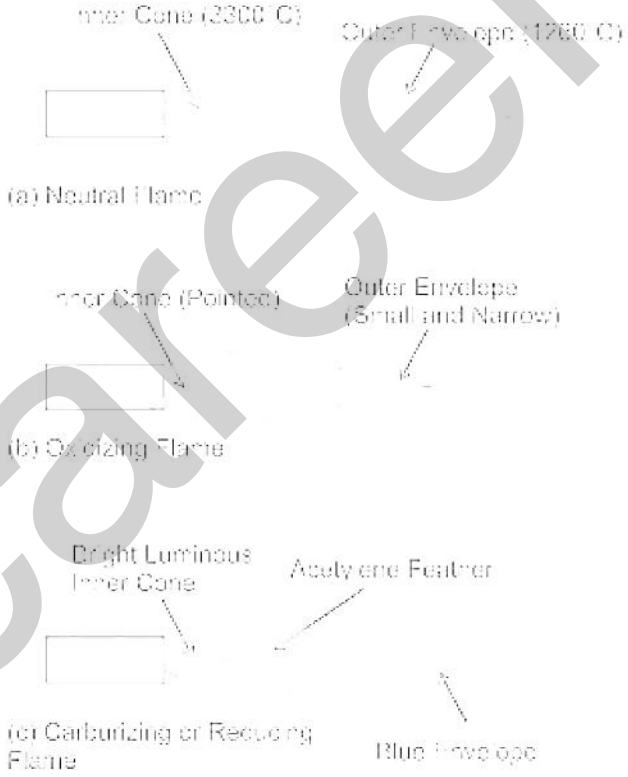
Explanation:

There are three different types of oxy-acetylene flames:

Neutral flames: When oxygen acetylene ratio is almost equal, i.e. 1: 1. A neutral flame is also known as a balanced flame.

Oxidizing flame: When the oxygen is greater than the fuel gas.

Carburising flame: When the fuel gas is greater than the oxygen.



21. **Answer: a**

Explanation:

सही उत्तर एडॉल्फ हिटलर है।

एडोल्फ हिटलर को 'फ्यूहरर' के नाम से भी जाना जाता था।

Key Points

- Nazi party was founded by Adolf Hitler.
- Adolf Hitler assumed the title of *Der Führer* or 'Fuehrer'.
- National Socialist German Workers Party is the other name of the Nazi party.
- He rose to power as the chancellor of Germany in 1933.
- During his dictatorship from 1933 to 1945, he initiated World War II in Europe by invading Poland on 1 September 1939.
- The name of his autobiography is ***"Mein Kampf".***

---

22. Answer: d

Explanation:

The correct answer is**Sophia**.

- **The name of the world's first robot citizen created in October 2017 is Sophia.**

Key Points

- Saudi Arabia became the first country in the world to grant citizenship to a robot.
- The female robot's name is Sophia.
- The robot, Sophia, is a humanoid created by the Hong-Kong-based Hanson Robotics for the purpose of aiding seniors and visitors to parks.
- Sophia has cameras and AI software that allows her to "make eye contact" and recognize people.
- She also has voice recognition capabilities and can become smarter by talking with people.

23. **Answer: b**

Explanation:

The correct answer is**Rishi Kumar Shukla**.

- **Rishi Kumar Shukla is the present CBI Director.**

Key Points

- Mr Rishi Kumar Shukla is the current Director General (DG) of the Central Bureau of Investigation (CBI) . (From 2019 to 2021).
- Former DG of Madhya Pradesh Police Mr Rishi Kumar Shukla was appointed as DG of CBI on 2 nd February 2019 .
- He is an IPS officer from the 1983 batch.

Important Points

- IPS Subodh Kumar Jaiswal is the current Director of the Central Bureau of Investigation (CBI).
- Jaiswal, a 1985-batch Indian Police Service (IPS) officer, is a former Maharashtra director general of police.
- He served as the director-general of the Central Industrial Security Force (CISF).

Additional Information

- CBI derives power to investigate from the Delhi Special Police Establishment Act, 1946.
- The Central Bureau of Investigation (CBI) is the premier investigating police agency in India
- It functions under the superintendence of the Department of Personnel, Ministry of Personnel, Pension & Public Grievances , Government of India - which falls under the prime minister's office.

---

24. Answer: b

Explanation:

Explanation:

- Newton's Second law of motion : The rate of change of momentum of any object is **directly proportional to the applied force on the body.**

$$\text{Force (F)} = ma = m \times \frac{V_f - V_i}{\Delta T}$$

$F \times \Delta T = \Delta P$

Where ΔP = Change in momentum and ΔT = change in time taken

- The above equation is known as Impulse Momentum equation and states that the impulse or force intensity is equal to change in momentum.
- According to the impulse-momentum equation, the change in momentum of an object depends on both the net force acting on the object and duration of the net force.

---

25. Answer: a

Explanation:

The correct answer is**Afghanistan**.

- **Afghanistan launched a new export route to India through the Chabahar Port.**

Key Points

- In February 2019, **Afghanistan** Launched New Export Route To India Through Chabahar Port.
- Through the route, 23 trucks carrying 57 tonnes of dried fruits, textiles, carpets and mineral products were dispatched from the southwestern Afghan city of Zaranj to Iran's Chabahar port.

Additional Information

- **Chabahar Port:-**
  - Chabahar Port is a seaport in south-eastern Iran. Its location lies in the Gulf of Oman.
  - Located close to Afghanistan and other central Asian countries including Turkmenistan and Uzbekistan, the port has also been called as the Golden Gate to these land-locked countries.
  - The port was partially built by India in the 1990s to provide access to Afghanistan and Central Asia, bypassing Pakistan under the Ashgabat Agreement.
  - Located close to Afghanistan and other central Asian countries including Turkmenistan and Uzbekistan, the port has also been called as the Golden Gate to these land-locked countries.

---

26. **Answer: a**

Explanation:

Explanation:

Because of its decorative and functional properties (such as environment protection, low cost, relative ease of application and the range of available colours), paint is widely used as a surface coating.

Types of paints:

Aluminium paint: The very fine ground aluminium is suspended in either quick-drying spirit varnish or slow drying oil varnish. The spirit of the oil evaporates, and a thin metallic film of aluminium is formed on the surface.

Bituminous Paint: This paint is prepared by **dissolving asphalt or mineral pitches or vegetable bitumen in any type of oil or petroleum.** The paint presents a black appearance and is used for painting ironwork underwater. The bituminous coating is also known as asphalt coating.

Enamel paint: This paint is available in different colours. It contains lead or zinc, oil, petroleum spirit and resinous matter.

Rubber paint: This paint is prepared from resins.

---

27. **Answer: b**

Explanation:

Concept:

Physical Properties	Metals	Non - Metals
Electrical Conductivity	Metals are good conductors of electricity.	Non - Metals are poor conductors of electricity.
Sonorous	Metals are sonorous which means the ringing sound is produced when they are hit.	**Non-metals** are non-sonorous.
Malleability	Metals can be converted into thin sheets and hence are malleable.	Non-metals cannot be converted into thin sheets and hence are non Malleable.
Ductility	Metals can be drawn into thin wires.	Non-metals cannot be drawn into thin wires and hence are non-ductile.
High melting and Boling point	**Metals have high melting and boiling point. They are usually solid at room temperature.**	Non - metals are having low melting points and boiling points. They can be solid, liquid or gas at room temperature.

28. **Answer: d**

Explanation:

The correct answer is **Justice Lokeshwar Singh Panta**.

- **The first Chairperson of the National Green Tribunal (NGT) was Justice Lokeshwar Singh Panta.**

Key Points

- The NGT was established on 18 th October 2010 .
- NGT is a specialized body set up under the National Green Tribunal Act (2010) for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources .
- The first Chairman of the NGT was Justice Lokeshwar Singh Panta on 18 October 2010.
- The Central Government in consultation with CJI is appointed the Chairperson of NGT.
- A Selection Committee shall be formed by the central government to appoint the Judicial Members and Expert Members.

Additional Information

- With the establishment of the NGT, India became the third country in the world to set up a specialized environmental tribunal, only after Australia and New Zealand , and the first developing country to do so.
- The NGT has five places of sittings, New Delhi is the Principal place of sitting, and Bhopal, Pune, Kolkata, and Chennai are the other four.

---

29. **Answer: b**

Explanation:

The correct answer is **Australia**.

- **Australia is the host of ICC Women's T20 World Cup 2020.**

Key Points

- ICC Women's T20 World Cup 2020:
  - It was the seventh ICC Women's T20 World Cup tournament.

- It was held in Australia.
- The Australian Cricket won the tournament, beating India by 85 runs.
- It was their fifth title.

Additional Information

- **Cricket:**
  - The first official cricket test match was played in the year **1877** between **Australia and England in Melbourne.**
  - The **First One Day International cricket match** was played in the year **1971 between England and Australia in Melbourne.**
  - The first World Cup of one-day matches was played in **1975 in London.**
  - The apex institution of world cricket is the **International Cricket Council** (ICC) and its headquarters are now in **Dubai.**
    - Earlier it was in Lords (England).
  - The **ICC** was founded in **1909**.
  - The **Board of Control for Cricket in India (BCCI)** was formed in **1927**.

---

30. **Answer: a**

Explanation:

Explanation:

All metals used in engineering work can be classified into two categories.

- Ferrous material: Ferrous metals are those in which the chief constituent is iron, although other constituents like carbon, manganese, phosphorus and sulphur etc. Example steel and cast iron
- Non-ferrous metals are those which do not contain iron. Metals like copper, aluminium, lead, tin etc and their alloys.

Steel is manufactured from iron ore. In the blast furnace, pig iron is produced by reducing iron ore. Thus, the raw material for iron and steel products is pig iron.

---

31. **Answer: c**

Explanation:

Explanation:

- The melting point is the temperature at which a solid melts into a liquid.
- Usually, metals have high melting and boiling point and they are solid at room temperature.

Metal	Melting Point
Tungsten	**3410°C**
Wrought iron	1540°C
Zinc	420 °C
Magnesium	650°C

Hence, Tungsten has the highest melting point out of the given options.

---

32. **Answer: b**

Explanation:

The correct answer is**1931**.

- **The Gandhi-Irwin pact was carried out in the year 1931.**

Key Points

- Gandhi Irwin Pact :
  - Gandhi-Irwin Pact was signed between Mahatma Gandhi and Viceroy Lord Irwin in London on 5 March 1931.
  - Important features of this pact:
    - INC would agree to discontinue the Civil Disobedience Movement.

- Congress would agree to join the second Round Table Conference.
- British would withdraw all orders imposing curbs on the activities of the Indian National Congress.
- British also agreed to withdraw trials relating to several offences except those involving violence and the release of prisoners arrested for participating in the civil disobedience movement.
- It was also agreed that the British would remove the tax on salt, which allowed Indians to produce, trade, and sell salt legally and for their own use.

---

33. Answer: a

Explanation:

Explanation:

The correct answer is 71%

- 71% of the Earth's surface is covered by water (mostly by seas and oceans).
- Out of total water on the Earth, only 2.5% of the water is freshwater.
- The actual water available for use is much smaller than this percentage as most of the freshwater is locked up as ice in glaciers.
- Hence water conservation is a must if we require water to be available for future generations.
- Water resources available on earth are :
  - Freshwater: Glaciers, ice caps, and snow
  - Groundwater
  - Oceans, seas, streams, rivers, lakes, ponds
  - Wetlands- lagoons, swamps, and marshes
  - Precipitation- Rain, snow, and dew

---

34. Answer: b

Explanation:

Explanation:

Explosion welding:

- **It is a solid state welding process in which coalescence is effected by high-velocity movement together of the parts to be joined produced by a controlled detonation.**
- Even though heat is not applied in making an explosion weld it appears that the metal at the interface is molten during welding.
- This heat comes from several sources, from the shock wave associated with impact and from the energy expended in collision.
- Heat is also released by plastic deformation associated with jetting and ripple formation at the interface between the parts being welded.
- Plastic interaction between the metal surfaces is especially pronounced when surface jetting occurs. It is found necessary to allow the metal to flow plastically in order to provide a quality weld.
- Explosion welding creates a strong weld between almost all metals.
- It has been used to weld dissimilar metals that were not weldable by the arc processes.
- The weld apparently does not disturb the effects of cold work or other forms of mechanical or thermal treatment.
- The process is self-contained, it is portable, and welding can be achieved quickly over large areas.
- The strength of the weld joint is equal to or greater than the strength of the weaker of the two metals joined

Additional Information

Welding

The joining of two similar or dissimilar metals with each other. It comes under permanent fastening.

There are basically three main types:

1. Solid-state welding

2. Liquid state welding
3. Solid/Liquid state welding

1) Solid state welding:

- It is a group of welding processes that produces coalescence at temperatures essentially below the melting point of the base materials being joined, without the addition of filler metal . They are a homogeneous group of welding.
- No heat resources will be required but the pressure may be applied externally for welding.
- It is classified into five groups:

1. **Explosive welding**
2. Friction welding
3. Ultrasonic welding
4. Diffusion welding
5. Forge welding

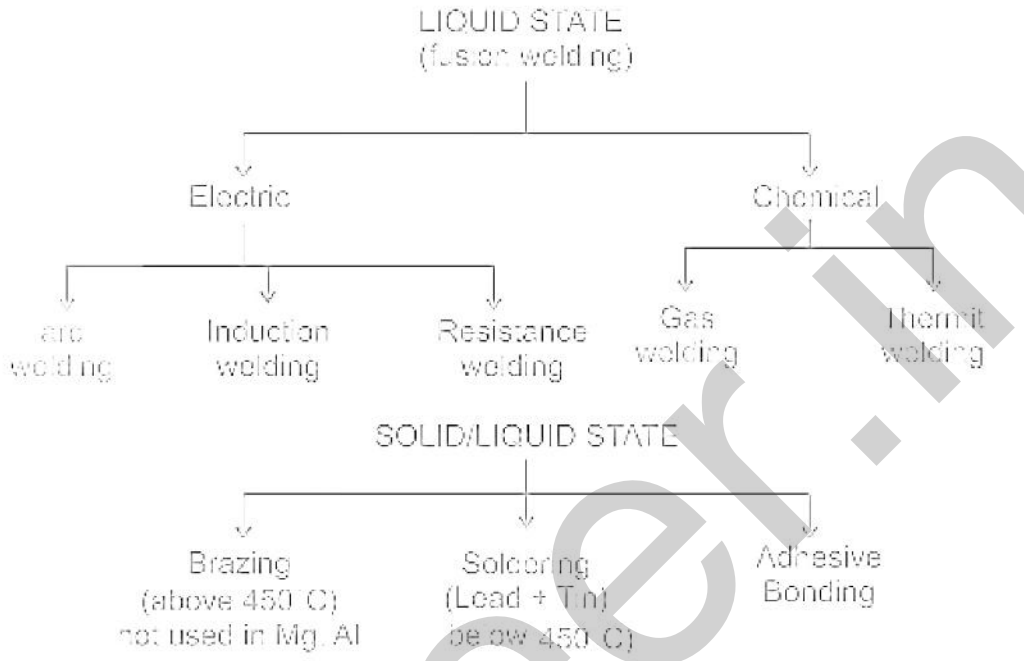
2) Solid/Liquid state welding:

- These methods are used when the metals to be joined cannot withstand the high temperature produced in arc and gas welding.
- It is heterogeneous group of welding.
- It is classified into :

1. Brazing
2. Soldering

3) Liquid state welding:

- It is a group of welding processes that produces coalescence at temperatures essentially below the melting point of the base materials being joined, with the addition of filler metal .
- They are a homogeneous group of welding.
- Heat resources will be required for welding.



Friction Welding:

- Friction welding is not a fusion welding technique as no melting of the base metal occurs.
- HAZ is formed in the friction welding technique and also it can join dissimilar metals .
- During the friction welding process, the combination of heat and force applied between two parts produces more than just a solid-state weld.
- One of the most notable results of the process is the formation of flash .
- As two parts are heated and the material at the weld interface softens, the excess material starts to extrude away from the weld interface. That extruded material is called flash. Flash formation varies from part to part due to shape, type of friction welding process, and the material used.
- Friction stir welding (FSW) is a solid-state process that produces welds of high-quality difficult-to-weld materials such as aluminum.
- In the process a non-consumablerotating FSW tool is plunged between two clamped plates and frictional heat is generated due to relative motion which causes a plasticized zone to form around the tool.
- As the rotating tool moves along the joint line, a consolidated solid-phase joint is formed

Advantages:

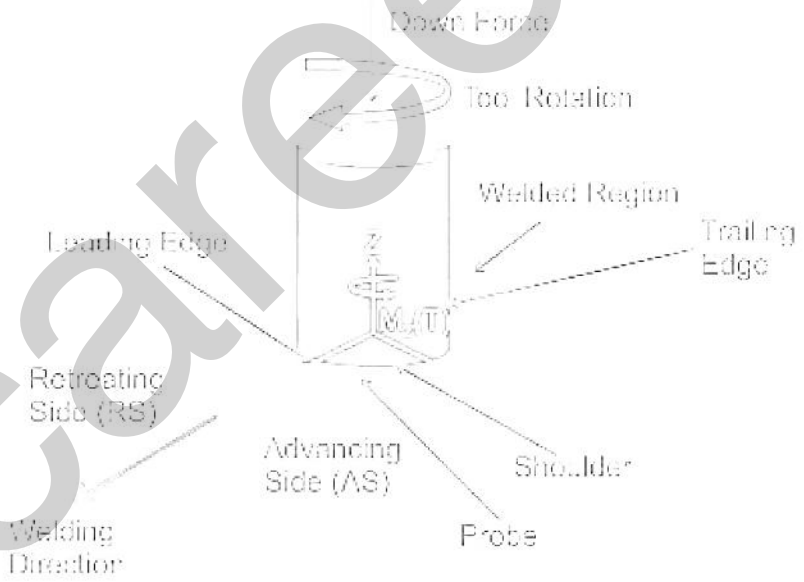
- FSW eliminates many of the defects associated with fusion welding techniques such as shrinkage, solidification cracking, and porosity

Applications:

- It is fast becoming the process of choice for manufacturing lightweight transport structures such as boats, trains and aeroplanes

Limitation:

- The primary limitation of the process is that few configurations can be welded.



Forged welding:

- First both the work plates heated together. The heating temperature is about 50 to 90% of its melting temperature. Both the plates are coated with flux.
- Now manual hammering is done by a blacksmith hammer for making a joint. This process is repeated until a proper joint is created.
- For welding large work pieces, mechanical hammering is used which is either driven by electric motor or by using hydraulic mean. Sometime dies are used which provides finished surface.

Application:

- It is used to join steel or iron.
- It is used to manufacture gates, prison cells etc.
- It is widely used in cookware.
- It was used to join boiler plates before introduction of other welding process.
- It was used to weld weapon like sword etc.
- Used to weld shotgun barrels.

Advantages:

- It is simple and easy.
- It does not require any costly equipment for weld small pieces.
- It can weld both similar and dissimilar metals.
- Properties of weld joint is similar to base material.
- No filler material required.

Disadvantages:

- Only small objects can be weld. Larger objects required large press and heating furnaces, which are not economical.
- High skill required because excessive hammering can damage the welding plates.
- High Welding defects involve.
- It cannot use as mass production.
- Mostly suitable for iron and steel.
- It is a slow welding process.

Diffusion welding / bonding:

- Diffusion welding / bonding is a solid-state welding process, in which welding is performed with applications of pressure and elevated temperature for coalescence of faying surfaces.
- This is done to cleaned carefully and mated metal surfaces so that they actually grow together by atomic diffusion.

The diffusion welding process develops in two stages:

First stage

The first step is to bring the intimate metal into contact with the metal. This is done by the application of pressure which distorts the roughness of the substrate and disrupts and expands the above mentioned surface layers and contaminants.

Second stage

The second stage consists of diffusion and grain growth to complete the weld and finally to eliminate the interface formed in the previous phase. The second phase induces complete metal bonding in the area of contact.

Method of diffusion welding (bonding):

Diffusion welding includes the following types of methods.

Gas-pressure bonding:

- The joining parts are held together in intimate contact and then heated to around 815 degrees centigrade. During heating, an inert gas pressure is created on all surfaces of the parts to be welded. Non-ferrous metals are joined with the help of the gas pressure bonding method.

Vacuum fusion bonding:

- The parts joining it are pressed together mechanically or hydraulically. A welding press which is used for diffusion welding, is employed in forging and is equipped to make pressures from three directions.
- The heating is done in the same way as in gas pressure bonding. These processes are performed in a vacuum chamber.
- Nevertheless, more pressure than can be applied to gas pressure bonding can be applied in this process, steel and for that vacuum fusion bonding is used.
- The temperature and pressure required for the propagation relationship of steel is about 1150 degrees centigrade and 700 kg/cm^2

Eutectic fusion bonding:

- It is a low temperature diffusion welding process in which a thin plate of some other material, such as nickel, is added. As the pieces are heated to an elevated temperature, the filler material expands and forms an Eutectic compound with the base metals.

Parameters of Diffusion Welding

The parameters of diffusion welding are as follows:

1. Pressure
2. Temperature
3. Time Surface

Uniform pressure assures stability of bond formation and The elevated temperature performs the important function of increasing the surface energy (mobility of the atom).Time is a dependent process parameter such as an increase in temperature, reducing the time required to complete the confounding process.

Other parameters

1. Metallurgical Factors
2. Surface Preparation.

Advantages of Diffusion welding

1. The main advantage of diffusion welding is that the weld metal having essentially the same properties as the base metal.
2. Dissimilar metal can be welded by this process also.

Application of Diffusion welding

- This process is mostly applied in the nuclear power industries to fabricate components, manufacture composites materials, and use in the aerospace missile and rocket industries

---

35. **Answer: a**

Explanation:

The correct answer is1920.

- India first took part in the Olympics Games in the year 1920.

Key Points

- **Olympics** :
  - **Athens** was the venue for the first **Olympics** which was **held in 1896.**
    - Since then Games are held every **four years.**
  - The **Olympic flag** was created in **1913** at the suggestion of **Baron Pierre de Coubertin.**
  - In the **Amsterdam Games in 1928,** an **Olympic flame was ceremonially lighted and burned** in a giant torch at the entrance of the stadium.
  - The **Olympic motto** is "***Citius Altius Fortius***" (faster, higher, stronger).
  - The symbol of the Olympics was designed in **1913** by **Pierre de Coubertin** .
    - He was the **founder of the International Olympic Committee.**
  - **India** first took part in the **Olympics Games in the year 1920** .

Important Points

- The five rings represent the union of the five inhabited continents – **Africa, the Americas, Asia, Europe and Oceania.**
  - The **blue ring** represents the **European continent.**
  - The **yellow ring** represents **Asia** .
  - The **red ring** represents **America** .
  - The **green ring** represents **Australia** .
  - The **black ring** represents **Africa** .

---

36. **Answer: d**

Explanation:

Concept:

For a rectangular channel, the critical depth is given by

$$y_{critical} = \left(\frac{q^2}{g}\right)^{\frac{1}{3}}$$

where q = discharge per unit width and g = acceleration due to gravity.

Calculation:

Given:

Q = 5 m 3 /sec, B = 2 m

q = Q/B = 5/2 = 2.5 m^2/sec

$$y_{critical} = \left(\frac{(2.5)^2}{10}\right)^{\frac{1}{3}} = (0.625)^{\frac{1}{3}} = 0.86 \text{ m}$$

---

37. Answer: b

Explanation:

The correct answer is **Asiatic Lion.**

Key Points

- **The Asiatic lion was critically endangered till 2008 but has since been upgraded to the endangered category.**
- There are more than 142,500 species on the IUCN Red List, with more than 40,000 species threatened with extinction, including 41% of amphibians, 37% of sharks and rays, 34% of conifers, 33% of reef-building corals, 26% of mammals and 13% of birds.
- IUCN, International Union for Conservation of Nature , was established on 5 October 1948 .
- The IUCN Red List of Threatened Species was founded in 1964.
- It is the world's most comprehensive inventory of the global conservation status of biological species.

Additional Information

Some of the tags of IUCN are: (May 2022)

Categories (IUNC Status)	Definition	Examples
Extinct (EX)	No known individuals remaining	Pink, Head Duck, Indian aurochs
Extinct in the wild (EW)	Known only to survive in captivity	Alagoas curassow, Beloribitsa
Critically endangered (CR)	Extremely high risk of extinction in the wild.	Cross River Gorilla, Eastern Lowland Gorilla, Hawksbill, Turtle, Gharial
Endangered (EN)	High risk of extinction in the wild	Pygmy Hog, Northern Right Whale, The Vaquita, Amur, Leopard, Lion Tailed Macaque
Vulnerable (VU)	High risk of endangerment in the wild.	Nilgiri Marten, Nilgiri Langoor, Marbled cat
Near Threatened (NT)	Likely to become endangered in the near future	Przewalski's horse, the Humpback whale
Least Concern (LC)	Lowest risk	Harp Seal, Giraffe

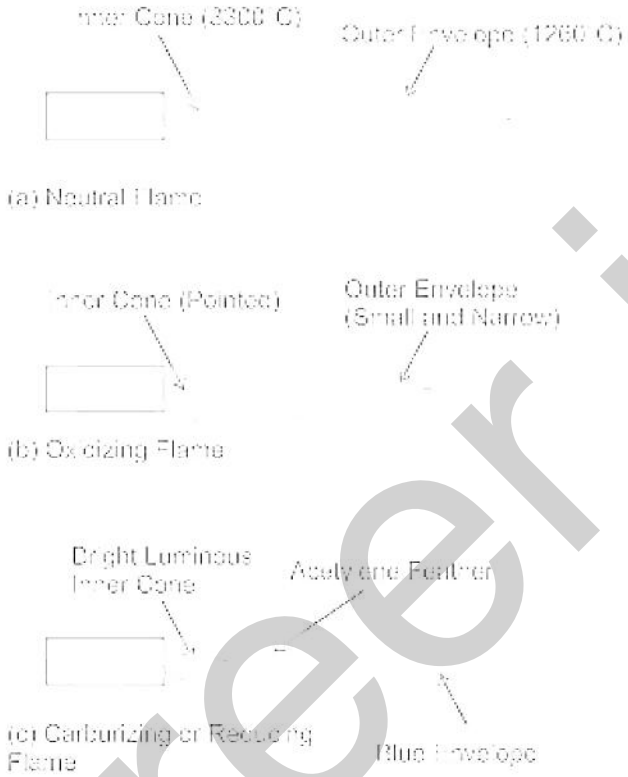
38. **Answer: d**

Explanation:

Explanation:

Types of flames in gas welding:

- Neutral flame:
  - The neutral flame has a 1:1 ratio of oxygen and acetylene by volume.**Structurally it consists of two zones namely the inner cone and the outer envelope.**
  - It has a clear, well-defined, or luminous inner cone indicating that the combustion is complete. Such a flame makes a hissing sound and is the most used type of flame for welding metals.
  - It normally does not affect the chemistry of the weld metal and usually produces a clean-looking weld having properties comparable to the base metal. It is most often used for welding low-carbon structural steel and aluminum.
- Carburizing Flame:
  - The carburizing flame has a 0.85 :0.95 ratio of oxygen and acetylene by volume.
  - The inner zone has white color, the intermediate zone which is red in color and the outer cone has a blue color. The inner cone temperature is about 2900° Centigrade. This flame is used to weld medium carbon steel, nickel, etc.
- Oxidizing Flame:
  - The oxidizing flame has a 1.15 :1.5 ratio of oxygen and acetylene by volume.
  - The inner zone has a very bright white color and has a temperature of about 3300 degrees centigrade. The outer flame has blue in color. This flame is used to weld oxygen-free copper alloys like brass, bronze, etc.



39. **Answer: b**

Explanation:

Explanation:

An electrode is a metallic wire of standard size and length, generally coated with flux (may be bare or without flux coating also) used to complete the welding circuit and provide filler material to the joint by an arc, maintained between its tip and the work.

Coating factor: The ratio of **the coating diameter to the core wire diameter is called the coating factor.**

- 1.25 to 1.3 for light coated
- 1.4 to 1.5 for medium coated
- 1.6 to 2.2 for heavy-coated
- Above 2.2 for super heavy-coated electrodes

40. **Answer: b**

Explanation:

The correct answer is**Pinaki Chandra Ghose.**

- **Pinaki Chandra Ghose has been appointed as the Chairman of India's Lokpal or anti-corruption ombudsman.**

Key Points

- Justice Pinaki Chandra Ghose was appointed the first Lokpal of India in 2019.
- Pinaki Chandra Ghose is a retired judge of the Supreme Court of India.
- Prior to his elevation to the Supreme Court, Pinaki had served as Chief Justice of the Andhra Pradesh High Court.

Important Points

- A Lokpal is an anti-corruption authority that represents the public interest in the Republic of India.
- The Lokpal has jurisdiction to inquire into allegations of corruption against its public functionaries and for matters connected to corruption over the central government .
- Following the Jan Lokpal movement led by Anna Hazare in 2011 , The Lokpal and Lokayuktas Act was passed with amendments in parliament in 2013 .

---

41. **Answer: b**

Explanation:

The correct answer is **Palghat**.

- **Palghat pass links Kerala with Tamil Nadu.**

Key Points

- Palghat Gap is located between Coimbatore (Tamil Nadu) and Palakkad (Kerala).
- It is located between the Nilgiri Hills to the north and Anaimalai Hills to the south.

Additional Information

- Thalghat :
  - it is located in the state of Maharashtra .
  - It connects Mumbai to Nashik.
- Bhor Ghat:
  - It is a mountain pass located in Lonavala, Maharashtra in the Western Ghats.
  - It connects Mumbai to Pune.

---

42. Answer: c

Explanation:

Explanation :

The swing and distance between centers define the capacity of a lathe .

Specification of Lathe:

The length between the centers:

- This expresses the maximum length of job that can be mounted between the lathe centers ie.e between head stock and tail stock.

The length of the bed:

- It gives the approximate floor area that the lathe can occupy.

The height of the centers:

- It is measured from the lathe bed.

The maximum diameter:

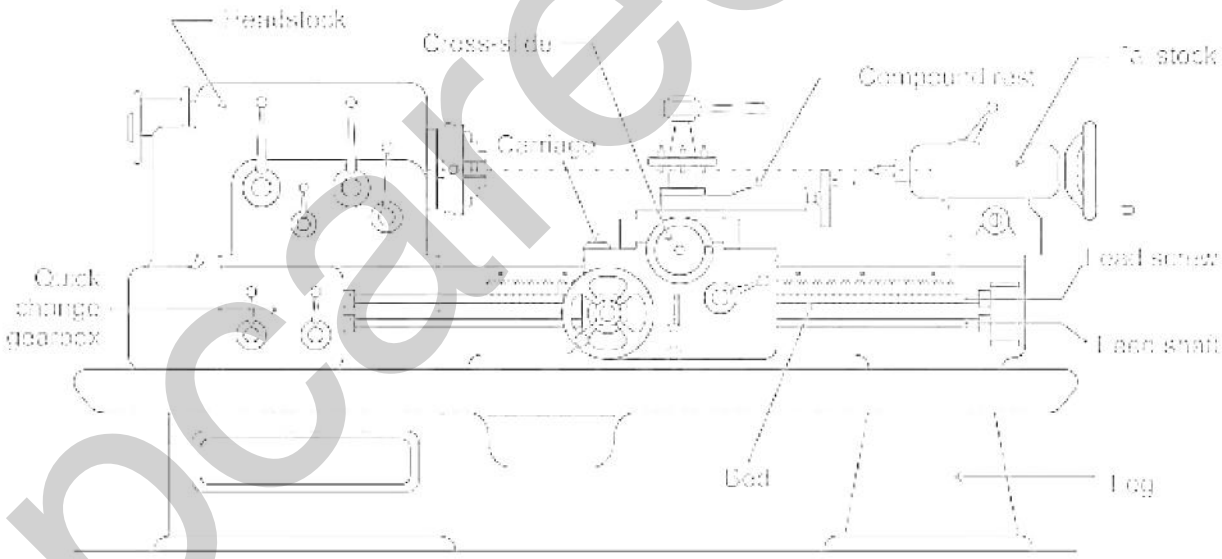
- It is the diameter of the work or bar that may pass through the hole of the headstock spindle.

The swing diameter of the bed:

- It indicates the maximum diameter of the work that may revolve over the bed ways.

The swing diameter over carriage :

- **It indicates the maximum diameter of the work that may rotate over the saddle** . This is normally less than the swing diameter over the bed.



43. **Answer: a**

Explanation:

Explanation:

Solid (pack) carburizing:

- The components are enclosed by a carburizing medium (compound) and mounted in a sealed box in solid or pack carburizing .
- Coke or charcoal mixed with barium carbonate as energiser is often used as the medium. Temperatures range from 790 to 845°C for periods ranging from 2 to 36 hours.

Important Points

- Carburising is the process of saturating the surface layer of low carbon steels at 850° - 950°C with carbon from a carbonaceous source capable of giving up its carbon to the metal.
- There are following methods of carburizing:
    1. Pack carburizing
    2. Gas carburizing
    3. Liquid carburizing
    4. Vacuum carburizing
    5. Ion carburizing

Vacuum carburizing

- Vacuum carburizing is a clean method used to introduce carbon into the surface of the steel, and also prevents grain boundary oxidation.
- Vacuum or low-pressure carburizing is carried out in a vacuum furnace at pressures below that of normal atmospheric pressure.
- The principle of carburizing is exactly the same as that of the gas carburizing process, the main difference being the use of sub-atmospheric pressure.

Pack carburizing:

- In this process, components are packed in an environment with high carbon content .
- A reducing agent (carbon monoxide) is introduced when heated. Due to high temperatures, carbon monoxide starts to release carbon to be diffuse into the steel surface.
- The materials are then hardened due to carbon absorption. The case depth is approximately 0.1 – 1.5 mm. Pack carburizing requires high skilled labor , due to the temperature which is hard to uniform.

Gas carburizing:

- Gas Carburising is almost similar to Pack Carburising except for the part where the supply of carbon monoxide gas to the heated furnace and carbon decomposition.
- The carbon monoxide gases are contained safely and the components are enclosed in a carbon filed enclosure that is replenished continuously to maintain high carbon content which results in a high production rate in comparison to pack carburizing.
- A lot of problems that are faced in Pack Carburising are solved by using this process.
- This method can be used in mass production.

Liquid Carburising:

- For this process, the steel components are immersed in a liquefied carbon-rich environment (cyanide). Another method is by using molten salt.
- The molten salt can also introduce carbon into the metal. The metal is then undergone rapid quenching. The quality produced is similar to the ones in Gas Carburising , but with low nitrogen and high carbon content.

Solid powder carburizing:

- In this method, the carburizing compound is a solid carburized , usually charcoal of 3 to 10 mm size (fines are screened off), or coke, semi-coke, or coal.
- To accelerate the carburizing activator, or **energizer normally BaCO 3 and/or Na 2CO 3**in amounts 10-30% of charcoal is added.

---

44. Answer: d

Explanation:

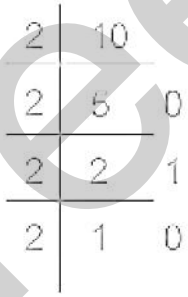
Convert decimal to binary:

Conversion Steps:

Steps To Convert From Base 10 To Base 2 (Binary):

- Write the given decimal number as the dividend and write the base of the binary system i.e. 2 as the divisor.
- Divide the dividend by the divisor and write the quotient as the new dividend and the remainder (0 or 1) on the right side of the dividend.
- Continue to divide the divisor as mentioned in Step 2 until you get the quotient as 0 or 1.
- Starting with the bottom remainder, write the sequence of the remainders upwards to the top to get the Binary equivalent of the given decimal number.

Calculation:



So, the binary equivalent of 10 is (1010) 2

Hence, option (4) is the correct answer.

---

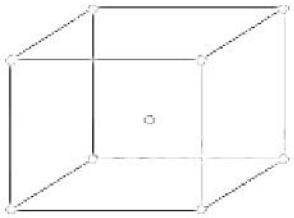
45. Answer: b

Explanation:

Concept:

Crystal structure of Material is classified as follows:

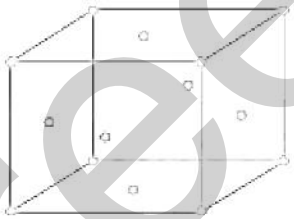
BCC: BCC stands for Body-Centered Cubic. In one unit cell, there is one atom at center, 1 atom at each corner. The crystal structure is used for Brittle materials only.



BCC

E.g. V, Mo, Ta, W, Ferrite or α-iron, δ-ferrite or δ-iron

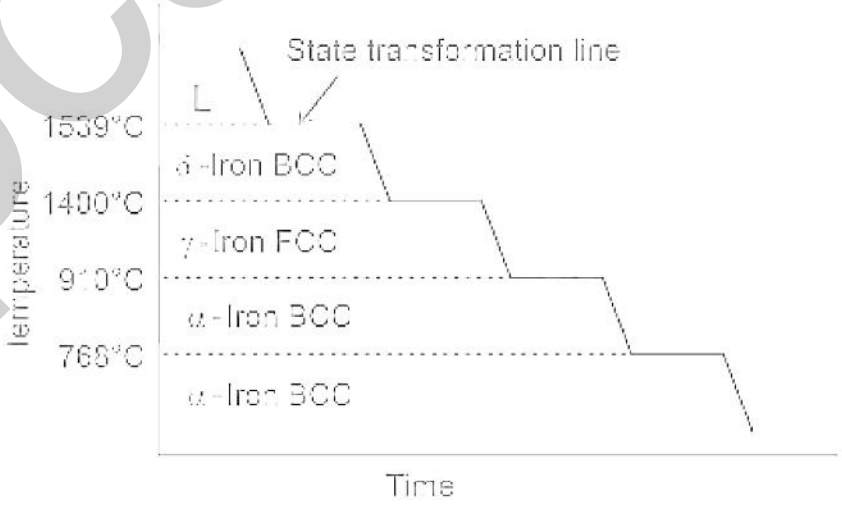
FCC: FCC stands for Face Centered Cubic. In one unit cell, there is one atom at center, 1 atom at each corner, and 1 atom on each face. The crystal structure is used for Ductile materials only.



FCC

E.g. Ni, Cu, Ag, Pt, Au, Pb, Al , Austenite or γ-iron

The iron-carbon diagram shows the different crystal structures for different phases.

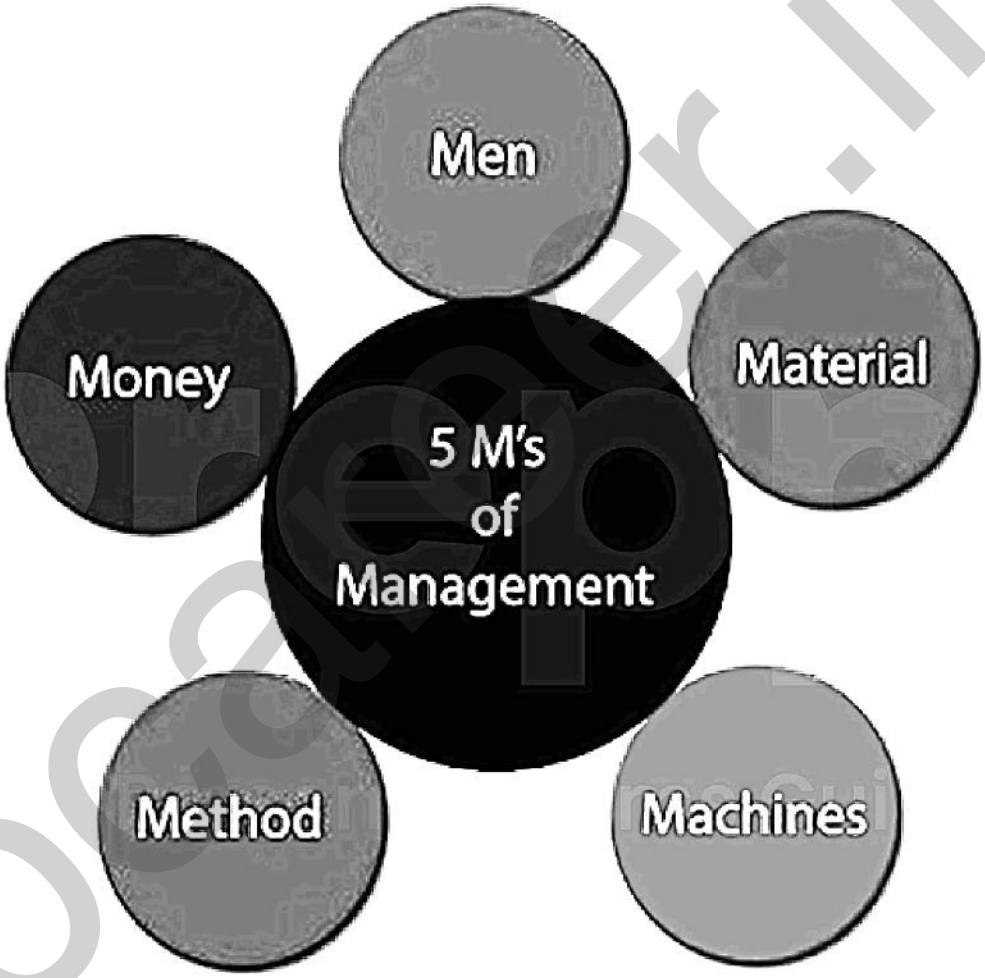


46. **Answer: b**

Explanation:

Explanation:

The five M's of management are analyzed below:



Money :

- money is the most critical and all purpose resource because it is used to acquire or hire other resources. In organization , money is employed to generate more money in the form of profits or surplus. A business firm or enterprise requires money in the form of fixed capital and working capital.

Manpower :

- manpower refers to the managerial and non-managerial personnel employed I an organization.other resources cannot act by themselves and have to be utilised by human beings. Therefore ,human resources mobilize, allocate and utilize the physical and financial resources of an organization.

Materials :

- materials represent the physical raw materials and intermediate products (semi-finished goods) which are converted and/or assembled into finished products with the help of certain processes and technology

Machinery:

- machines are the equipment used to process the materials into finished or semi-finished products. Employment of modern machinery helps to reduce costs and to improve the quality of output. Technology has therefore become an important ingredient in the efficient management of organizations

Methods:

- methods refer to the normal and prescribed ways of doing things various operations are performed according to certain systems and procedures. Use of right methods helps to increase efficiency of operations and contributes to effective management

every other factor which is a part of the five M's has it's own dynamics. it is the duty of management or managers to understand or analyze the basic nature and the functions of each M and the source of its availability. Managers must clearly know the purposes for which the other factors are employed and coordinate them in such a way as to optimize their combined productivity

---

47. **Answer: a**

Explanation:

Explanation:

Types of gas	c v	c p	$\gamma = \frac{c_p}{c_v}$
Monoatomic	(3/2)R	(5/2)R	1.67
Diatomic	(5/2)R	(7/2)R	1.4
Tri - atomic	(7/2)R	(9/2)R	1.28

∴ y = 1.4 for air, which is predominantly a diatomic gas.

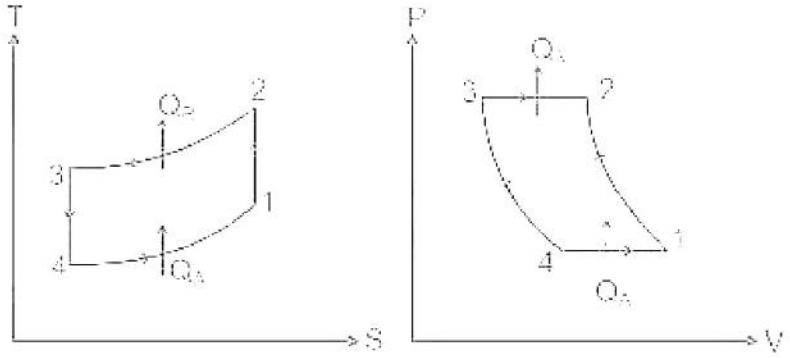
---

48. Answer: a

Explanation:

Explanation:

- Bell Coleman cycle is also known as Reversed Brayton cycle or Reversed Joule cycle
- The working fluid of the Bell Coleman refrigeration cycle is Air.
- This system of refrigeration is used for Air Craft refrigeration and it has lightweight.



where,

1. Process 1 - 2:isentropic compression
2. Process 2 - 3: constant pressure heat rejection
3. Process 3 - 4: isentropic expansion
4. Process 4 - 1: constant pressure heat absorption

---

49. Answer: b

Explanation:

Concept :

Strain Energy:

- Strain energy is a type of potential energy that is stored in a structural member as a result of elastic deformation .
- It is given by -

$U = \frac{1}{2} \times P \times \Delta$

$\Rightarrow U = \frac{P^2 L}{2AE}$

For given values of L, A, and E

$U \propto P^2$ ---(1)

Here,

P - Load (N)

Δ - Elastic deformation = $\frac{PL}{AE}$ ... (for prismatic bar)

A - Area of c/s of the bar

L - Length of the bar

E - modulus of elasticity

Additional Information

The stress-strain curve for steel is shown below the figure.

By comparing with the above curve, we will get,

P → Proportional limit

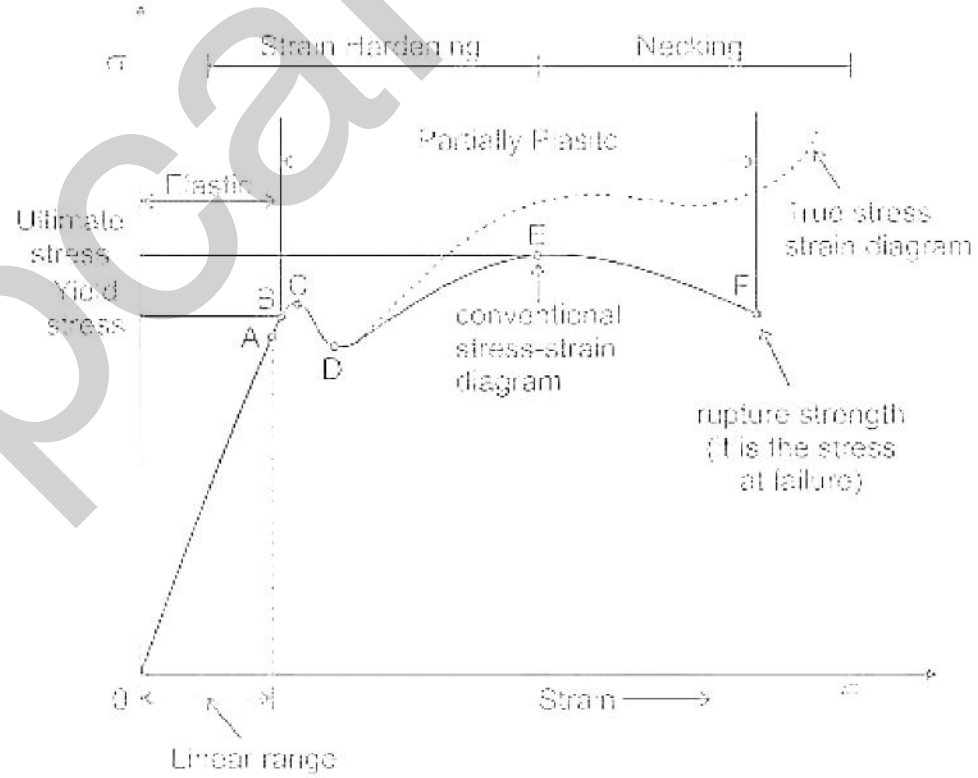
Q → Elastic limit

R → Upper yield point

S → Lower yield point

T → Ultimate tensile strength

U → Failure



- So it is evident from the graph that the strain is proportional to stress or elongation is proportional to the load giving a straight-line relationship. This law

of proportionality is valid up to point A. Point A is known as the limit of proportionality or the proportionality limit.

- For a short period beyond point A, the material may still be elastic in the sense that the deformations are completely recovered when the load is removed. The limiting point B is termed as Elastic Limit.
- Beyond the elastic limit plastic deformation occurs and strains are not totally recoverable. There will be thus permanent deformation or permanent set when the load is removed. These two points are termed as upper and lower yield points respectively. The stress at the yield point is called the yield strength.
- A further increase in the load will cause marked deformation in the whole volume of the metal. The maximum load which the specimen can withstand without failure is called the load at the ultimate strength . The highest point 'E' of the diagram corresponds to the ultimate strength of a material.
- Beyond point E, the bar begins to form the neck. The load falling from the maximum until a fracture occurs at F.

---

50. **Answer: c**

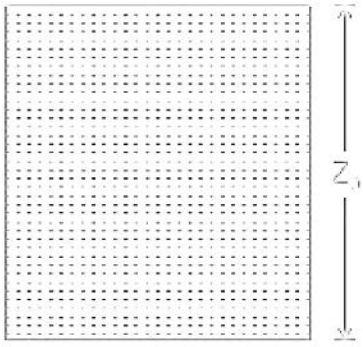
Explanation:

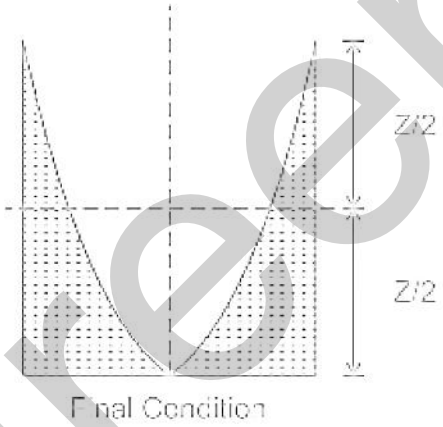
Explanation:

A cylinder rotating about the vertical axis has forced vortex flow.

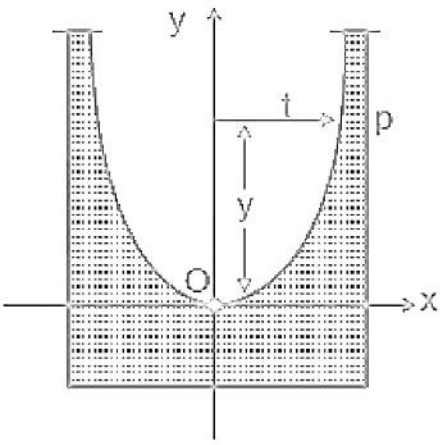
Forced vortex flow

- It is defined as the type of vortex flow, in which some external torque is required to rotate the fluid mass .
- The fluid mass in this type of flow rotates at the constant angular velocity ω. The tangential velocity of any fluid particle is given by
- $v = \omega \times r$, r = Radius of fluid-particle from axis of rotation.





- If a vertical cylinder filled with water and then rotated about its vertical axis at a constant speed such that the liquid spills out from the top, then the free surface is paraboloid which has half the volume of a cylinder of the same height and the center of the bottom of the cylinder will be exposed to the atmospheric pressure.
- The atmospheric gauge pressure is zero
- When a liquid-filled vessel is rotated the liquid profile becomes a paraboloid due to centripetal force, as shown in the figure below



The pressure at any point P due to rotation is

$P_R = \frac{1}{2}\rho r^2\omega^2$

Gauge pressure at depth y is P G = -ρgy

If p_0 is atmospheric pressure, the total pressure at point P is

$p = p_0 + \frac{1}{2}\rho r^2\omega^2 - \rho gy$

For any point on the surface of rotating fluid, p = p 0

Hence, for any surface point;

$p = p_0 + \frac{1}{2}\rho r^2\omega^2 - \rho gy$

or $\frac{1}{2}\rho r^2\omega^2 = \rho gy$

Height of paraboloid, $y = \frac{r^2\omega^2}{2g}$

The rise and the fall of the liquid from the original level is equal, Hence the rise of the liquid surface above the original level will be $\frac{r^2\omega^2}{4g}$

---

51. Answer: d

Explanation:

Concept:

Toughness: The ability of the material to withstand stress (resist fracture due to high impact loads) without fracture is known as toughness. It is defined as the ability to absorb energy in the plastic state.

Malleability: It is the ability of a metal to exhibit large deformation or plastic response when being subjected to compressive force.

Elasticity: It is the property of a material to regain its original shape after deformation when the external forces are removed.

Plasticity: It is the property of a material that r etains the deformation produced under load permanently. Thus, it is a property of a material that allows it to deform without fracture .

Ductility: The property of the material that allows it to be drawn into wires or elongated before failure is known as ductility.

Brittleness: The property of a material that produces fracture without any appreciable deformation is known as brittleness. It is the opposite of toughness. **The material which fails suddenly without any plastic deformation is said to be Brittle material.**

---

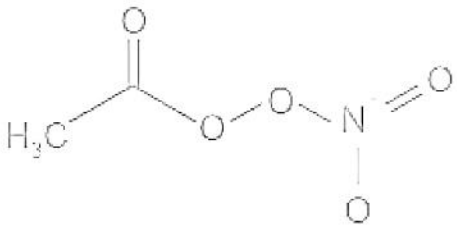
52. **Answer: d**

Explanation:

Explanation :

PAN:

- They are Peroxyacyl nitrate compounds.
- PAN are toxic in nature.
- They have chemical formula as $C_2H_3O_5N$.
- PAN is a gas at normal temperature and pressure (NTP).
- They are composed of carbon, hydrogen, nitrogen and oxygen atoms.
- PAN is a phytotoxic air pollutant.
- It is formed by the reaction of hydrocarbons and nitrogen oxides under the influence of light.
- It is also known as polyvinyl cyanide or cartesian 61.
- It is a synthetic resin prepared by a polymerization chain reaction of acrylonitrile.
- They are commonly used in the process of polymerization.



Additional Information

Peroxyacyl nitrogen:

It is an oxidant that is more stable than Oxone.

Peroxyacyl nitrite:

It is a pollutant present in a good amount in petrochemical smog.

---

53. Answer: c

Explanation:

Correct Option is 3).

A media access control address (MAC address) is a unique identifier assigned to a network interface controller (NIC) for use as a network address in communications within a network segment. This use is common in most IEEE 802 networking technologies, including Ethernet, Wi-Fi, and Bluetooth.

Ethernet frame format (802.3)

PREAMBLE (7 byte)	SFD (1 byte)	Destination MAC address (6 byte)	Source MAC address (6 byte)	VLAN (4 byte)	Length (2 byte)	Data (46 - 1500 byte)	CRC (4 byte)

Important Points:

MAC broadcast address (MAC destination) consists of 6 bytes i.e. 48 bits and all are 1's

MAC broadcast address → FF:FF:FF:FF:FF:FF

Limited broadcast address (IP-32 bit) → 255.255.255.255

---

54. **Answer: d**

Explanation:

Explanation:

LASER :

- LASER is an acronym for Light Amplification by Stimulated Emission of Radiation.

Ruby Laser :

- A solid-state laser that uses the synthetic ruby crystal for its laser medium is a Ruby Laser.
- It consists of a cylindrical rod optically flat and accurately parallel. One end is fully silvered, other is partially silvered.
- Ruby rod is surrounded by a glass tube (flash lamp) which is filled with xenon through an optical pumping system.
- Ruby crystal is composed of aluminum oxide (Al 2O 3) doped with 0.05 % Chromium oxide (Cr 2O 3) .
- Aluminium atoms in the crystal lattice replaced with Cr 3+ .
- Chromium gives the ruby its vibrant red colour.

---

55. **Answer: c**

Explanation:

Explanation:

Anodizing

- **Anodizing is an electrolytic passivation process used to increase the thickness of the natural oxide layer on the surface of metal parts.**
- The process is called anodizing because the part to be treated forms the anode electrode of an electrical circuit.
- **Anodic films are most commonly applied to protect aluminium alloys,** although processes also exist for titanium, zinc, **magnesium,** zirconium etc.
- The aluminium article is made as to the anode and dilutes H_2SO_4 as the electrolyte.

Additional Information

Practical Applications of Electrolysis:

(i) Electroplating:

- The process of depositing a thin layer of metal such as gold, silver, nickel, etc.) over an inferior metal such as iron is known as electroplating.
- The aim of electroplating is to provide a good appearance and protect the object against corrosion.

(ii) Refining of Metals:

- The impure metal is used as the anode and a small piece of pure metal is used as the cathode.
- The salt solution of the metal to be purified is used as the electrolyte.
- When the DC supply is applied to the electrodes, pure copper from the anode goes into the solution and gets deposited on the cathode.
- The impurities sink to the bottom of the container and from an 'anode mud'.

(iii) Production of Chemicals: The process of electrolysis is being extensively used for the commercial production of chemicals like sodium carbonate, sodium bicarbonate, caustic soda, etc.

(iv) Extraction of Metals from Ores: Many metals such as Al, Mg, Zn, Cu, etc. are extracted from their ores by electrolysis.

(v) Production of Oxygen and Hydrogen: By the electrolysis of acidic water, oxygen and hydrogen can be produced.

(vi) Electrolytic Capacitor:

- An electrolytic capacitor consists of two aluminium foils in which a very thin dielectric is sandwiched by the process of electrolysis.
- Two foils of aluminium (which act as electrodes) are dipped in a solution of boric acid, glycerine, and ammonia water.
- When current is passed between anode and cathode, a very thin film of aluminium oxide (Al2O3) is formed on the anode surface.
- This oxide film acts as a dielectric. Since the oxide film is very thin, the electrolytic capacitor has a very large capacitance.

(vii) Electro-Typing: This is the process in which we obtain an impression of a page of the book in copper.

---

56. Answer: c

Explanation:

Explanation:

Magnetic field strength or field intensity (H) is the amount of magnetizing force.

Magnetic flux density (B) is the amount of magnetic force induced on the given body due to the magnetizing force H.

A magnetization curve (or) hysteresis loop (or) B-H loop plots the relationship between the induced magnetic flux density (B) and the magnetizing force or magnetic field strength (H).

To make the BH curve, need to take flux density on Y-axis and field strength on X-axis

$B = \mu H$

The amount of magnetic field we apply, air never saturates. Air is non-magnetic material and for non-magnetic material, $\mu = \mu_0 = 4\pi \times 10^{-7}$

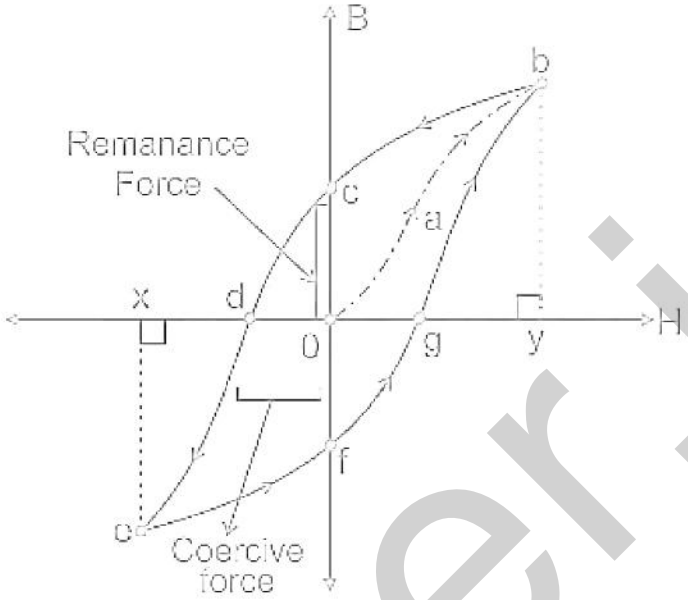
$B \propto H$

So, the **B-H curve for air will be a straight line passing through the origin.**

Additional Information

Hysteresis Loop (B.H Curve):

- Consider a completely demagnetized ferromagnetic material (i.e. B = H = 0)
- It will be subjected to the increasing value of magnetic field strength (H) and the corresponding flux density (B) measured the result is shown in the below figure by the curve O-a-b.
- At point b, if the field intensity (H) is increased further the flux density (B') will not increase any more, this is called saturation b-y is called solution flux density.
- Now if field intensity (H) is decreased, the flux density (B) will follow the curve b-c. When field intensity (H) is reduced to zero, flux remains the iron this is called Remanent flux density or remanence, it is shown in fig. O-C.
- Now if the H increased in the opposite direction the flux density decreases until the point d here the flux density (B) is zero.
- The magnetic field strength (points between O and d) require to remove the residual magnetism i.e. reduce B to zero called a coercive force.
- Now if H is increased further in the reverse direction causes the flux density to increase in the reverse direction all the saturation point e.
- If H is varied backwards OX to O-Y, the flux Density (B) follows the curve b-c-d-d.
- From the figure the clear that flux density changes 'log behind the changes in the magnetic field strength this effect is called hysteresis.
- The closed figure b-c-d-e-f-g-b is called the hysteresis loop.



From the above diagram, we can see in B – H curve

X-axis intercept = Coercive force

Y-axis intercept = Residual magnetism or Remanence force

---

57. **Answer: b**

Explanation:

Explanation:

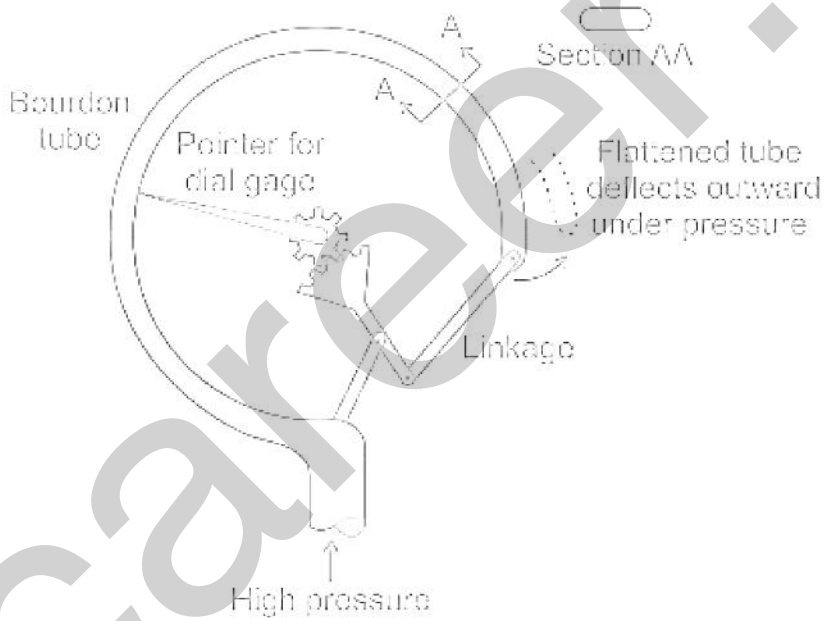
McLeod gauge:

- The Mcleod gauge is used for the measurement of very low pressure orultra-high vacuum pressure.
- It is nothing but special development sealed U-tube manometer, in which low-pressure fluid is compressed to high pressure and then it read by basic manometer techniques.
- The operation of the Mcleod gauge is based on Boyle's law.
- The Mcleod gauge has excellent accuracy of ±1%.

Additional Information

Bourdon Tube:

- Bourdon gauges are available to cover a large range of pressures. Bourdon gauges are purely mechanical devices utilizing the mechanical deformation of a flattened but bent tube that winds or unwinds depending on the pressure difference between the inside and the outside. The motion is against a spring torque such that a needle attached to the shaft indicates directly the pressure difference.



Manometer:

- A simple manometer consists of a glass tube having one of its ends connected to a point where pressure is to be measured and another end remains open to the atmosphere. Common types of simple manometers are:
  - Piezometer
  - U-tube Manometer
  - Single Column Manometer
- Differential Manometers measure the difference of pressure between two points in a fluid system and cannot measure the actual pressures at any point in the system. It consists of a U-tube, containing a heavy liquid, whose two ends are connected to the points whose difference of pressure is to be measured.

58. Answer: d

Explanation:

Concept:

Velocity: The rate of change of displacement of a body is called the velocity of that body.

$Velocity\,(v) = \frac{Change\ in\ displacement}{time\ taken} = \frac{dx}{dt}$

Acceleration: The rate of change of velocity is termed as the acceleration of a body.

$Acceleration\ \ (a) = \frac{Final\ velocity\ (v) - Initial\ velocity\ (u)}{t} = \frac{dV}{dt} = \frac{d^2x}{dt^2}$

Calculation:

Given:

x = t 3 (t - 6)

$a = \frac{d^2x}{dt^2}$

$a = \frac{d^2}{dt^2}[t^3(t-6)] = \frac{d^2}{dt^2}[t^4 - 6t^3]$

$a = 12t^2 - 36t$

---

59. Answer: b

Explanation:

Explanation:

Thermal diffusivity: It is defined as the ratio of thermal conductivity and thermal capacity of the material.

$Thermal\ diffusivity\ \ (\alpha) = \frac{Thermal\ Conductvity\ (K)}{Thermal\ Capacity\ (\rho C)}$

It signifies the ability of a substance to conduct heat relative to its ability to store thermal energy.

Larger the value of thermal diffusivity, faster the propagation of heat through the substance and lower the storage of heat within the substance and it will be observed a quick increase in temperature with in the substance.

- Unit of thermal diffusivity (α): $\frac{m^2}{s}$
- Dimensional formula : L 2t -1

---

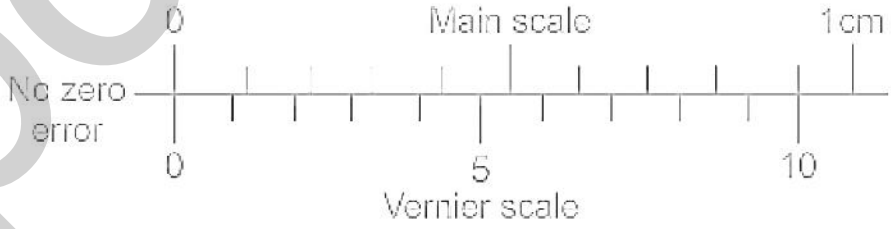
60. Answer: b

Explanation:

Explanation:

Zero error

- When the fixed jaw and sliding jaw are closed, but the zero on the Vernier scale coincides with zero on the main scale. Then the Vernier calliper does not have zero error.



Main scale vernier scale in no error case

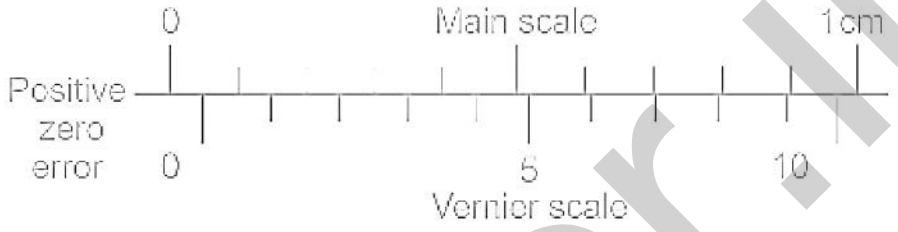
- When the fixed jaw and sliding jaw are closed, but the zero on the vernier scale does not coincide with zero on the main scale. Then the vernier calliper said to have zero error.

There are two types of error

1. Positive error
2. Negative error

Positive zero error

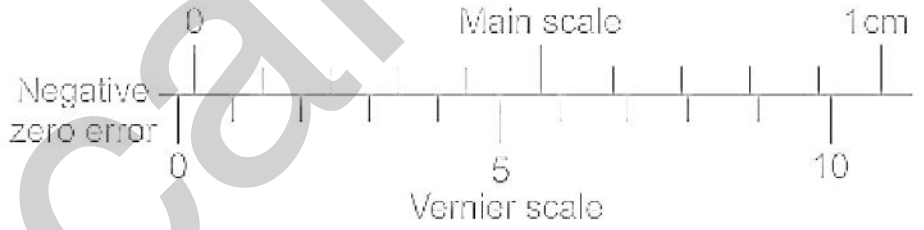
- **Positive zero error occurs if zero on the vernier scale lies on right side of zero on the main scale.**
- **If the error is positive, the correction is negative .**



Main scale vernier scale in positive error case

Negative zero error

- A negative zero error occurs if zero on the vernier scale lies on the left side of zero on the main scale.
- If the error is negative, the correction is positive.



Main scale vernier scale in negative error case

Important Points

Zero error is always subtracted from the observed readings.

---

61. Answer: b

Explanation:

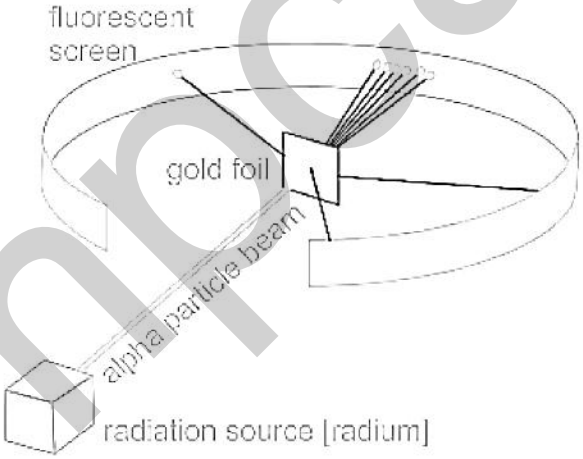
The correct answer is **Atomic nucleus.**

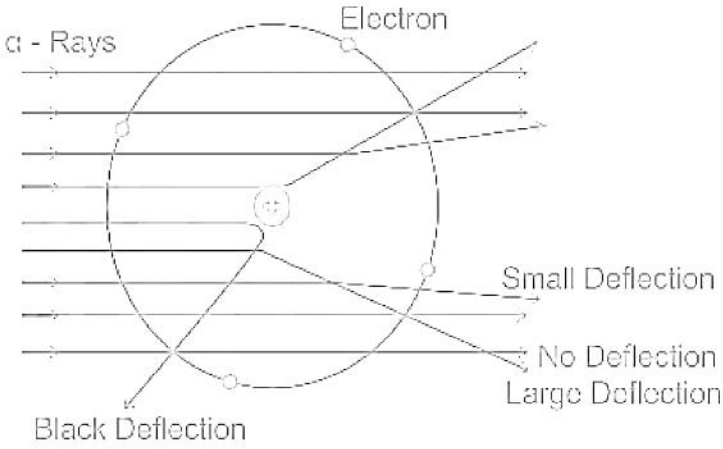
Explanation:

- Rutherford's alpha-particle scattering experiment led to the discovery of the atomic nucleus.
- Rutherford's model of the atom proposed that a very tiny nucleus is present inside the atom and electrons revolve around this nucleus. The stability of the atom could not be explained by this model.

Additional Information

- **Ernest Rutherford** was fascinated by the arrangement of electrons within an atom. Rutherford designed an experiment for this purpose. Fast-moving alpha (α)-particles were made to fall on a thin gold foil in this experiment.
- He selected gold foil because he wanted the layer to be as thin as possible. The thickness of this gold foil was approximately 1000 atoms.
- α-particles are helium ions that are doubly charged. The fast-moving α-particles have a lot of energy because they have a mass of 4 u.
- The -particles were expected to be deflected by the subatomic particles in the gold atoms. He didn't expect to see large deflections because the α-particles were much heavier than the protons.
- However, the α-particle scattering experiment gave completely unexpected results.





The following observations were made:

1. The majority of the fast-moving -particles passed straight through the gold foil.
2. The foil deflected some of the -particles at small angles.
3. Surprisingly, one particle in every 12000 appeared to rebound.

Key Points

- **Electrons** were discovered by **J.J. Thomson** , and **protons** were discovered by **E.Goldstein.**
- **J. Chadwick** discovered the presence of **neutrons** in an atom's nucleus.
- **Electrons** have a **negative charge** , **protons** have a **positive charge** and **neutrons** have **no charge.**

---

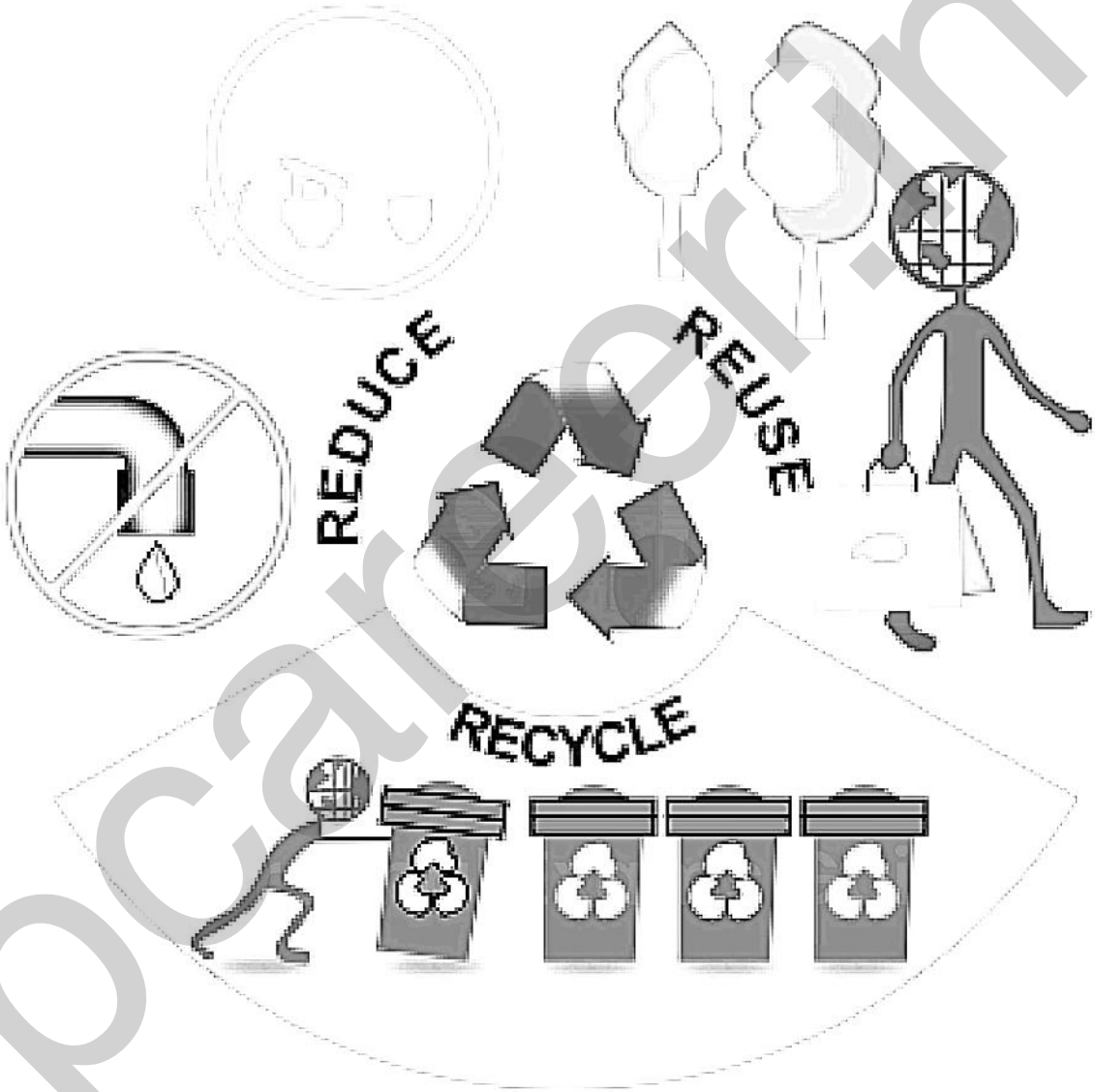
62. **Answer: a**

Explanation:

The 3R's related to Environmental awareness is Reduce, Recycle and Reuse.

It is a motto used by conservationists to reduce waste, curtail consumption and ensure the best approach for the environment and human wellbeing.

- Reduce : It implies reducing the amount of waste generation.
- Recycle : It is the recovery and reprocessing of discarded material for usage in new products.
- Reuse : It suggests finding new ways to use things.

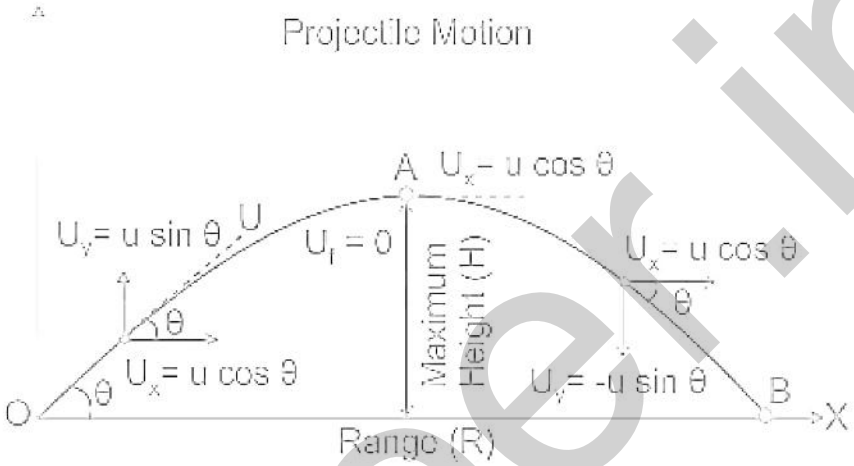


63. **Answer: b**

Explanation:

Concept

Projectile motion: When a particle is projected obliquely near the earth surface , it moves simultaneously in horizontal and vertical directions . This type of motion is called projectile motion.



$Total\ time\ of\ flight = \frac{2\ u\ sin\theta}{g}$

$Range\ of\ projectile = \frac{u^2 \sin 2\theta}{g}$

$Maximum\ Height = \frac{u^2 \sin^2\theta}{2g}$

Where, u = projected speed

θ = angle at which an object is thrown from the ground.

g = acceleration due to gravity = 9.8 m/s 2

Maximum Range: It is the longest distance covered by the object during projectile motion.

- When the angle of projection is 45°, the maximum horizontal range is obtained.

Additional Information

- Maximum height is the maximum vertical distance travelled by the projectile from the horizontal plane.

We know that, $Maximum\ Height = \frac{u^2 \sin^2\theta}{2g}$

For maximizing the vertical range, sin θ must be maximum

Which is sin θ = 1

⇒ θ = 90°

$Maximum\ Vertical\ Height = \frac{u^2}{2g}$

Hence for vertical maximum range angle should be 90°

---

64. Answer: a

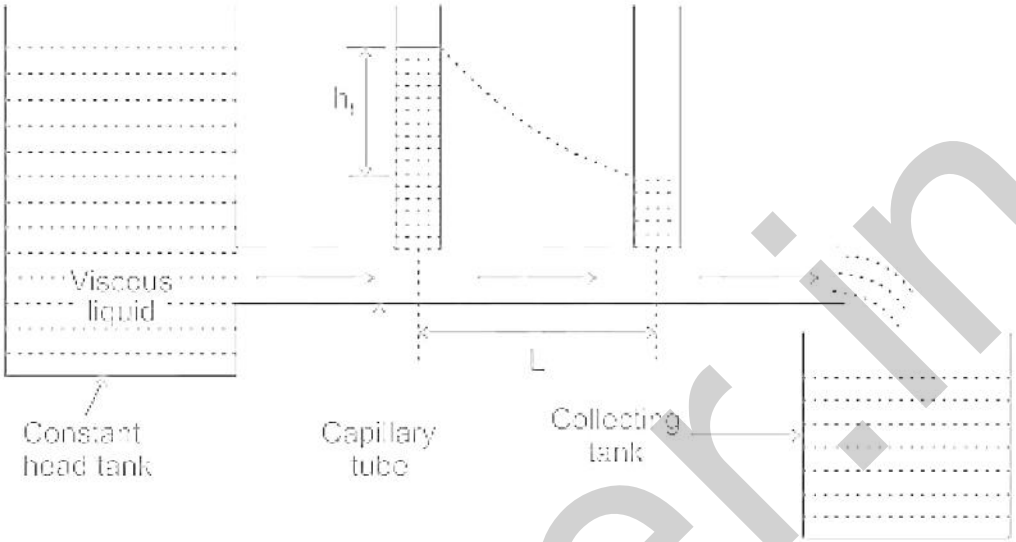
Explanation:

Explanation:

Capillary Tube Viscometer:

- Viscometer is an instrument used for measuring the viscosity of a fluid. In the capillary tube viscometer, the pressure needed to force the fluid to flow at a specified rate through a narrow tube is measured.
- This type of viscometer is based on **laminar flow through a circular pipe.**
- It has a circular tube attached horizontally to a vessel filled with a liquid whose viscosity has to be measured. Suitable head (h f) is provided to the liquid so that it can flow freely through the capillary tube of certain length (L) into a collection tank as shown in figure.
- The flow rate (Q) of the liquid having specific weight w l can be measured through the volume flow rate in the tank.
- The Hagen-Poiseuille**equation** for laminar flow can be applied to calculate the viscosity (μ) of the liquid.

$\mu = \left(\frac{\pi}{128}\right) \frac{W_l h_f d^4}{QL}$



65. **Answer: d**

Explanation:

Explanation:

Buckling/critical load:

The load at which column buckle is termed as buckling load. Buckling load is given by:

$P_b = \frac{\pi^2 EI}{L_e^2}$

where E = Young's modulus of elasticity, I min = Minimum moment of inertia, and L e = Effective length

End conditions	L e	Buckling load
Both ends hinged	L e = L	$P_b = \frac{\pi^2 EI}{L_e^2}$
Both ends fixed	L e = L/2	$P_b = \frac{4\pi^2 EI}{L_e^2}$
One end is fixed and another end is free	L e = 2L	$P_b = \frac{\pi^2 EI}{4L_e^2}$
One end is fixed and another end is hinged	$L_e = \frac{L}{\sqrt{2}}$	$P_b = \frac{\pi^2 EI}{2L_e^2}$

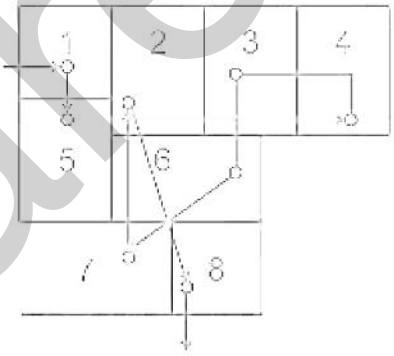
66. **Answer: a**

Explanation:

Explanation:

Process layout:

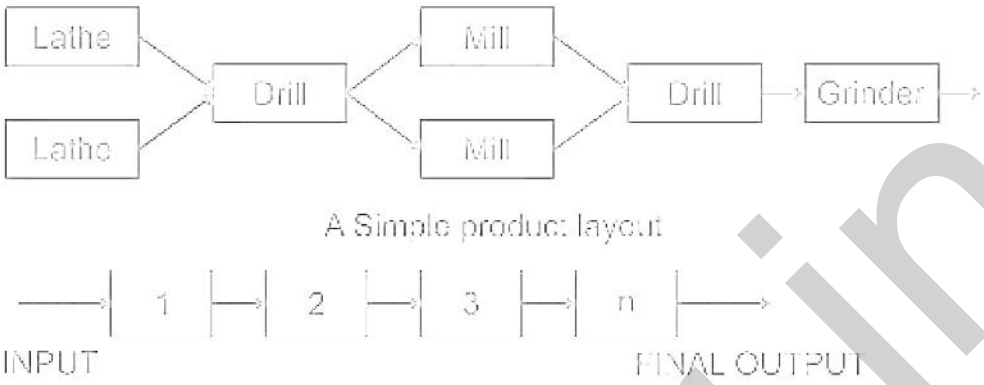
- A process layout also called a job-shop or Functional layout.
- In this layout, similar equipment or machines are grouped together.
- This layout is useful to produce High varieties of products with low volume.
- Part travels, according to the established sequence of operations, from area to area, where the proper machines are located for each operation.
- Hospitals , where the areas are dedicated to a particular type of care, is an example of this.



Process Layout showing product movements
1. Store room, 2. Inspection Department, 3. Broaching Section, 4. Milling Section
5. Lathe Section, 6. Shaper Section, 7. Drill Section, 8. Stock room

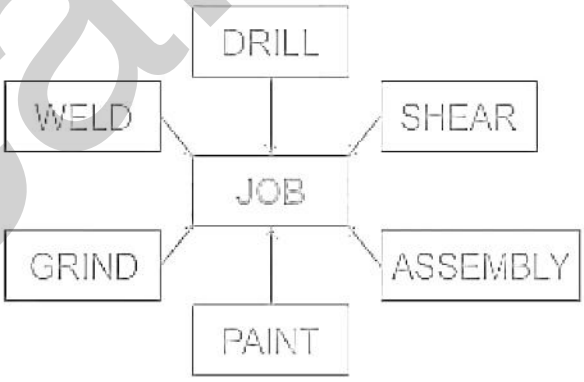
Product layout:

- A product layout is also called a flow-shop layout.
- This layout is very useful to produce a very high volume of products with very low variety.
- In this layout equipment or work-processes are arranged according to the requirement of a specific product.
- The path for each part is, in effect, a straight line.
- **Automobiles manufacturing is an example of the product layout industry.**



Fixed-position layout:

- This layout is just opposite to the process layout.
- Very low volume and very low variety products are made in this layout.
- In a fixed-position layout, the product remains at one location & manufacturing equipment is moved to the product rather than vice-versa.
- Very high weight and bulky product which can not be moved from one place to another place conveniently like Ships, Rockets, Submarine are made with this layout.



A Pictorial Representation of Fixed Location Type of Layout

67. **Answer: b**

Explanation:

Key Points

- O ptical Mark Reading (OMR) is a method of entering data into a computer system.
- Optical Mark Readers reads pencil or pen marks made in pre-defined positions on paper forms as responses to questions or tick list prompts.
- The OMR technology could be used if data is to be collected from a large number of sources simultaneously, a large volume of data must be collected and processed in a short period of time, information mainly comprises the selection of categories or "tick box" answers to multiple-choice questions.
- The OMR data entry system contains the information to convert the presence or absence of marks into a computer data file.

---

68. **Answer: a**

Explanation:

Explanation:

Rake angle:

- Rake angle is the angle of inclination of rake surface from reference plane.
- It is an important parameter in various cutting and machining process.
- There are three types of rake angle i.e. positive, negative and zero.

Positive rake angle: It is used when there is requirement of less cutting force and used for low strength materials like mild steel etc.

Negative rake angle: It is used for hard metals which requires high cutting force and machined at very high speed.

Zero rake angle: It is used for gear cutting or thread manufacturing. Brass and cast iron are machined with zero rake.

Threading is done by a form tool. The forms tool ideally have zero rake angle.

---

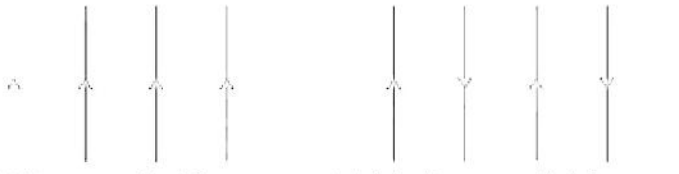
69. **Answer: d**

Explanation:

Explanation:

Like Parallel Forces: The forces, whose lines of action are parallel to each other and all of them act in the same direction as shown in Figure are known as like parallel forces.

Unlike Parallel Forces: The forces, whose lines of action are parallel to each other and all of them do not act in the same direction as shown in Figure are known as unlike parallel forces.



The given forces are of 100 N, 200 N and 300 N have their lines of action parallel to each other but act in the opposite directions. **As the line of actions of these forces**

are parallel but act in opposite directions. Hence these forces are Unlike parallel forces.

---

70. **Answer: b**

Explanation:

Explanation:

Tolerance grade :

- In a standardized system of limits, lower is the tolerance value, lower is the grade of tolerance number but more precision is the component.
- The Bureau of Indian Standards (BIS) specifies 18 basic tolerance grade numbered IT01, IT0, IT1, IT2, to IT16 .
- The commonly used tolerance grades for machine components are from IT5 to IT14 and expressed in terms of tolerance grade ' i', which is a function of geometric mean diameter (D in mm) of the various diameter ranges as per the standard.

$i = 0.45\sqrt[3]{D} + 0.001D$ in µm

D = D 1 x D 2

D 1 and D 2 are the nominal sizes marking the beginning and the end of a range of sizes, in mm.

Some important grade and their tolerance value are given in the table below.

Grade	Tolerance
IT5	7i
IT6	10i
IT7	**16i**
IT8	25i
IT9	40i
IT10	64i
IT11	100i
IT12	160i
IT13	250i
IT14	400i
IT15	640i
IT16	1000i

Alternate Method

The value of tolerance grade can be found by,

$10(1.6)^{(ITn-IT6)}$

Here, the value for the tolerance grade IT-8 is:

$10(1.6)^{(IT8-IT6)} = 10 \times 1.6^2 = 25i$

where i is the standard tolerance unit or fundamental tolerance unit.

---

71. Answer: b

Explanation:

CONCEPT:

- When a body is submerged in a fluid, it experiences pressure due to the surrounding fluid.
- The resultant of the pressure due to the fluid acts at a point in the body.
- Centre of pressure: The point where the total sum of (or resultant) pressure due to the fluid acts on a body submerged inside it.
- Centre of mass: The point where all the mass of a body is assumed to be concentrated.
- Centre of buoyancy:**The centre of gravity of the volume of fluid displaced by the body submerged in the fluid is called the centre of buoyancy.**
- Metacentre: The point at which an imaginary vertical line passing through the centre of buoyancy and centre of gravity intersects the imaginary vertical line through a new centre of buoyancy created when the body is displaced, or tipped, in the fluid.

---

72. **Answer: d**

Explanation:

The correct answer is Shift + Space.

- Short-cut key to Select entire row in M.S. Excel Worksheet is Shift + Space.

Key Points

- This table lists the most frequently used shortcuts in Excel.

TASK	SHORTCUT KEY
Close a workbook.	Ctrl+W
Open a workbook.	Ctrl+O
Go to the Home tab.	Alt+H
Save a workbook.	Ctrl+S
Copy selection.	Ctrl+C
Paste selection.	Ctrl+V
Undo recent action.	Ctrl+Z
Remove cell contents.	Delete
Choose a fill color.	Alt+H, H
Cut selection.	Ctrl+X
Go to the Insert tab.	Alt+N

TASK	SHORTCUT KEY
Apply bold formatting.	Ctrl+B
Center align cell contents.	Alt+H, A, C
Go to the Page Layout tab.	Alt+P
Go to the Data tab.	Alt+A
Go to the View tab.	Alt+W
Open the context menu.	Shift+F10 or Windows Menu key
Add borders.	Alt+H, B
Delete column.	Alt+H, D, C
Go to the Formula tab.	Alt+M
Hide the selected rows.	Ctrl+9
Hide the selected columns.	Ctrl+0

73. **Answer: b**

Explanation:

Explanation:

- Generally, drills are manufactured to standard sizes in the metric system.
- These drills are available in specified steps.
- The drills, which are not covered under the above category, are manufactured in,
    1. Letter drills
    2. Numberdrills

Number drills:

- The number drill series consists of drills numbered from 1 to 80.
- **The No.1 drill is the largest, with 5.791 mm diameter, and the No.80 drill is the smallest, with 0.35 mm diameter.**
- There is no uniform variation in the drill diameters from number to number.
- To find the correct diameter of a number drill, refer to a drill Size Chart or a Hand-book.
- Number drill series are also known as Wire gauge series

Additional Information

Letter drills:

- The letter drill series consists of drill sizes from 'A' to 'Z'. The **letter 'A' drill is the smallest with a 5.944 mm diameter, and the letter 'Z' is the largest, with a 10.49 mm diameter.**
- In the number drill and the letter drill series, the correct diameter of the drill is gauged with the help of the respective drill gauges.
- A drill gauge is a rectangular or square-shaped metal piece containing a number of different diameter holes.
- The size of the hole is stamped against each hole.

74. **Answer: d**

Explanation:

Correct option is 4).

Key Points

- To field is generally for the main recipients of your email.
- CC stands for carbon copy and BCC stands for blinding carbon copy .
- CC and BCC are both ways of sending copies of an email to additional people.
- It is used to send copies of an email to additional people by specifying multiple addresses in the To field.
- BCC field of a message, those addresses are invisible to the recipients of the email .
- Any email addresses that you place in the To field or the CC field are visible to everyone who receives the message.
- You put four email addresses in the To field or put one email address in the To field and three in the CC field, the four people will all receive the same email.
- They'll also be able to see the email address of every other recipient in the To and CC fields.

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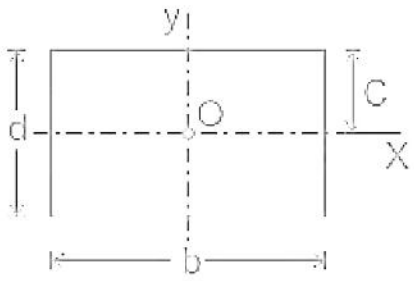
75. **Answer: d**

Explanation:

Explanation:



Moment of inertia of the rectangular section about X-X axis passing through the C.G. of the section (parallel to width):

$I_{xx} = \frac{bd^3}{12}$

Moment of inertia of the rectangular section about Y-Y axis passing through the C.G. of the section (parallel to depth):

$I_{yy} = \frac{db^3}{12}$

---

76. **Answer: a**

Explanation:

Key Points

- **Extinct species** refer to those that have **no living individual** on Earth now.
- Extinction of a species can be caused by various natural and man-made reasons.
  - **Invasion of non-native species** - When new species are brought into their habitat from other external habitats.
  - **Overexploitation of resources** - When all the natural resources like food or water are exhausted due to overuse or over-crowding.
  - **Pollution** - Environmental pollution like air, water or soil pollution.
  - **Global environment change** - like global warming, rising of sea levels, etc.

Important Points

- **Dodo** was a **flightless bird** that lived on the island of **Mauritius** .
- It nested on the ground and were more vulnerable.

- It **did not have any natural predator** in its habitat, so it was not afraid of humans.
- When Portuguese and Dutch sailors landed on this island, the birds were discovered for the first time.
- They started killing these birds for its flesh.
- The sailors used them for food because they were **easy source for fresh meat** .
- The bird population started decreasing because of this.
- As human settlements increased, the bird's natural habitat was also lost.
- This led to the ultimate extinction of the bird.
- The **last Dodo was killed in 1681** .

Additional Information

- Some other animals that went extinct due to overexploitation are:
  - Quagga from South Africa
  - Stellar's Sea Cow from Russia
  - Thylacine from Australia

---

77. **Answer: d**

Explanation:

Explanation:

- Renewable energy is also known as clean energy which is obtained from natural sources and can be replenished.
- Solar energy, wind energy, hydroelectric power, biomass energy, geothermal energy, and tidal energy are examples of renewable sources of energy.
- Energy is free in nature, some are infinitely available, called sustainably, and some are called non-renewable.
- It is our duty to ensure that sustainable and non-renewable technology is used properly.
- Non-renewable electricity is a finite resource that can inevitably run out over time.
- Non-renewable energy does not regenerate itself at a reasonable pace for sustainable economic extraction within meaningful human timeframes.

- Non-renewable energy is fossil fuel energy, such as coal, crude oil, natural gas, and uranium.
- Unlike renewable energy, non-renewable energy requires human interference to make it suitable for use.
- Fossil fuels are primarily fossil.
- Fossil fuels are thought to have been produced more than 300 million years ago when the planet was very different in its landscape.
- Types of Non-renewable resources:
    - Fuels which are formed by remains of animals and plants
    - Divided into further three categories: Natural Gas, Oil, and **Coal**
    - Thermal Electricity uses Coal for heat production and converts that heat into electricity.
    - Nuclear fuels : The use of fission-based nuclear energy requires naturally occurring radioactive material as a reactor.
        - Uranium is the most natural fission fuel and is found in the soil at extremely low concentrations and extracted in 19 countries.
        - Nuclear power generates approximately 6 % of the world's oil and 13-14% of the world's electricity.

Additional Information

- The difference between renewable and non-renewable sources of energy.

Renewable sources of energy	Non-renewable sources of energy
Renewable sources of energy are the natural resources that get replenished from time to time.	Non-renewable sources of energy are obtained from the earth's crust and once used they disappear.
These resources do not cause any pollution.	These resources cause pollution.
Solar energy and wind energy are examples of renewable sources of energy.	Fossil fuels and natural gas are examples of non-renewable sources of energy.

78. **Answer: a**

Explanation:

Explanation:

Themit Welding: Thermit is a mixture of aluminium powder and metal oxide. Aluminium combined with oxygen and intense heat will be released. **It is used for the repair of railway tracks.**

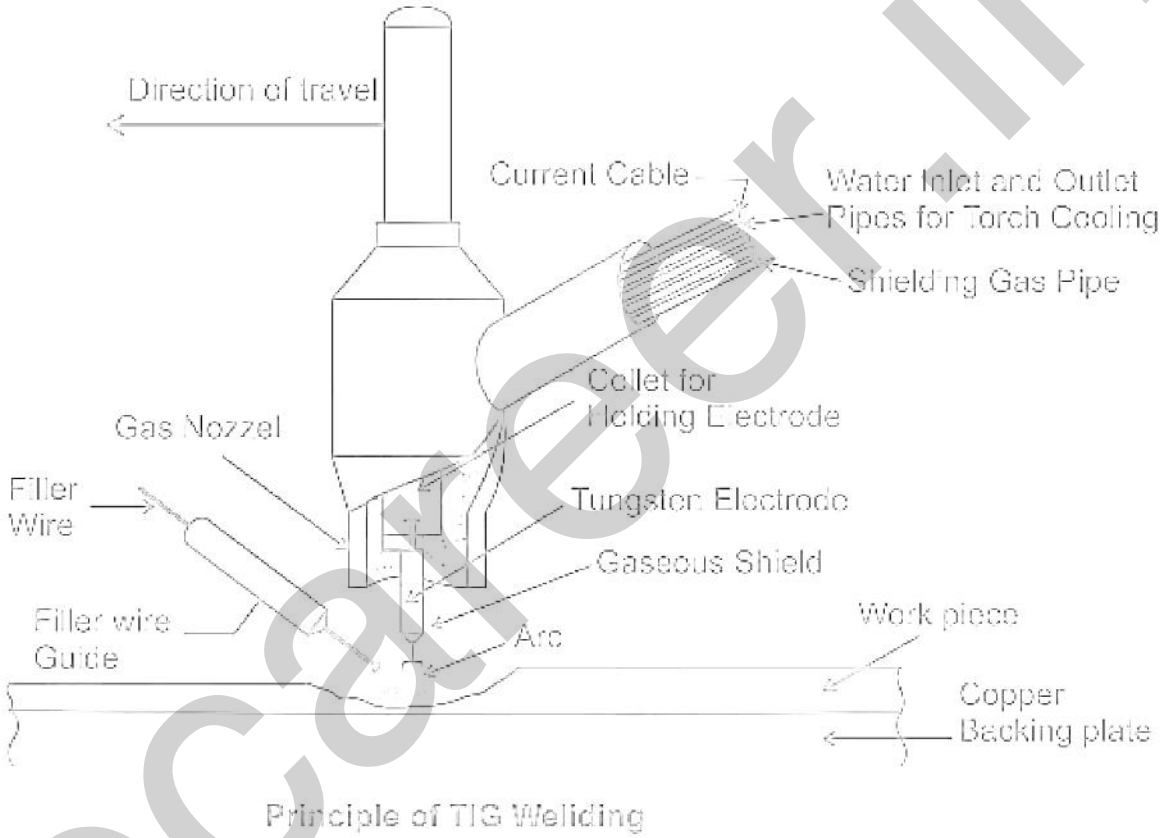
Submerged a rc welding: In submerged arc welding the arc is completely submerged into the granular flux powder and forming a blanket.

TIG Welding:

- Tungsten Inert Gas (TIG) or Gas Tungsten Arc (GTA) welding is the arc welding process in which arc is generated between non-consumable tungsten electrode and workpiece.

- The tungsten electrode and the weld pool are shielded by an inert gas normally argon and helium.
- Tig welding is used for Aluminium, Magnesium and Titanium alloy.

The principle of tungsten inert gas welding process is shown below

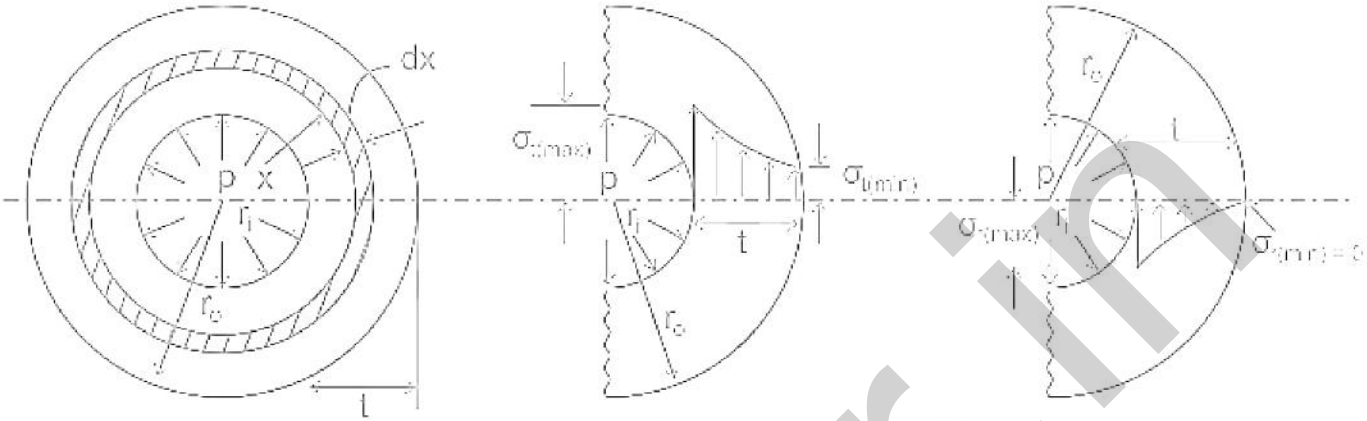


79. **Answer: b**

Explanation:

Explanation:

In the case of thin cylinders, the hoop stress is determined by assuming it to be uniform across the thickness of the cylinder but in thick cylinders, the hoop stress is not uniform across the thickness, it varies from a maximum value at the inner circumference to a minimum value at the outer circumference.



(a) Thick cylindrical shell b) Tangential stress distribution (c) Radial stress distribution

Stress distribution in thick cylindrical shells subjected to internal pressure

For a thick cylinder hoop stress (tangential stress) is given by,

$$\sigma_h = \frac{P(r_i)^2}{(r_0)^2-(r_i)^2}\left[1+\frac{(r_0)^2}{x^2}\right]$$

For a thick cylinder Radial stress is given by,

$$\sigma_r = \frac{P(r_i)^2}{(r_0)^2-(r_i)^2}\left[1-\frac{(r_0)^2}{x^2}\right]$$

r i ≤ x ≤ r o

Where, r i and r o are inner and outer radius, respectively

Additional Information

Thin spherical shell

For the thin spherical shell of diameter d and thickness t, subjected to internal pressure p,

$\sigma 1 = \sigma\ 2 = \sigma h = \frac{Pd}{4t}$

80. **Answer: a**

Explanation:

Explanation:

Poisson's ratio is the ratio of transverse strain to longitudinal strain

$$\nu = -\frac{\epsilon_{\text{lateral}}}{\epsilon_{\text{longitudinal}}}$$

Most materials have Poisson's ratio values ranging between 0.0 and 0.5 (mostly 0.33).

A perfectly incompressible material has a value of 0.5 .

Stainless steel: 0.30–0.31,

Steel: 0.27–0.30,

Cast iron:0.21–0.26,

Cork: 0.0,

Rubber: 0.5.

∴ Poisson's ratio of rubber lies between 0.45 to 0.50.

Additional Information

For a rigid body, the value of Poisson's ratio is zero.

A zero Poisson's ratio means that there is no transverse deformation resulting from an axial strain.

- Most materials have Poisson's ratio values ranging between 0.0 and 0.5.
- A perfectly incompressible material deformed elastically at small strains would have a Poisson's ratio of exactly 0.5.
- Most steels and rigid polymers when used within their design limits (before yield) exhibit values of about 0.3, increasing to 0.5 for post-yield deformation which occurs largely at constant volume.
- Rubber has a Poisson ratio of nearly 0.5.
- Cork's Poisson ratio is close to 0, showing very little lateral expansion when compressed.

81. **Answer: a**

Explanation:

Explanation:

Duralumin :

- It is an alloy made up of 93% Aluminum, 3% Copper, 2% Magnesium, and 2% manganese .
- It is workable, ductile, and relatable in the normal state and can be drawn and rolled into a variety of shapes.

Uses of Duralumin:

- Duralumin is used for making blades of Aeroplane .
- Used for making wire, bar, and rods for the screw machine products
- Used in heavy-duty forgings, wheels, plates, extrusions, aircraft fittings, space booster tankage and truck frame, and other suspension components.
- Used as a sheet for the auto body panels.
- Used for making die and hand forgings.

Additional InformationAlloys

- Alloys are the homogenous mixture of two or more metals or metals and non-metals.
- The mixing is done in molten form.
- Alloying is the way to prevent the corrosion of the metal.
- Apart from this, alloys give strength to the metal.
- In construction, steel an alloy of iron and carbon (95% iron + 5% carbon) is used.
- Apart from this alloys have several other uses which has been given in the below table.

Alloys	Composition	Uses
Brass	Copper + Zinc	Utensils
Bronze	Copper + Tin	Medals
Solder	Lead + Tin	Welding
Duralumin	Aluminium + magnesium, copper	Aeroplane
Magnellium	Aluminum + Magnesium	Beam Balance
German Silver	Copper, zinc and Nickel	tableware (commonly silver plated), marine fittings, and plumbing

82. Answer: d

Explanation:

Concept:

Equation of Pure torsion

$\frac{T}{I_P} = \frac{\tau}{r} = \frac{G\theta}{L}$ where,

T = Maximum torque, I P = Polar moment of inertia, τ = shear stress at any point at a distance r from center, G = Modulus of rigidity, θ = angle of twist in radians, R = radius of shaft

Considering the rigidity of shaft, The maximum shear stress induced in the solid shaft of diameter d, to transmit twisting moment T is given by,

$\tau_{max} = \frac{16T}{\pi d^3}$

The maximum shear stress induced in the hollow shaft of outer diameter d o and inner diameter d i to transmit the twisting moment T.

$\tau_{max} = \frac{16T}{\pi d_o^3(1-K^4)}$, where K is the ratio of outer and inner diameter, $K = \frac{d_i}{d_o}$

Calculation:

Given:

d = 50 mm, L = 0.7 M, T = 1200 N-m

Maximum shear stress-induced, $\tau_{max} = \frac{16T}{\pi d^3}$

$\Rightarrow \tau_{max} = \frac{16 \times 1200 \times 1000}{\pi \times 50^3} = 48.9\ MPa$

---

83. Answer: d

Explanation:

Explanation:

Trend line:

- **Best - fit line** is known as the trend line.
- It is generally used in the Linear regression analysis method of forecasting
- Linear Regression is a mathematical technique of obtaining the line of **best fit between a dependent variable which is usually the demand of a product and any other variable on which demand is dependent.**

- **In regression analysis, the relationship between some independent variable x and dependent variable y can be represented by a straight line Y = a + bx**

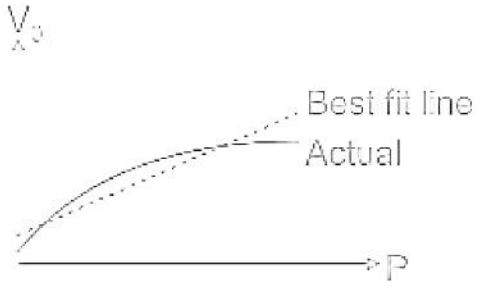
where,

a = intercept on y-axis, b = slope of line

$$a = \frac{\sum y - b\sum x}{n}$$

$$b = \frac{n\sum(xy) - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

- Trendlines are easily recognizable lines that traders draw on charts to connect a series of prices together or show some data's best fit.
- The resulting line is then used to give the trader a good idea of the direction in which an investment's value might move.
- A trendline is a line drawn over pivot highs or under pivot lows to show the prevailing direction of price.
- Trendlines are a visual representation of support and resistance in any time frame.
- They show the direction and speed of price, and also describe patterns during periods of price contraction
- In terms of metrology, **Best Fit Straight Line (BFSL)** method is the relationship of the calibration curve to a calculated straight line that minimizes the error but does not pass through the endpoints.

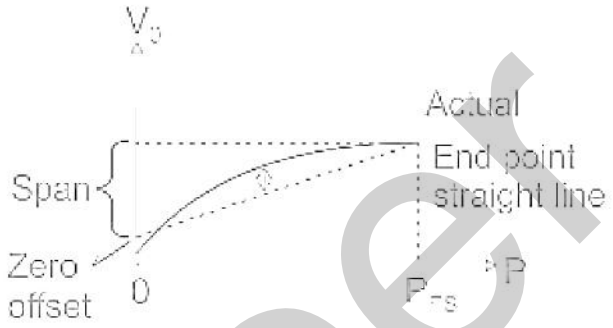


Least square line:

- The Least Squares Regression Line is the line that makes the vertical distance from the data points to the regression line as small as possible. It's called a "least square" because the best line of fit is one that minimizes the variance (the sum of squares of the errors).

Endpoint line:

- End point method measures non-linearity when a straight line is drawn connecting the endpoints from P0 (zero differential pressure) to P_{RS} (full scale). In this case, the end point accuracy is preserved when calibration adjustments are made to zero offsets or span



Terminal line:

- Relationship of a calibration curve to a specified straight line with end points at zero and full scale.

---

84. Answer: a

Explanation:

The correct answer is the **paper industry.**

- **Paper Industry flourishes in Nepanagar.**

Key Points

- Nepanagar is famous for the Newsprint industry.
- Nepanagar is an industrial township in Burhanpur district in the state of Madhya Pradesh .
- Nepa Mills Limited which was earlier known as The National News Print Ltd.
- It was originally floated by a private entrepreneur in 1947 and the management was taken over by the Madhya Pradesh Government in 1949 and became a Central Government Company in 1959.

- It is the first indigenous newsprint manufacturing unit in the country.
- The word " **NEPA** " is coined by the **National Environment Protection Authority.**

Additional Information

- Rohtas industry at Dalmia Nagar in Bihar is famous for the production of heavy chemicals .
- The **sugarcane industry** is famous in **Uttar Pradesh.**
- **Madhya Pradesh** is famous for its **cement industry.**

---

85. Answer: a

Explanation:

Explanation:

Surface grinding machines:

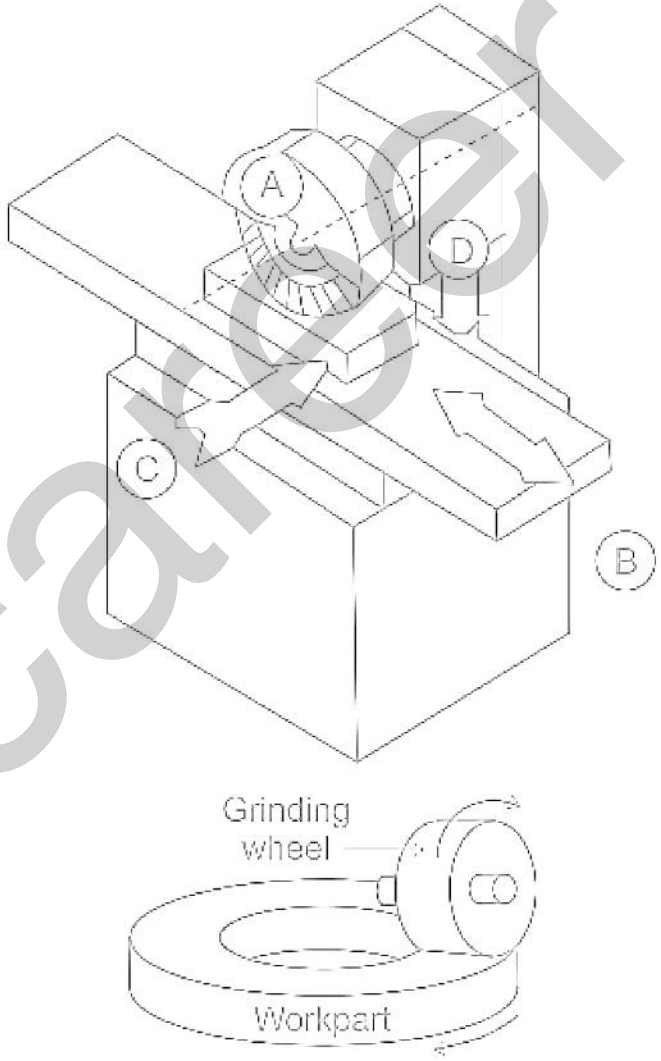
- These machines are intended to produce and finish that surface.
- The common classification of surface grinders are:
- According to the table movement:
    1. Reciprocating table type.
    2. Rotary table type.
- According to the spindle direction :
    1. Vertical spindle.
    2. Horizontal spindle.

Depending upon the construction variation following four main machines are available with different table movement and spindle directions.

Surface grinding machine with horizontal spindle and reciprocating table:

- A horizontal spindle reciprocating table machine basically consists of a horizontal spindle carrying the grinding wheel and a rectangular work table.
- This type of machine tool consists of a grinding wheel located on the horizontal spindle.

- Longitudinal movement is given by the table and crossfeed is by table or wheel head depending upon the design of the machine.
- It has a table with a reciprocating facility and consists of T-slots for holding workpieces.
- The table can be moved longitudinally or perpendicular to the longitudinal feed.
- They are vastly used for all types of plane surface grinding where smooth finish and close tolerances are required.



The above-given diagram is a Horizontal spindle and rotary table surface grinding machine.

---

86. **Answer: a**

Explanation:

Explanation :

Silica and its properties:

- Silicon dioxide is also known as silica.
- It has the chemical formula SiO_2.
- It is commonly found in nature as quartz and in various living organisms.
- It is used in the food industry as an anti-caking agent.
- It has a good power to absorb water.
- It is also used to clarify food beverages.
- It is used in gliding and polishing glass and precious stones.
- It is a ceramic material that has widespread industrial use.
- It is important for humans for the formation of bones and connective tissues.

Additional Information

Metallic Alloy:

- Alloy is a mixture of a metal with two or more metals or non-metals.
- It is used for various purposes.
- Alloys are corrosion resistant.
- They are better being used in place of pure metals.
- Examples are steel, bronze and brass.

Organic Polymer:

- Organic polymers are organic carbon chain compounds.
- They have similar or different monomer units that combine together for polymer.
- They have endless extended changing.

Composite Material:

- Composite materials are solid materials.
- They are made of two or more substances combined together.
- They are used for different purposes like making matrices, cloth sheets etc.

- Example- polymer matrix, metal matrix and ceramic matrix.

---

87. **Answer: c**

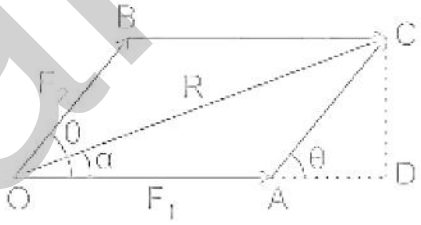
Explanation:

Concept:

Law of Parallelogram of forces

This law is used to determine the resultant of two coplanar forces acting at a point.

It states that "If two forces acting at a point are represented in magnitude and direction by two adjacent sides of a parallelogram, then their resultant is represented in magnitude and direction by the diagonal of the parallelogram which passes through that common point."



Let two forces F 1 and F 2, acting at the point O be represented, in magnitude and direction, by the directed line OA and OB inclined at an angle θ with each other.

Then if the parallelogram OACB be completed, the resultant force R will be represented by the diagonal OC.

$R = \sqrt{F_1^2 + F_2^2 + 2F_1F_2cos\theta}$

Calculation:

Given:

F 1 = 6 N and F 2 = 10 N, θ = 60°

Resultant force is given by,

$R = \sqrt{F_1^2 + F_2^2 + 2F_1F_2cos\theta}$

$\Rightarrow\ R = \sqrt{6^2 + 10^2 + 2 \times 6 \times 10 \times cos60}$

R = 14 N

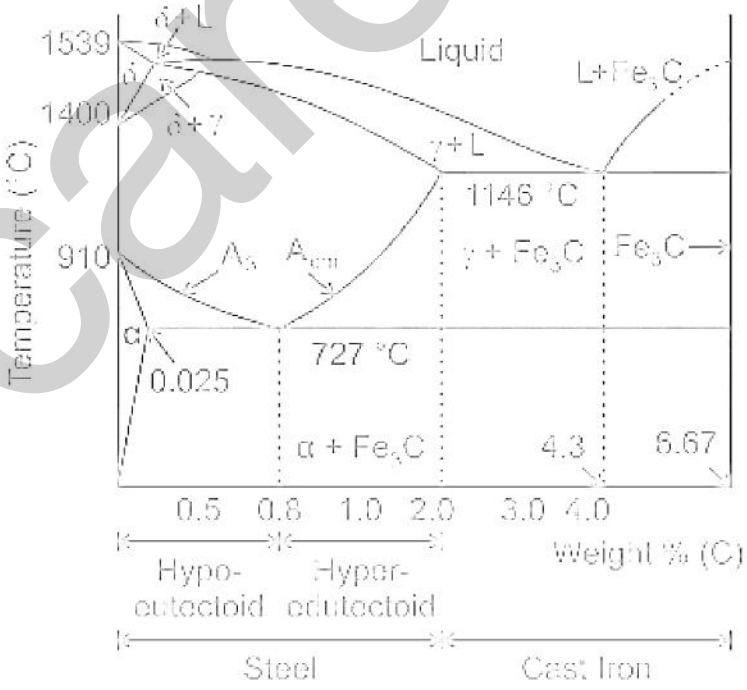
---

88. Answer: c

Explanation:

Explanation:

Steel and Cast Iron : Alloys of iron and carbon, containing up to 2.14% carbon are called steels , and those containing carbon above 2.14% are called cast irons.



Eutectic: For alloy of iron and carbon only, the eutectic, or lowest freezing point composition is that **having 4.3% of carbon.**

- Hyper-eutectic CI:
  - Carbon content above 4.3% of the alloy is termed hyper-eutectic alloy.

- The hyper-eutectic composition is liable to have coarse opened grain structures and comparatively large flakes of “kish” graphite when cooled slowly as in ordinary sand modules.

- Hypo-eutectic CI:
  - Carbon content below 4.3% of the alloy is termed hypo-eutectic alloy.
  - The hypo-eutectic alloys have relatively fine graphite and denser tighter structures.

Eutectoid/Pearlite steel:

A 0.84% carbon steel or eutectoid steel is known as PEARLITE steel. This is much stronger than ferrite or cementite.

- Hypo-eutectoid Steel:
  - Plain carbon steels in which carbon percentage is less than 0.8% are called hypo-eutectoid steel.
- Hypereutectoid Steel:
  - Plain carbon steels in which carbon percentage is more than 0.8% are called hyper-eutectoid steel.

---

89. **Answer: a**

Explanation:

Concept:

A grinding wheel consists of the abrasive that does the cutting, and the bond that holds the abrasive particles together.

A standard marking system is used to specify and identify grinding wheels.

The following is the sequence of arrangement:

Abrasive type – Grain size – Grade of bond – Structure – Bond type

Let us understand it with an example

51	A	46	H	5	V	8
Position 0	Position 1	Position 2	Position 3	Position 4	Position 5	Position 6
Manufacturer's Symbol for abrasive (Optional)	Type of abrasive grit size	Grain size	Grade	Structure (Optional)	Type of bond	Manufacturer's own mark (Optional)

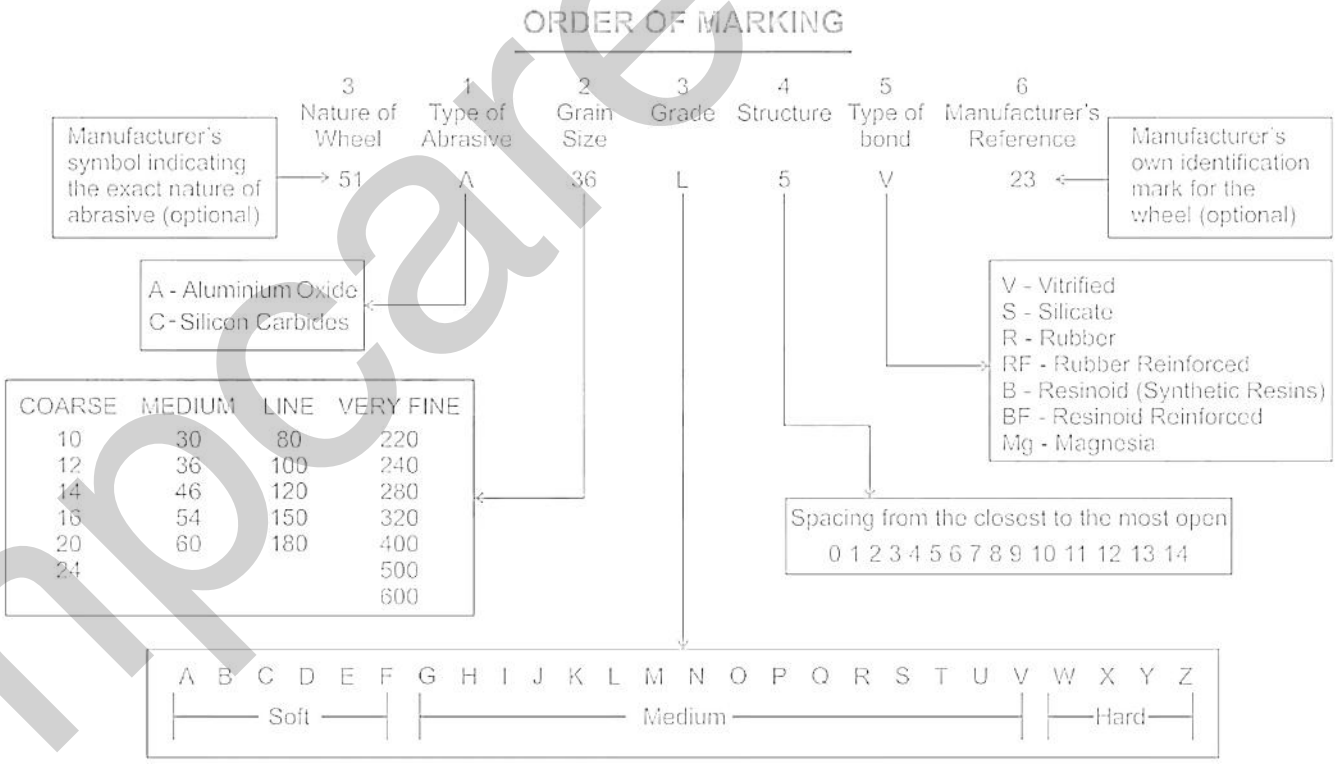


Chart illustrating standard marking system IS : 551 - 1966

- Abrasive type: 'A' for aluminium oxide, 'C' for silicon carbide
- Grain size: They are indicated by a number ranging from 10 (coarse) up to 600 (very fine)
- Grade of bond: It shows the hardness of the grinding wheel. The grades range from 'A' indicating light or 'soft' bond to 'Z' indicating a firm or 'hard' bond

- Structure: This structure is indicated by a number from 1 to 12. The higher numbers indicate a progressively more open structure.It is an optional specification.
- Bond type: V – Vitrified, S – Silicate, B – Resinoid, R – Rubber, E – Shellac, O – Oxychloride

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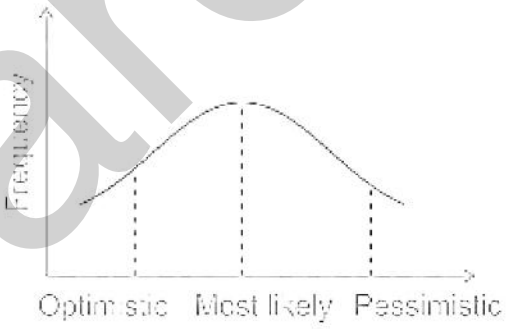
90. Answer: d

Explanation:

Explanation:

PERT approach takes account of the uncertainties. In this approach, 3-time values are associated which each activity. So it is probabilistic.



Whereas CPM involves the critical path which is the largest path in the network from starting to ending event and defines the minimum time required to complete the project. So it is deterministic.

CPM	PERT
CPM is an **activity-oriented** network diagram	PERT is an **event-oriented** network diagram
CPM is based upon a deterministic approach	It is based on the Probabilistic approach
Only one time estimates are made for each activity	Three-time estimates are made for each activity
Each activity follows a normal distribution	Each activity follows β distribution

91. **Answer: c**

Explanation:

Explanation:

Economic Order Quantity (EOQ):

- A decision about how much to order has great significance in inventory management.
- The quantity to be purchased should neither be small nor big because the costs of buying and carrying materials are very high.
- Economic order quantity is the size of the lot to be purchased which is economically viable.
- This is the number of materials that can be purchased at minimum costs.

- Generally, economic order quantity is the point at which inventory carrying costs are equal to order costs.

At EOQ:

Ordering cost = Holding cost

$\frac{D}{Q^*}C_o = \frac{Q^*}{2}C_h \Rightarrow Q^* = \sqrt{\frac{2DC_o}{C_h}}$

D = Annual or yearly demand of inventory (unit/year)

Q = Quantity to be ordered at each order point (unit/order)

C o = Cost of placing one order [Rs/order]

C h = Cost of holding one unit in inventory for one complete year [Rs/unit/year]

---

92. Answer: b

Explanation:

Explanation:

Chip thickness ratio / Cutting ratio (r):

It is the ratio of chip thickness before cut (t 1) to the chip thickness after cut (t 2) .

$r = \frac{Chip\ thickness\ before\ cut\ (t_1)}{Chip\ thickness\ after\ cut\ (t_2)} \Rightarrow \frac{uncut\ chip\ thickness}{chip\ thickness}$

chip thickness after the cut (t 2) is always greater than the chip thickness before the cut (t 1), ∴ r is always < 1 , i.e. the uncut chip thickness value is less than the chip thickness value.

Assuming volume to be constant:

t 1b 1L 1 = t 2b 2L 2

$\frac{t_1}{t_2} = \frac{L_2}{L_1} \quad (\because b_1 = b_2)$

as t 2 > t 1, ∴ L 2 < L 1 i.e. length after cut is less than the length before the cut.

Assuming discharge to be constant:

t 1b 1V = t 2b 2V c

$\frac{t_1}{t_2} = \frac{V_c}{V} \quad (\because b_1 = b_2)$

$\frac{t_1}{t_2} = \frac{V_c}{V}$

i.e. the cutting ratio is the ratio of cutting ratio to cutting velocity.

as t 2 > t 1, ∴ V > V c i.e. cutting velocity is greater than the chip velocity.

---

93. **Answer: c**

Explanation:

Explanation:

Sherardizing

- This process is used for galvanizing those small parts having intricate shapes
- **In this process, there is a box or container having filled with fine zinc powder**
- The parts are placed in this box, surrounded by the powder; The box is then heated in an oxygen
- Zinc powder vaporises; Zinc vapour comes in contact with the surface of the workpiece and zinc is deposited on the workpiece
- The workpiece is then taken out and it is allowed to cool down to room temperature; In this way galvanizing of the workpiece can be completed.

Additional Information Cementation: There are three types of cementation processes for protecting metal surfaces.

- Sherardizing (Zinc coating)

- Colourizing (Aluminium coating)
- Chromizing (Chromium coating)

Anodizing: Anodizing is used to provide a decorative and corrosion-resistant coating on aluminium and its alloys only.

A thin coating of oxide on aluminium can protect the surface from corrosion.

Aluminium is ideally suited to anodizing, although other non-ferrous metals such as magnesium and titanium also can be anodized.

Parkerising is a process used for making thin phosphate coating on steel.

Galvanizing: It is a process of giving a protective coating of zinc on iron sheets and components to protect the surface from corrosion. It is the process of coating of zinc by hot- dipping.

---

94. Answer: d

Explanation:

Explanation:

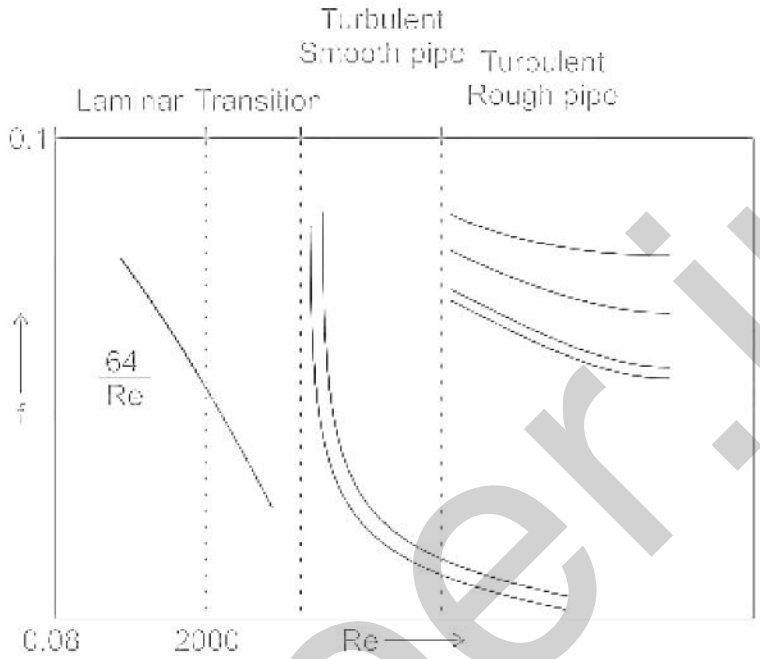
For a laminar fully developed flow through pipes, the friction factor, f is found from the exact solution of the Navier-Stokes equation is given by:

$f = \frac{64}{Re}$

$f \propto \frac{1}{Re}$

Where , f = Friction factor, Re = Reynolds Number

Thus, the friction factor is inversely proportional to Reynolds Number . So, after plotting in the log plain it is like a straight line coming downwards. So, that is what you see for the laminar flow in the moody chart.



95. **Answer: c**

Explanation:

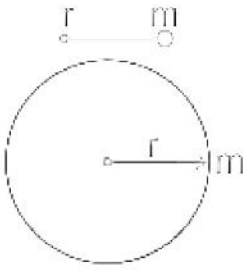
CONCEPT:

- Moment of Inertia: A quantity expressing a body's tendency to resist angular acceleration is called the moment of Inertia.
- For point mass Moment of inertia is simply the mass times the square of the perpendicular distance to the axis of rotation.

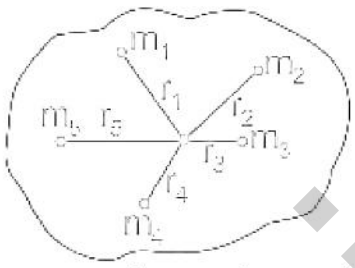
$I = m \times r^2$

where I is the Moment of Inertia, m is point mass, r is the perpendicular distance from the axis of rotation.

- For a rigid body system, the moment of inertia is the sum of the moments of inertia of all its particles taken about the same axis.



$I = mr^2$



$I = \Sigma m r^2 = m_1 r_1^2 + m_2 r_2^2 + m_3 r_3^2 + m_4 r_4^2 + m_5 r_5^2$

$I = \sum m_i r_i^2$

where I is the Moment of Inertia, m is point mass, r is the perpendicular distance from the axis of rotation.

- If the mass is situated close to the axis Moment of Inertia will be small because the distance of mass particles from the axis of rotation will be small.
- If the mass is situated at a large distance from the axis Moment of Inertia will be large because the distance of mass particles from the axis of rotation will be large.
- So the moment of Inertia depends on the position of the axis of rotation as well as the mass distribution.
- The moment of inertia is a physical property of configuration mass distribution and an axis of rotation .
- It also depends on the shape and size of the body because when we change the shape and size then the distance from the axis of rotation will change.

Hence The Moment of Inertia does not Depend on the Angular velocity of the body.

---

96. **Answer: b**

Explanation:

Explanation:

Plate Planer Machine:

- Edge planer is also called planer and is used for beveling and squaring the edges of steel plates used for pressure vessels in different applications and in the ship buildings industry.
- The table holds the work that remains in a stationary position. The workpiece can be attached by air-operated clamps.
- **It is designed for cutting the edges of heavy steel plates, pressure vessels and armoured plates.**
- The tool-head that mounts on the carriage moves along two horizontal guideways.

Divided Table Planer Machine:

- Divided table Planer Machine has two tables on the bed that can reciprocate separately or jointly. This will save idle time when you set the work.
- Divided type planer is mostly suitable for mass production work that can Machine is to be done identically, the work on one of the tables is loaded, the other part can reciprocate the cutting tool for the finishing process.
- Finishing the work can be done after the table is stopped and the finished job is ejected by shifting the table to the end.
- Heavy and large jobs are clamped together therefore given the reciprocating movement by the tool.

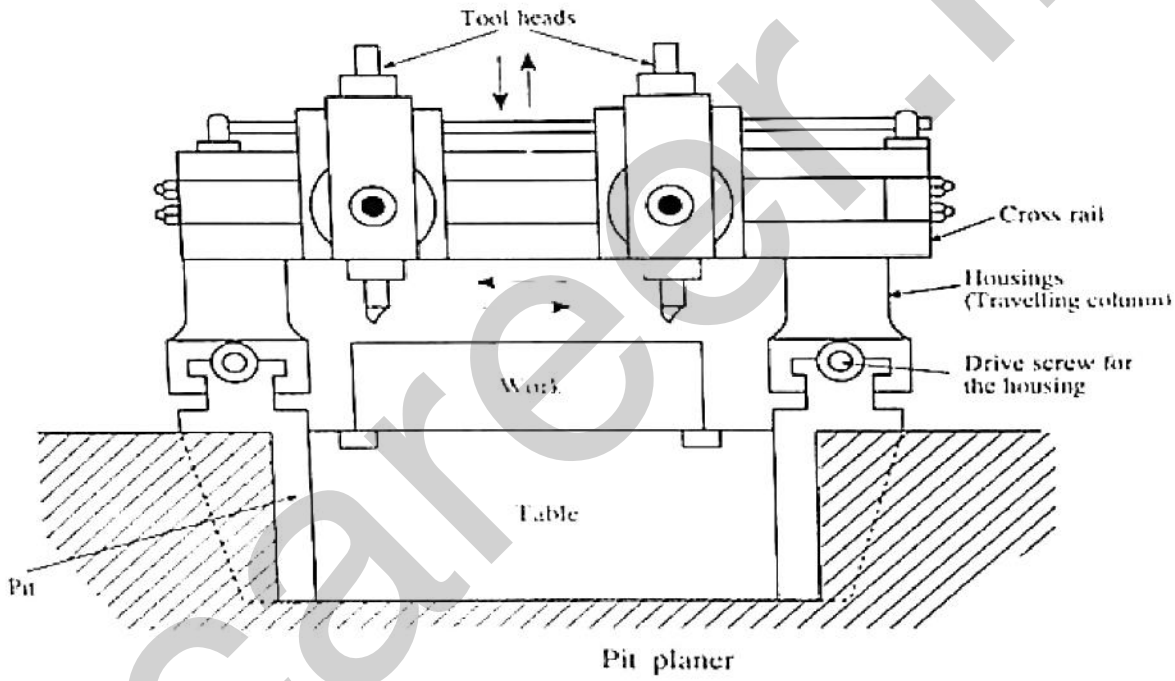
Open Side Planer Machine:

- One housing on one side of the base is attached or clamped on which a cross rail on a table moves.
- The open side planer machine has three tool heads mounted on the machine. Single housing will bear the entire load, therefore it should be rigid and robust to face the forces.
- It can slide along the guideways of the housing in the vertical direction which carries the tool heads.

Pit Planer Machine:

- The pit planer has a massive construction in which the table is kept in a pit and kept stationary.

- The cross rail reciprocates on a horizontal rail mounted on both sides of the table.
- The table of the planer is levelled with the floor, so heavy work can be loaded.
- It has two tool heads and these can be moved horizontally and vertically to have the feed.
- By means of a motor, a driving screw is used for driving the column.



Pit planer

Double Housing Planer Machine:

- Most of the workshops use a double housing planer machine. Double housing planers have a long heavy base with machined guideways accurate on which a table reciprocates. The bed length is greater than twice the length of the table.
- Two vertical housings are mounted on housing: One on each side and these are connected at the top by a cross member. It has a horizontal cross rail that carries two tool head slides over the vertical faces of the machine housing.
- Tool heads are moved by hand or power in the cross or vertical direction for the feeding operation. Double housing planer is a high speed, heavy-duty as well as rigid machine.
- It has a high degree of surface finish. Work is mounted on a table which reciprocates while the tool is held on the machine frame.

- It can make deep cuts and heavy feeds can be applied to finish the work in a short time. The tool is stationery and work is moving.
- Heavier, stronger, and larger tools are used.
- Throughout the stroke cutting and return, speeds are uniform.
- Double housing Planer consumes a power of 150 horsepower and the double housing holds the large floor area.

---

97. **Answer: d**

Explanation:

Explanation:

Buffing:

- Buffing is a rotating **cloth wheel that is impregnated with fine abrasive compounds, and it produces a bright-lustre finish on metal and composites.** Buff wheels are impregnated with liquid rouge or a greaseless compound-based matrix of the specialized fine abrasive called compound.
- The compound is sprayed or pressured into the rotating buffing wheel. The buff wheel acts as the carrier of the compound, which ultimately does the surface finishing.

Honing:

- Honing machines are metal abrading tools and processes utilizing hard tooling and perishable abrasives stones.
- The honing process was developed to allow for the perfection of bore geometry, size control, final surface finish and surface structuring.
- The honing process provides the final sizing and creates the desired finish pattern on the interior of tubing or cylinder bores.
- Finishing is accomplished by expanding abrasive stones of suitable grit and grade against the work surface.

Lapping:

- It is an abrading process for refining surface finish and the geometrical accuracy of flat cylindrical and spherical surfaces
- It is a process or removing surface roughness , tool marks, surface cracks from grinding, slight distortions and other minor – defects from previous operations
- Lapping produces geometrically true surfaces, corrects minor surface imperfections, improves dimensional accuracy and provides a very close fit between two contact surfaces
- Since very thin layers of metal (0.005 to 0.01 mm) are removed in lapping, it is, therefore, unable to correct substantial errors

Nitriding:

- Nitriding is a case of the hardening process in which nitrogen (Ammonia) instead of carbon is added to the surface of the steel.
- Nitriding heats the steel part to 482-621°C (900-1,150°F) in an atmosphere of ammonia gas and dissociated ammonia.
- The time the part spends in this environment dictates the depth of the case.
- No quenching is done after nitriding.

---

98. **Answer: b**

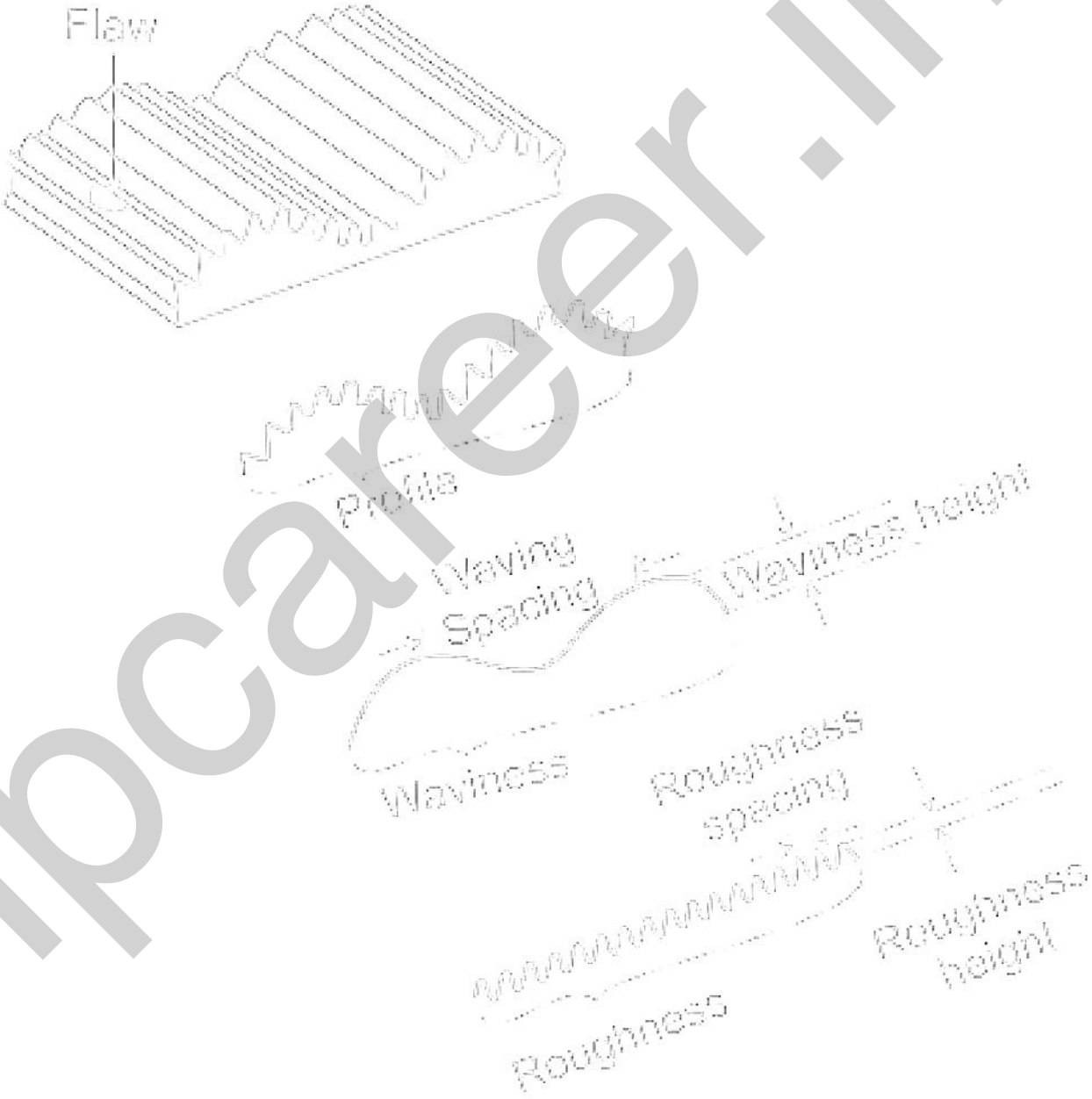
Explanation:

Explanation:

Chatter in machine tools:

- During the cutting process , there is a dynamic interaction between the cutting tool, the workpiece , and the machine tool.
- Chatter is a harmonic imbalance between the cutting tool and the workpiece , meaning the componentsare literally bouncing against each other.
- **The cutting forces exerted by the tool on the part set up will lead to resonance, eventually progressing toself-induced vibrations.**
- The c hatter ing may generate loud noises and may even produce a visual ' waviness ' on the part surface being machined.

- Th is is the result of an uneven surface from the to olmachining with varying cutting loads per rotation.
- The waviness is called the secondary texture and is caused for instance by an imperfection in the cutting tool machine such as vibration, chatter, heat treatment or a badly trued grinding wheel.



Additional Information

- Two other type s of vibrations encountered during machining are ' Free V ibrations ' (c aused by impact forces like the sudden motion reversal of the

work table during rapid traverse), and 'Forced Vibrations' (which result from the vibratory motion of intermittent cutting of a multi-tooth milling cutter or rotation of a part mounted off-centre on the lathe).

- Extremely large side cutting edge angles and clearance angles may cause tool chatter.

---

99. **Answer: d**

Explanation:

Explanation:

- The Earliest Expected Time (TE) is the time when an event can be expected to occur earlier.
- The Latest allowable occurrence time (TL) is the latest time by which an event must occur to keep the project on schedule (without delaying the project).
- Event slack is defined as the difference between the latest event and the earliest event times.
- Slack time is the amount of time a task can be delayed before the project finish date is delayed. Thus, the slack is the difference between event times denoting the range within which an event time can vary.
  Slack = TL - TE
  - Positive slack:
    When TL > TE. It indicates the project is ahead of schedule meaning thereby the excess resources.
  - Zero slack:
    When TL = TE. It indicates that the project is going on schedule meaning thereby adequate resources.
  - Negative slack:
    When TL < TE. It indicates the project is behind schedule meaning **thereby a lack of resources.**

---

100. **Answer: c**

Explanation:

Explanation:

Lacquering:

- **Lacquering is the process used for applying a protective finish to metallic objects** .

Lacquering process is done as follows:

1. It is difficult to coat steel plates uniformly with tin during the process of manufacture.
2. Small microscopic spaces are always left uncoated, although the coating may appear perfect to the naked eye.
3. The content of the can may react with the exposed parts of the container and cause discolouration of the product or corrosion of the tin plate.
4. When the corrosion is severe, the steel is attacked and black stains of iron sulfide are produced.
5. It is necessary to coat the inside of the can with some material like lacquer, which would prevent discolouration, but would not impart its flavour or injure the wholesomeness of the contents.
6. The process of coating the inner side of the can prevent discolouration of the product is called lacquering.
7. Lacquers include oleo-resinous material, synthetic resins, phenolic resins, epoxy resins, and vinyl resins. There are two types of lacquers:
    - The acid-resistant lacquer is ordinary gold-coloured enamel and the cans treated with it are called A.R-enamel cans .
    - The sulfur-resistant lacquer is also of golden colour and the cans coated with it are called C-enamel cans or S.R. cans . Acid-resistant cans are used for the packing of fruits of the acid group with soluble colouring matter such as raspberry, strawberry, red plum, coloured grapes, etc. Sulfur-resistant cans are used for non-acid products like peas, corn, beans, etc.

Additional Information

Embossing

- A stamping process that produces a shallow relief design on sheet metal.
- Embossing is the operation of forming impressions of figures, letters, or designs on sheet metal.
- The punch or the die or both of them may have the design engraved on them which are formed on the sheet metal by squeezing and with the plastic flow of metal.

Etching :-

- In this process, The workpiece is immersed in the etchant where the material of the workpiece having no protective coating is removed by the chemical action of the etchant.
- Enchant is selected depending on the workpiece material and rate of material removal and surface finish required.
- There is a necessity to ensure that maskant and enchant should be chemically active.
- Common enchants are H 2 SO 4 , FeCL 3 , and HNO 3 . The selection of etchant also affects MRR as in the CHM process, MRR is indicated as penetration rates (mm/min).

Engraving:

- Engraving is the practice of incising a design onto a hard, usually flat surface by cutting grooves into it with a burin (is a steel cutting tool used in engraving).
- The result may be a decorated object in itself, as when silver, gold, steel, or glass are engraved, or may provide an intaglio (family of printing and printmaking techniques) printing plate, of copper or another

metal, for printing images on paper as prints or illustrations; these images are also called "engravings".

- Engraving is one of the oldest and most important techniques in printmaking

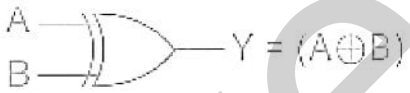
---

101. Answer: d

Explanation:

The correct option is $4)$.

Symbol:



Truth Table:

Input A	Input B	Output $Y = A \oplus B$
0	0	0
0	1	1
1	0	1
1	1	0

Output Equation: $Y = \mathbf{A} \oplus \mathbf{B} = \bar{A}B + A\bar{B}$

Key Points:

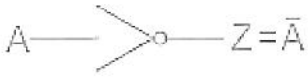
1) The output is low when both the inputs are the same

2) The output is high when both the inputs are different

Additional Information

NOT GATE

Symbol:



Truth Table:

Input (A)	Output (Ā)
0 (Low)	1 (High)
1 (High)	0 (low)

Output Equation: $Y = \bar{A}$

Key Points: The output of NOT gate is an invert of the input

AND GATE

Symbol:

Truth Table:

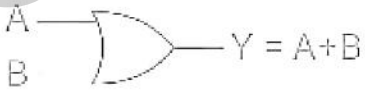
Input A	Input B	Output Y = A.B
0	0	0
0	1	0
1	0	0
1	1	1

Output Equation: Y = A.B

Key Points: The output is high only when both the inputs are high

OR GATE

Symbol:



Truth Table:

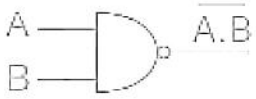
Input A	Input B	Output Y = A + B
0	0	0
0	1	1
1	0	1
1	1	1

Output Equation: Y = A + B

Key Points: The output is low only when both the inputs are low

NAND GATE

Symbol:



Truth Table:

Input A	Input B	Output $Y = \overline{AB}$
0	0	1
0	1	1
1	0	1
1	1	0

Output Equation: $Y = \overline{A.B} = \bar{A} + \bar{B}$

Key Points:

1) The output is low only when both the inputs are high

2) It is a universal gate.

---

102. Answer: a

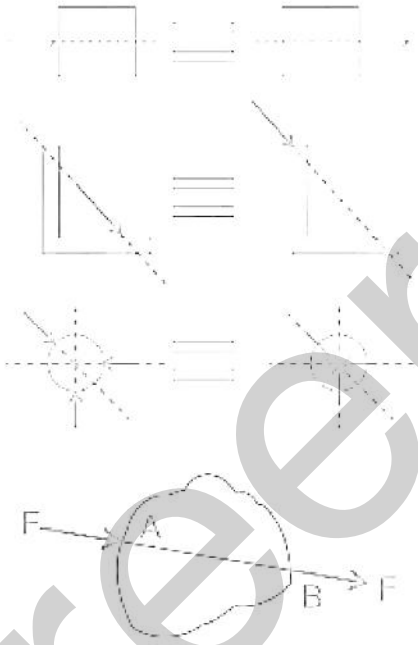
Explanation:

Explanation:

Law of Transmissibility of Force:

According to this law, "the state of rest or motion of the rigid body is unaltered if a force acting on the body is replaced by another force of the same magnitude and

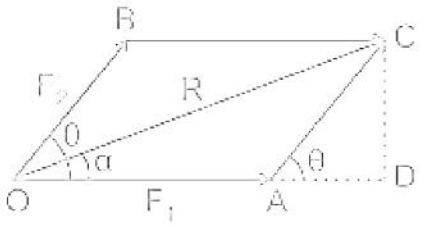
direction but acting anywhere on the body along the line of action of the replaced force"



1. Law of Parallelogram of forces

This law is used to determine the resultant of two coplanar forces acting at a point.

It states that "If two forces acting at a point are represented in magnitude and direction by two adjacent sides of a parallelogram, then their resultant is represented in magnitude and direction by the diagonal of the parallelogram which passes through that common point."



Let two forces F 1 and F 2, acting at the point O be represented, in magnitude and direction, by the directed line OA and OB inclined at an angle θ with each other.

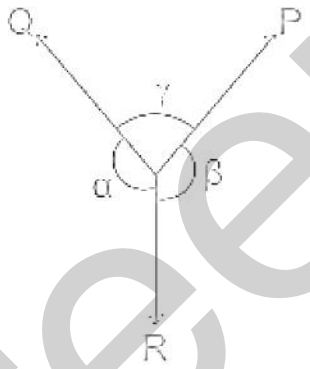
Then if the parallelogram OACB be completed, the resultant force R will be represented by the diagonal OC.

$$R = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos\theta}$$

1. Lamis Theorem :

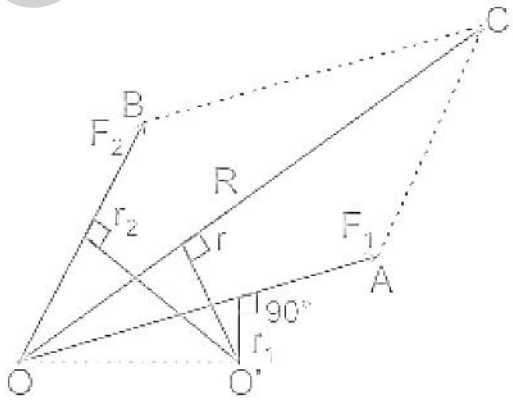
If a body is in equilibrium under the effect of three forces then each force is proportional to the sine of the angle between the other two.

$i.e \frac{P}{\sin\alpha} = \frac{Q}{\sin\beta} = \frac{R}{\sin\gamma}$



1. Varignon's Principle of moments (or the law of moments):

It states, "If a number of coplanar forces are acting simultaneously on a particle, the algebraic sum of the moments of all the forces about any point is equal to the moment of their resultant force about the same point ."



i.e. R × r = F 1 × r 1 + F 2 × r 2

---

103. Answer: b

Explanation:

The correct answer is **Odd leg caliper.**

Explanation:

- A caliper is a measuring instrument with two adjustable legs or jaws used to measure the dimensions of material parts.
- A **hermaphrodite caliper** is a tool for laying out lines parallel to the edges of a workpiece. It can also be used to determine the centre of cylindrical workplaces.
- A hermaphrodite caliper has **one bent leg inward and one straight leg** that ends in a sharp point; this type of caliper is used for scribing lines at a specific distance from a flat or curved surface.
- Hermaphrodite calliper is also known as Odd leg caliper.

---

104. **Answer: a**

Explanation:

The correct answer is **Antacid**.

Explanation:

Antacid:

- During **indigestion ,stomach produces too much acid** , which causes pain and irritation.
- Antacids are a type of medication that is used to treat conditions caused by stomach acid.
- Antacids, which are bases, are used to get rid of this pain.
- The excess acid in the stomach is neutralized by these antacids.
- Antacids contain sodium hydrogen carbonate as an ingredient.
- Because it is alkaline, **it neutralises excess stomach acid** and provides relief.

Additional Information

Analgesic:

- Analgesics are drugs that **act on the nervous system.** These have an impact on the mechanism of message transfer from nerve to receptor.
- Analgesics relieve or eliminate pain without impairing consciousness, causing mental confusion, incoordination, or paralysis, or causing other nervous system disturbances.

Antiseptic:

- Antiseptics are chemicals that either **kill or prevent microorganisms from growing.**
- Antiseptics are substances that are applied to living tissues such as wounds, ulcers, cuts, and diseased skin surfaces.

Antibiotic:

- Because of their low toxicity in humans and animals, antibiotics are used as drugs to **treat infections** .
- Antibiotics were initially defined as chemical substances produced by microorganisms (bacteria, fungi, and moulds) that inhibit or even destroy the growth of microorganisms.

---

105. **Answer: c**

Explanation:

Concept:

The specific speed of a centrifugal pump is defined as the speed of a geometrically similar pump which would deliver one cubic metre of liquid per second against a head of one metre.

$$N_s = \frac{N\sqrt{Q}}{H_m^{3/4}} = \frac{\omega\sqrt{Q}}{(gH)^{3/4}}$$

Important Points

Specific speed for the turbine,

$$N_s = \frac{N\sqrt{P}}{H^{5/4}}$$

---

106. **Answer: c**

Explanation:

Explanation:

Specific gravity:

Specific gravity is also termed as relative density. The relative density/specific gravity of a substance is defined as the ratio of the density, mass or weight of the substance to the density, mass, or weight of water at 4°C (Standard atmospheric conditions)

$$\gamma = \frac{\text{Density of Substance}}{\text{Density of same volume of water}} = \frac{\rho}{\rho_w}$$

Specific volume (v):

specific volume in m 3/kg and also the specific volume is inverse of density (ρ).

Kinematic viscosity:

It is defined as the ratio between the dynamic viscosity and density of the fluid.

$\nu = \frac{\mu}{\rho}$

---

107. Answer: b

Explanation:

Explanation:

Dalton's law of partial pressures states that in a mixture of non-reacting gases, the total pressure exerted is equal to the sum of the partial pressures of the individual gases.

Suppose there are n 1 moles of gas A 1, n 2 moles of gas A 2, n 3 moles of gas A 3,... and up to n k moles of gas A k, are there in a homogeneous mixture of inert ideal gases at a temperature T, a pressure P, and a volume V.

Since there is no chemical reaction, the mixture is in a state of equilibrium with the equation of state

pV = (n 1 + n 2 + n 3 + ...+ n k) $\bar{R}$ .T Where, $\bar{R}$ is universal gas constant.

and $\bar{R}$ = 8.3143 kJ / kg-mol-K

$p = \frac{n_1 \bar{R} T}{V} + \frac{n_2 \bar{R} T}{V} + \frac{n_3 \bar{R} T}{V} + \ldots + \frac{n_k \bar{R} T}{V}$

As $p_1 = \frac{n_1 \bar{R} T}{V}$, $p_2 = \frac{n_2 \bar{R} T}{V}$, $p_3 = \frac{n_3 \bar{R} T}{V}, \ldots p_k = \frac{n_k \bar{R} T}{V}$

Thus, p = p 1 + p 2 + p 3 +...+ p k

---

108. Answer: a

Explanation:

The correct option is 1).

A valid email address is an address composed of two parts, a username, and a domain name. The prefix appears to the left of the @ symbol. The domain appears to the right of the @ symbol. For example, in the address name@website.com, "name" is the email prefix, and "website.com" is the email domain

The 2 parts of an Email Address are:

Username - The first part of an email address is the username.
Domain - The last part of an email address is the domain, which can be broken down into two portions: the mail server and the top-level domain.

---

109. Answer: a

Explanation:

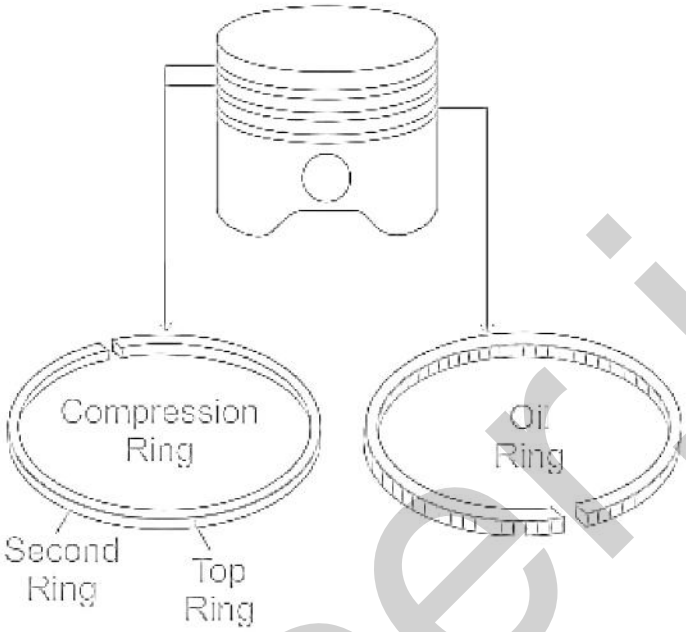
Explanation:

Piston rings: There are two types of piston rings

1. Compression rings: These rings effectively seal the compression pressure and the leakage of the combustion gases. These are fitted in the top grooves. They also transfer heat from the piston to the cylinder walls. These rings vary in their cross-section. The following types of compression rings are used

- Rectangular Rings
- Taper-faced rings
- Barrel-faced rings
- Inside bevel rings
- Keystone rings

2. Oil control rings: The main purpose of an oil ring is to scrape the excess oil from the liner and drain it back to the oil sump during the downward movement of the piston. It prevents the oil from reaching the combustion chamber.



- **Since grey cast iron has properties of self-lubrication and damping of small vibrations.**
- They are widely used for machine base, engine frames, drainage pipes, elevator and industrial furnace counterweights, pump housings cylinder and piston rings of IC engines, flywheel etc.

---

110. **Answer: d**

Explanation:

Explanation:

Stress	Pressure
Stress can be defined as the internal resistive force to the deformation per unit area.	Pressure can be defined as the amount of force applied per unit area.
Stress may be tensile, compressive and shear in nature.	The pressure is always compressive in nature.
Stress is developed internally.	The pressure is exerted externally.
Due to stress, the pressure will not be developed.	Due to pressure, stress will be developed.
Stress can be either a positive or negative physical quantity.	The pressure is always a positive physical quantity.
Stress can act both parallel and perpendicular to the object.	Pressure can act only perpendicular to the object.
Unit of stress N/m 2.	Unit of pressure N/m 2.

Important Points

- S tress is mostly used in the case of solid and Pressure is most commonly used for fluids i.e. liquid or gas.
- In the viscous flow of fluids shear stress is used but there is no meaning of tensile or compressive stress in fluids.

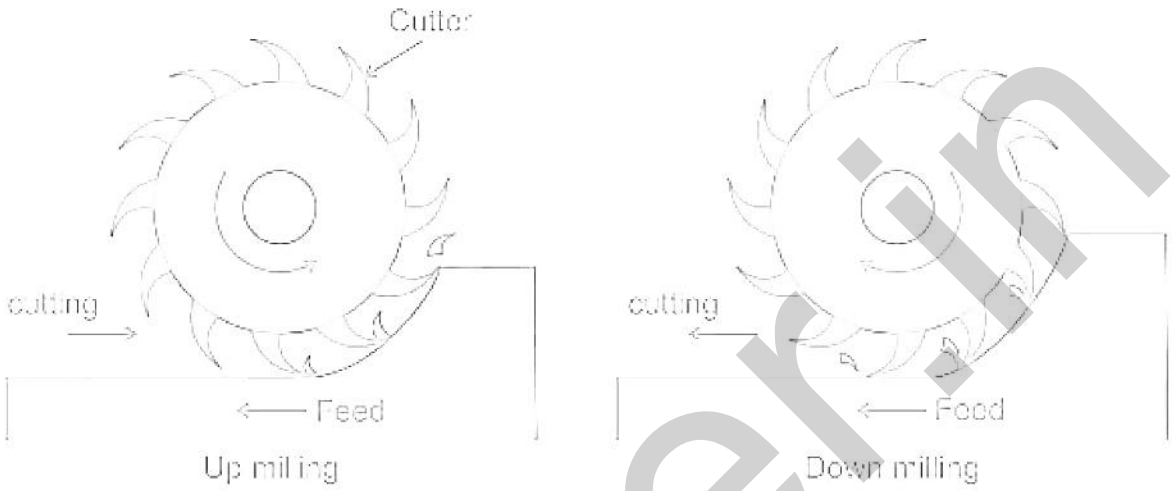
111. **Answer: a**

Explanation:

Explanation:

Milling is a process of producing flat and complex shapes with the use of a multi-point (or multi-tooth) cutting tool. The axis of rotation of the cutting tool is perpendicular to

the direction of feed, either parallel or perpendicular to the machined surface.



Milling machines are superior to other machines in terms of accuracy and surface finish.

There are two basic types of milling operations:

Down milling:

- The cutter rotation is in the same direction as the motion of the workpiece being fed.
- The cut starts with the full chip thickness
- The cutting force is maximum at the beginning and minimum at the end of the cut.
- In down milling, the cutting force is directed on to the work table, which allows thinner parts to be machined without susceptibility to breakage, but it requires the optimum holding device as the cutting tool forces the work-piece in the opposite direction of the tool motion. Therefore the gap between the lead screw and the half nut increases which requires backlash eliminator.
- A better surface finish is obtained.

Up milling:

- The workpiece is moving towards the cutter, opposing the cutter direction of rotation.
- The cutting force is minimum during the beginning of the cut and maximum at the end of the cut.

112. **Answer: c**

Explanation:

Explanation:

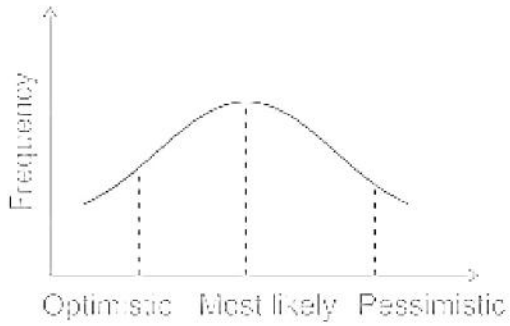
A project may be defined as a combination of interrelated activities which must be executed in a certain order before the entire task can be completed.

The aim of planning is to develop a sequence of activities of the project so that the project completion time and cost are properly balanced.

To meet the objective of systematic planning, the management has evolved several techniques applying network strategy.

PERT (Programme Evaluation and Review Technique) and CPM (Critical Path Method) are network techniques which have been widely used for planning, scheduling and controlling the large and complex projects.

- PERT (Project Evaluation and Review Technique) approach takes account of the uncertainties. In this approach, 3-time values are associated which each activity. So it is probabilistic .



- CPM (Critical Path Method) involves the critical path which is the largest path in the network from starting to ending event and defines the minimum time required to complete the project.So it is deterministic.

Difference between PERT and CPM (Critical Path Method)

PERT	CPM
1. Probabilistic approach	1. Deterministic approach
2. **Three-time estimate**	2. **One-time estimate**
3. Event oriented network model	3. Activity-oriented network model
4. The slack concept is used	4. Float concept is used
5. Project crashing is not possible	5. Project crashing is possible
6. Deals with probabilistic time estimates	6. Deals with deterministic time estimates

113. **Answer: b**

Explanation:

Explanation:

- The interrupt is a signal emitted by hardware or software when a process or an event needs immediate attention.
- It alerts the processor to a high-priority process requiring interruption of the current working process.

Additional Information

Spool

- "Spool" is technically an acronym for simultaneous peripheral operations online.
- Spooling is a process in which data is temporarily held to be used and executed by a device, program or the system.
- Data is sent to and stored in memory or other volatile storage until the program or computer requests it for execution.

Page File:

A pagefile is a reserved portion of a hard disk and is used as an extension of random access memory (RAM) for data in RAM that is not been used recently.

Stack:

- A stack is a linear data structure.
- The elements in a stack are added and removed only from one end, which is called the TOP.
- Hence, a stack is called a LIFO (Last-In-First-Out) data structure, as the element that was inserted last is the first one to be taken out.
- The push operation is used to insert an element into the stack.
- The pop operation is used to delete the topmost element from a stack.

---

114. **Answer: d**

Explanation:

Explanation:

Pour point

The pour point in that temperatures just about which the oil sample will not flow under certain prescribed conditions. In other words, pour point of a liquid is the temperature below which the liquid **loses its flow characteristics.**

Important Points

- Flash Point: The flash point of a volatile material is the lowest temperature at which vapors of the material will ignite when given an ignition source.
- Fire Point: The fire point of a fuel is the lowest temperature at which the vapor of the fuel will continue to burn for at least 5 seconds after ignition by an open flame. The main difference in fire and flashpoint is that at the flashpoint a substance will ignite briefly, but vapor might not be produced at a rate to sustain the fire.
- Flashpoint and fire points are related to high-temperature characteristics of the fuel and tell the behavior of fuel at high temperatures.
- Cloud Point: Cloud point is the temperature at which oil becomes cloudy or hazy when oil is cooled at a specified rate.
- Pour Point: It is the temperature at which oil just ceases to flow. The pour point of the liquid is the lowest temperature at which it becomes semi-solid and loses its flow characteristics.
- Cloud point and pour point are related to low-temperature characteristics of the fuel and tells the behavior of fuel at low temperatures.

---

115. **Answer: b**

Explanation:

Concept:

Taylor's tool life equation:

Taylor has assumed that cutting velocity is the major parameter that is influencing the tool life, hence he established the relationship between cutting velocity and tool life called Taylor's tool life equation.

The Taylor's tool life equation is given as:

$V \times T^n = C$

where V = cutting velocity in m/min, T = tool life in min, n = Taylor's exponent

Additional Information

The value of n for different materials is mentioned in the table.

Tool material	Cutting speed (m/min)	n
High-speed steel	30	0.08 to 0.20
Cemented carbide	150	0.20 to 0.50
Coated carbide	350	
Ceramic	600	0.5 to 0.7

116. **Answer: c**

Explanation:

Explanation:

There are basically two approaches for measuring surface finish:

- Inspection by comparison (Qualitative Analysis): In these methods, the surface texture is assessed by observation of the surface.
- Direct Instrument Measurement (Quantitative Analysis): Direct methods enable to determination a numerical value of the surface finish of any surface. It enables a numerical value to be assigned to the surface finish

The various methods which are used for comparison are:

- Touch Inspection
- Visual Inspection

- Microscopic Inspection (Master finished surface is placed under the microscope and is compared)
- Scratch Inspection
- Micro Interferometer
- Surface photographs
- Reflected Light Intensity
- Wallace Surface Dynamometer
- Diffraction technique

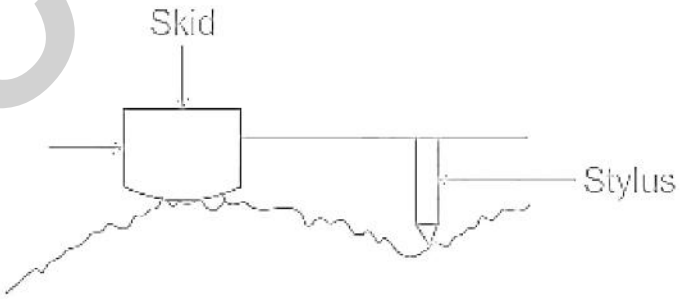
Some of the direct measurement instruments are:

- Tomlinson surface meter
- Profilometer
- Taylor-Hobson Talysurf

Stylus probe-type instrument:

Principle:

- When the stylus is moved over the surface which is to be measured, the irregularities in the surface texture are measured and it is used to assess the surface finish of the workpiece.



Working

- The stylus type instruments consist of a skid, stylus, amplifying device and recording device.
- The skid is slowly moved over the surface by hand or by motor drive.
- The skid follows the irregularities of the surface and the stylus moves along with the skid.

- When the stylus moves vertically up and down and the stylus movements are magnified, amplified and recorded to produce a trace. Then it is analyzed by an automatic device.

Advantage

- Any desired roughness parameter can be recorded.

Disadvantages

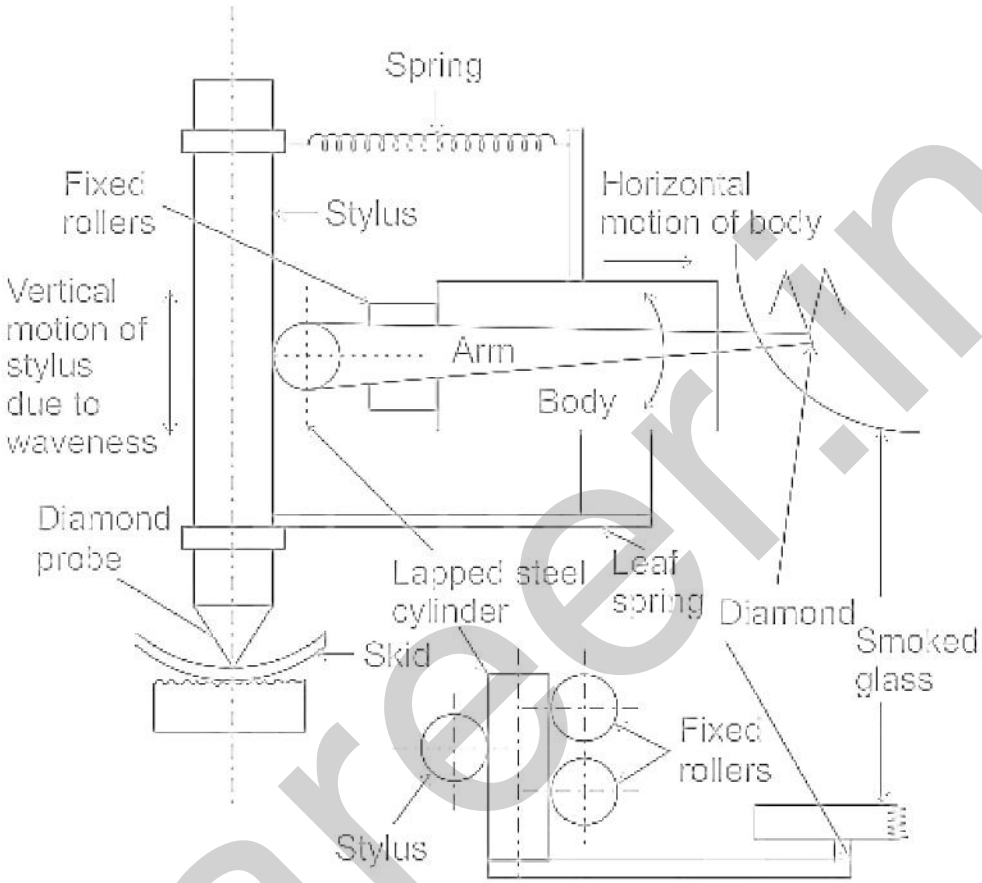
- Fragile material cannot be measured.
- High Initial cost.
- Skilled operators are needed to operate

Tomlinson Surface meter:

This instrument uses mechanical-cum-optical means for magnification.

Construction

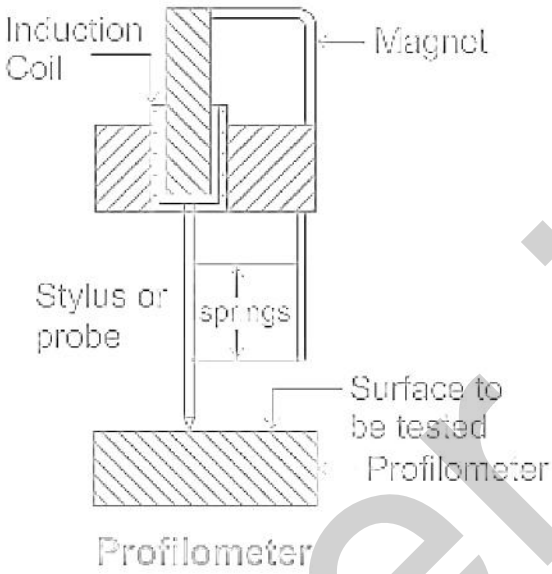
- In this the diamond stylus on the surface finish recorder is held by spring pressure against the surface of a lapped cylinder.
- The lapped cylinder is supported one side by probe and other side by rollers.
- The stylus is also attached to the body of the instrument by a leaf spring and its height is adjustable to enable the diamond to be positioned and the light spring steel arm is attached to the lapped cylinder.
- The spring arm has a diamond scriber at the end and smoked glass is rest on the arm.
- When measuring surface finish the body of the instrument is moved across the surface by a screw rotation.
- The vertical movement of the probe caused by the surface irregularities makes the horizontal lapped cylinder to roll.
- This rolling of lapped cylinder causes the movement of the arm. So this movement is induces the diamond scriber on smoked glass.
- Finally the movement of scriber together with horizontal movement produces a trace on the smoked glass plate and this trace is magnified by an optical projector.



Tomlinson Surface meter

Profilometer:

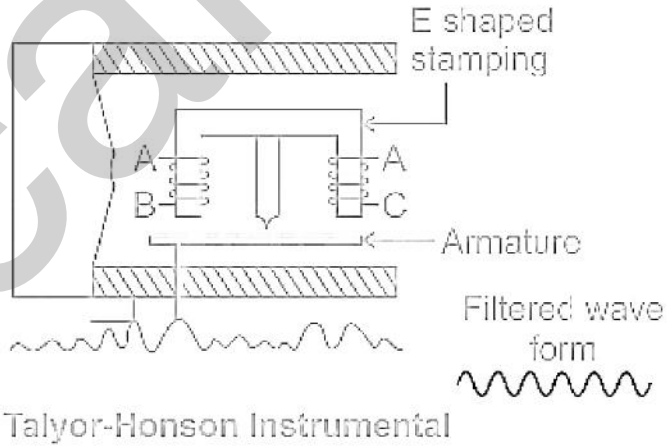
- It is an indicating and recording instrument to measure roughness in microns.
- The main parts of the instrument are tracer and an amplifier.
- The stylus is mounted in the pickup and it consists of induction oil located in the magnet.
- When the stylus is moved on the surface to be tested, it is displaced up and down due to irregularities in the surface.
- This movement induces the induction coil to move in the direction of permanent magnet and produces a voltage. This is amplified and recorded.



Profilometer

Taylor-Hobson-Talysurf:

- It is working a carrier modulating principle and it is an accurate method comparing with the other methods.
- The main parts of this instrument is diamond stylus (0.002mm radius) and skid.



Talyor-Honson Instrumental

Principle:

- The irregularities of the surface are traced by the stylus and the movement of the stylus is converted into changes in electric current.

Working:

- On two legs of the E-shaped stamping there are coils for carrying an A.C. current and these coils form an oscillator.

- As the armature is pivoted about the central leg the movement of the stylus causes the air gap to vary and thus the amplitude is modulated.
- This modulation is again demodulated for the vertical displacement of the stylus.
- So this demodulated output is move the pen recorder to produce a numerical record and to make a direct numerical assessment.

---

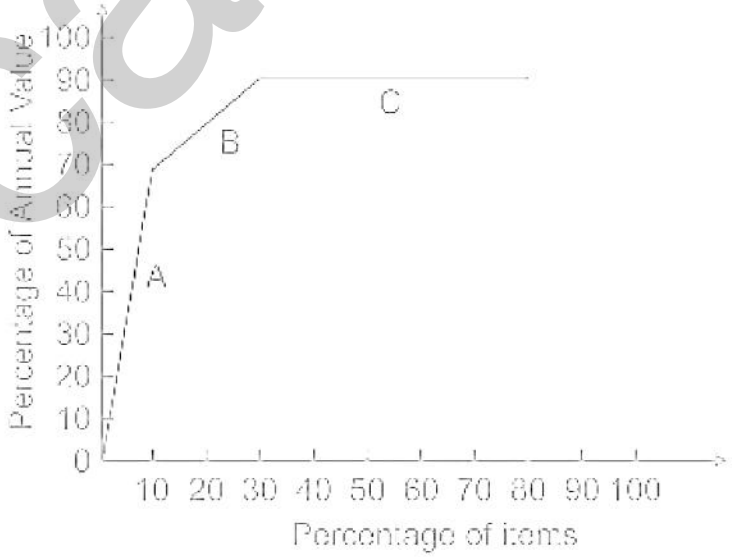
117. **Answer: b**

Explanation:

Explanation:

ABC Analysis shows: Divides on-hand inventory into three classes based on Annual consumption value:

ABC analysis is known as Always Better Control analysis. This is also known as the principal of the Law of Vital Few and Trivial Many.



Class A:

- Only 10% in the number
- Accounts for 75% of the annual inventory usage value
- It requires high attention for maintenance

- Needs continuous rigorous control
- Fixed-interval inventory control system might be used

Class B:

- Next 20% in the number
- Accounts for 15% of the annual inventory usage value
- Need relaxed control (periodic review)
- It requires high attention for maintenance

Class C:

- Next 70% in the number
- **Accounts for 10% of the annual inventory usage value**
- Can be managed in a more casual manner
- Fixed-order inventory control system might be used

Annual Usage Value = Annual Usage rate × Unit Cost

---

118. **Answer: b**

Explanation:

Silver reacts with Sulphur in the atmosphere and forms layer of silver sulphide which is black in colour.

$2\,Ag + S \rightarrow Ag\,2S$

Confusion Points

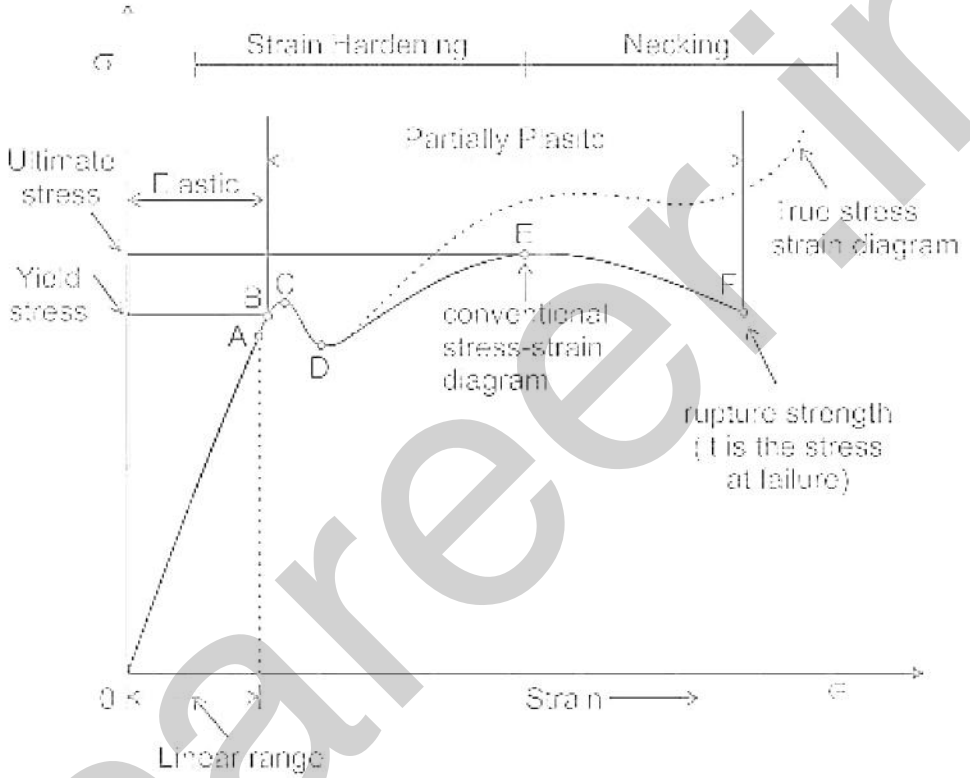
The general doubt here is the formation of oxide in place of sulphide. The colour of silver oxide is brown and colour of silver sulphide is Black.

---

119. **Answer: b**

Explanation:

Explanation:



Point A (Limit of proportionality or the proportionality limit): The stress is proportional to strain or elongation is proportional to the load giving an st. line relationship. This law of proportionality is valid up to a point A.

In the region OA, The stress is directly proportional to strain,

$\sigma \propto \epsilon$ or $\sigma = E\epsilon$

where E is proportionality constant and known as modulus of elasticity.

$$E = \frac{\sigma}{\epsilon}$$

Hence modulus of elasticity is defined as the amount of stress required to produce unit strain.

Modulus of elasticity of steel, E steel = 200 GPa = **2×10^6 kgf/cm 2**

Modulus of elasticity of Aluminium, E Aluminium = 80 GPa

Coefficient of expansion(α):

The fractional change of length, area, or volume per unit change in temperature of solid, liquid, or gas at a given pressure is called the coefficient of expansion.

Strain developed due to thermal expansion of the rod

$\epsilon = \alpha \Delta T$

Thermal stress due to the heating of a rod is given by

$\sigma T = \epsilon.E = \alpha.\Delta T.E$

where σT = thermal stress in N/m 2, ϵ = thermal strain in m/m, α = coefficient of thermal expansion in /°C , ΔT = rise in temperature in K.

and E is Young's modulus of elasticity of the material in N/m

Coefficient of expansion of steel, α steel = 12 × 10 -6 /°C

Coefficient of expansion of Aluminium, α Aluminium = 23 × 10 -6 /°C

---

120. **Answer: d**

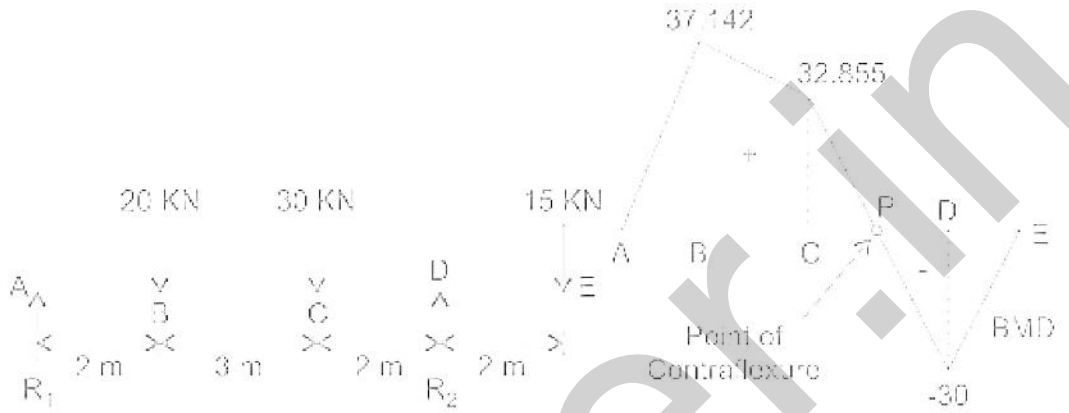
Explanation:

Explanation:

Hanging beam

If the end portion of a beam is extended beyond the support, such beam is known as **overhanging beam.** In case of overhanging beams, the B.M. is positive between the two supports, whereas the B.M. is negative for the over-hanging portion. Hence at some point, **the B.M. is zero after changing its sign from positive to negative or vice versa. That point is known as the point of contraflexure or point of inflexion.**

Point of Contraflexure . It is the point where the B.M. is zero after changing its sign from positive to negative or vice versa.



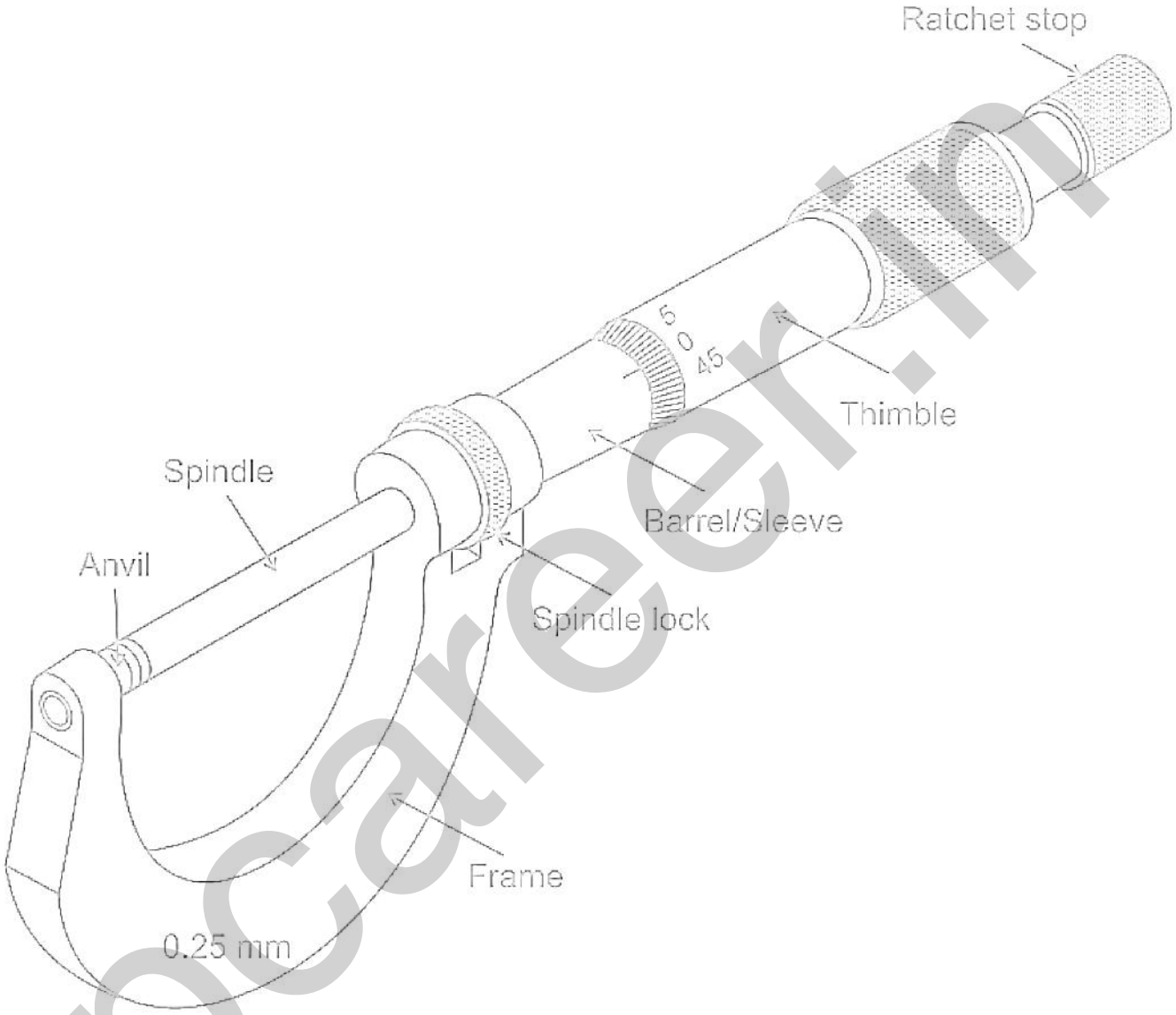
---

121. Answer: b

Explanation:

Explanation:

- Objects to be measured by Micrometer are placed between the measuring faces; the anvil and the spindle.
- The anvil is the stationary measuring face against which parts are held until the spindle contacts the work.
- It operates by measuring the space between a hard stop (anvil) and a movable surface (spindle).
- When a thimble is turned it drives the spindle closer or farther away from the anvil.



122. **Answer: a**

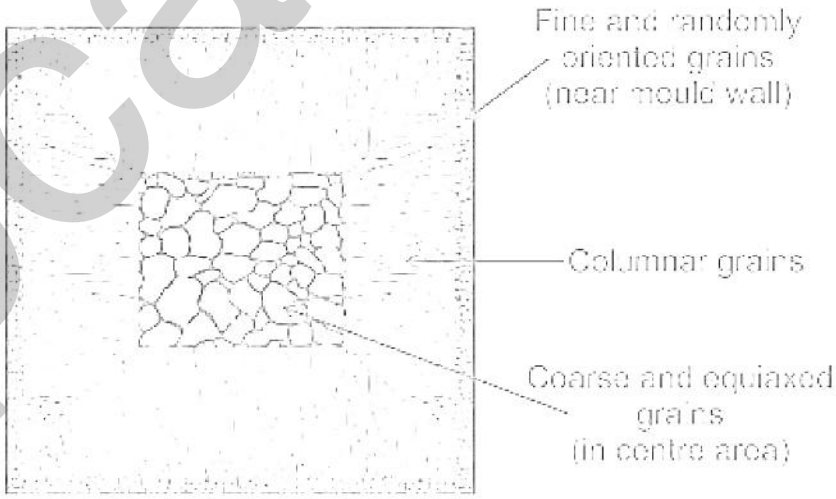
Explanation:

Explanation:

- When a low carbon steel is heated, there is no change in grain size upto the lower critical point and it is same for all steels (723° C).
- At this temperature, birth of new grains takes place. At the upper critical point, the average grain size is a minimum.

- Further heating of the steel causes an increase in the size of the grains, which in turn governs the final size of the grains when cooled.
- Some steels like medium carbon steel and many alloy steels when heated to a higher temperature, known as coarsening temperature, the grain size increases very rapidly.
- The coarsening temperature is not a fixed temperature and may be changed by prior hot or cold working and heat treatment.

- The temperature point at which the change starts on heating is called lower critical point and the temperature point where this change ends in heating is called upper critical point. It varies according to the carbon content in steel.
- The quenching of steel from the upper critical point results in a fine grained structure, whereas slow cooling or quenching from a higher temperature yields a coarse grained structure.
- The coarse grained steels are less tough and have greater tendency for distortion than those having a fine grain.
- **A fine grained steel, in addition to being tougher, are more ductile and have less tendency to distort or crack during heat treatment.**



- During the solidification of pure molten metal, the grains in the casting near the mould wall are fine and randomly oriented because the rate of solidification is high at the surface of mould during solidification.
- The grain size in the product phase depends on the relative rates of nucleation and growth.
- Each nucleating particle becomes a grain in the final product.

- So a high nucleation rate means a larger number of grains.
- Also when this is combined with a low growth rate, more time is available for further nucleation to take place in the parent phase that lies between slowly growing particles.
- So a combination of a high nucleation rate and a slow growth rate yields a fine grain size.
- On the other hand, a low nucleation rate combined with a high growth rate yields a coarse grain size.
- Material with finer grain tend to be stronger than material with coarse grains because they offer greater hindrance to dislocation motion .
- The grain size can be controlled either by the rate of solidification or by plastic deformation.

---

123. **Answer: d**

Explanation:

The correct answer is **Energy**.

Explanation:

Scalar quantity

- A **scalar quantity** is a physical quantity that only has magnitude. It has no direction.
- Scalar quantity is represented by a number only.
- For example – Energy, volume, mass, electric current, distance, speed, temperature, area.
- Energy is a scalar quantity because it does not have any direction.

Additional Information

Vector quantity

- A vector quantity is a physical quantity that has both a magnitude and a direction.

- For example – Torque, weight, acceleration, displacement, force, momentum, angular velocity.

Impulse

- The average force over the time interval t is defined as the impulse. Momentum is a vector quantity because it is the product of mass and velocity. Because impulse is affected by momentum, it is also a vector quantity.

Torque

- The moment of force (or torque) is a vector quantity.
- The magnitude of τ is $\tau = r F \sin\theta$

Momentum

- The momentum of a body is defined as the product of its mass m and velocity v and is denoted by p

p = mv

- Momentum is a vector quantity i.e., it has a magnitude as well as a direction.

---

124. **Answer: c**

Explanation:

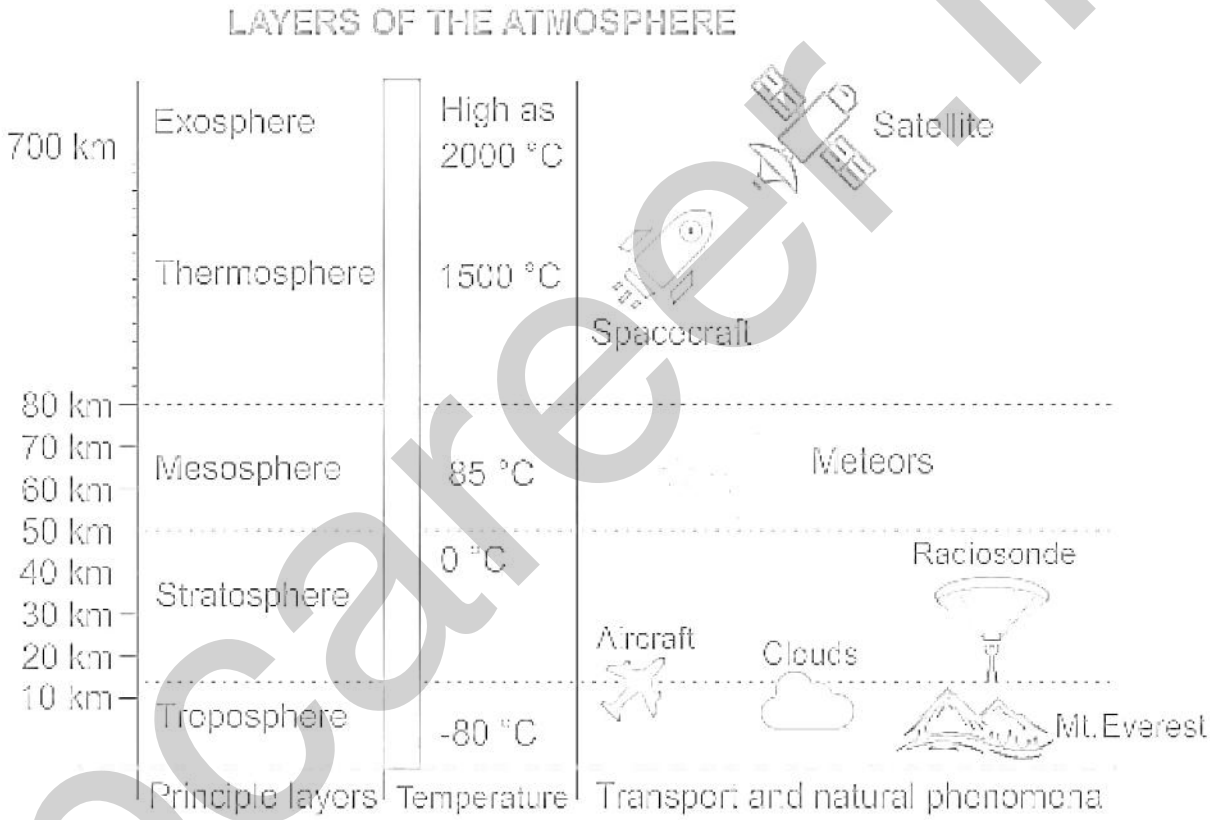
Explanation :

Atmosphere:

- It is a thin gaseous covering of the earth by a mixture of gases.
- It contains Nitrogen, oxygen, carbon dioxide, argon and other gases.
- Nitrogen is found to be 78 %, Oxygen is 21%, carbon dioxide is 0.03% and rest is other gases.
- Atmosphere serves as a protective layer for the earth's crust.
- The atmosphere has five different layers.

- They are troposphere, stratosphere, mesosphere, thermosphere and exosphere.
- The lower layer which surrounds the earth is troposphere.
- The uppermost layer is exosphere.

Layers of atmosphere:-



Ozone:

- Ozone is a layer of O_3 molecule that protects the earth from harmful UV rays.
- It makes a sheet so that the ill effects of sunlight can be controlled.
- It is a trioxide of oxygen which is an inorganic compound.
- Chemically, Ozone (O_3) is harmful to humans.
- Ozone layer is depleting due to an increase in global warming and greenhouse gases.
- Due to Chlorofluorocarbons (CFC) the ozone layer gets affected.
- There is a hole now generated in the ozone sheet, as claimed by the scientists.

125. **Answer: b**

Explanation:

Explanation:

Luminous Flux : The total quantity of radiant energy per second responsible for visual sensation from a luminous body is called Luminous Flux

It Is measured in lumens

One lumen is defined as the luminous flux emitted per unit solid angle from a point source of one candle power.

Candle Power (c.p) : The light radiating capacity of a source is called its candle power.

$$\mathbf{c.p} = \frac{\textbf{Flux emitted}}{\textbf{solid angle}} = \frac{\text{lm}}{\text{sr}}$$

Luminous Intensity (I) : Luminous Intensity in any particular direction is the luminous flux emitted by the source per unit solid angle in that direction

Its unit is candela

$$\mathbf{I} = \frac{\phi}{\omega}$$

Where ϕ is luminous flux and ω is the solid angle.

Plane Angle (2-D) : The angle subtended at a point by two converging lines lying in the same plane.

It is measured in radians

The ratio of the length of arc to its radius $\theta = \frac{arc}{radius}$

Solid Angle (3-D) : The angle subtended by the partial surface area of a sphere at its center.

It is measured in steradians

$\omega = A/r^2$

Where A is area and r is the radius

One steradian is defined as the solid angle that is subtended at the center of a sphere by its surface having an area equal to radius square

The maximum solid angle is approx 12.57, corresponding to the full area of the unit sphere, which is 4π

---

126. Answer: c

Explanation:

The correct answer is Ctrl + X.

- To execute the 'Cut' function in MS Excel, Ctrl + X keyboard shortcut key combination is used.

Key Points

- Ctrl+X is a keyboard shortcut that is used to cut a selected section of the text, image, or another object.

Additional Information

Other shortcuts keys for MS-Excel

Shortcut	Function
Alt + F	File menu options in the current program.
Alt + E	Edits options in the current program.
F1	Universal help (for any sort of program).
Ctrl + A	Selects all text
Ctrl + X	Cuts the selected item
Ctrl + Del	Cut selected item
Ctrl + C	Copy the selected item
Ctrl + Ins	Copy the selected item
Ctrl + V	Paste the selected item

127. **Answer: a**

Explanation:

Explanation:

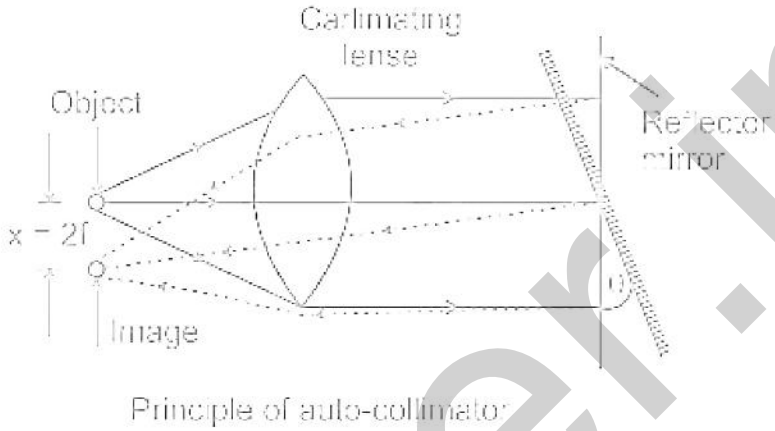
Profilometer:

- A profilometer is a compact device that can be used for the direct measurement of surface texture. The profilometer is capable of measuring roughness together with waviness and any other surface flaws.

Autocollimator:

- An autocollimator is an optical instrument that is used to measure small angles with very high sensitivity .
- The autocollimator has a wide variety of applications including precision alignment, detection of angular movement, verification of angle standards, and angular monitoring over long periods.

- An autocollimator is essentially an infinity telescope and a collimator combined into one instrument.



Principle of auto-collimator

Clinometer:

- It is an instrument for measuring angles of slope, elevation, or depression of an object with respect to the ground.
- While the spirit level is restricted to relatively small angles, clinometers can be used for much larger angles.
- Clinometers are used to determine the straightness and flatness of surfaces.

Optical square:

- Optical square and Prism square are instruments used to set out a right angle to a chain line.
- It is more convenient and accurate than cross-staff for setting out right angles. Consists of two mirrors making a 45° with each other, one mirror totally silvered another top-bottom un-silvered.

---

128. **Answer: c**

Explanation:

Explanation:

Bin cards:

- Bin means a rack, container, or room where goods are kept.
- Bin cards are printed cards used for accounting for the stock of material, in stores.
- A bin card is a quantitative record of receipts, issues, and closing balance of each item of stores.
- For every item of material, separate bin cards are kept.
- The details regarding the material such as the name of the material , the part number , the date of receipt and issue , the reference number , the name of the supplier , the quantity received and issued , the value of the material , the rate , the balance quantity , etc. are recorded in bin cards.
- The bin cards are kept in the bin serially according to the part number of the component.
- For each kind of material, a separate record is kept on a BIN CARD or Stock Card which shows details of the quantity of material received by, issued to and remained in stores. Bin card is attached to each bin or shelf.
- A bin card is not considered an accounting record; it simply informs the storekeeper of the quantities of each item on hand.
- Bin cards are checked periodically by the store inspectors to see that they are accurately maintained.

BIN CARD

Bin No .....
Material .....
Code No .....

Maximum Quantity .....
Ordering level .....
Minimum Quantity .....

Stores Ledger Folio .....

Date	Quantity Received	Quantity Issued	Balance	Remarks

129. **Answer: a**

Explanation:

Explanation:

There are different types of beam:

Overhanging beam:

- A beam having its end portion extended beyond the support is known as an overhanging beam .
- A beam may be overhanging on one side or on both sides.

Cantilever beam:

- A beam fixed at one end and free at the other end is known as a cantilever beam.

Simply Supported Beam:

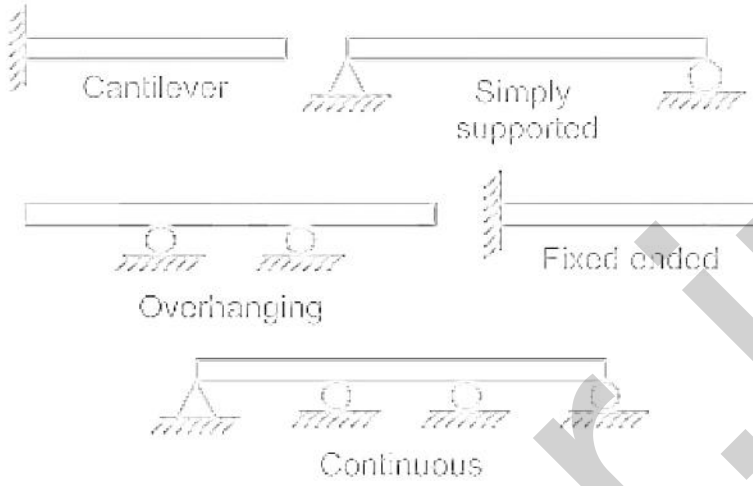
- A beam supported at its both ends is known as a simply supported beam.

Fixed beam:

- A beam whose both ends are fixed is known as a fixed beam.

Continuous beam:

- A beam supported on more than two supports is known as a continuous beam.

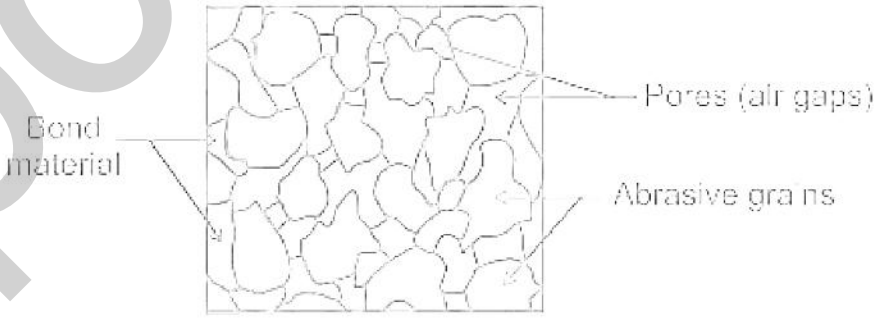


130. **Answer: a**

Explanation:

Explanation:

The structure of an abrasive wheel is the spacing of the abrasive grains. An abrasive wheel can be manufactured with the abrasive grains tightly packed together or widely spaced.



Introduction about the construction of the grinding wheel:

A grinding wheel consists of the abrasive that does the cutting, and the bond that holds the abrasive particles together.

In order to suit the grinding wheel for different work situations, the features such as abrasive, grain size, grade, structure and bonding materials can be varied.

Abrasives:

There are two types of abrasives: Natural abrasive, Artificial abrasive

Grain size (Grit size)

The number indicating the size of the grit represents the number of openings in the sieve used to size the grain. The larger the grit size number, the finer the grit.

Grade

Grade indicates the strength of the bond and, therefore, the 'hardness' of the wheel. In a hard wheel the bond is strong, and securely anchors the grit in place and, therefore, reduces the rate of wear. In a soft wheel, the bond is weak, and the grit is easily detached resulting in a high rate of wear.

Structure

This indicates the amount of bond present between the individual abrasive grains and the closeness of the individual grains to each other . An open structure wheel will cut more freely. That is, it will remove more metal in a given time and produce less heat. It will not produce such a good finish as a closely structured wheel.

Bond

The bond is the substance which, when mixed with abrasive grains, hold them together, enabling the mixture to be shaped to the form of the wheel, and after suitable treatment to take on the necessary mechanical strength for its work.

---

131. **Answer: b**

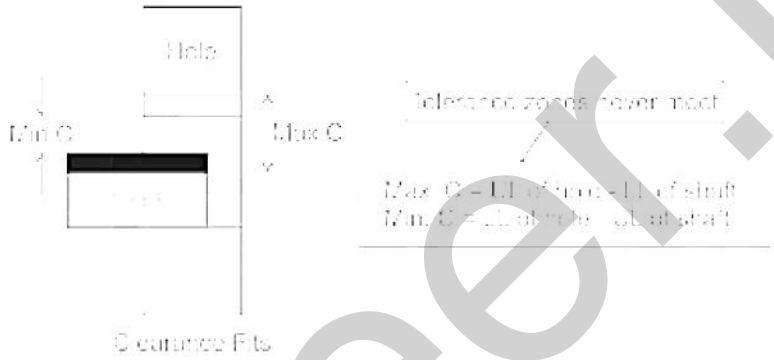
Explanation:

Explanation:

Fit is a relationship that exists between two mating parts, a hole and a shaft, with respect to their dimensional difference before assembly.

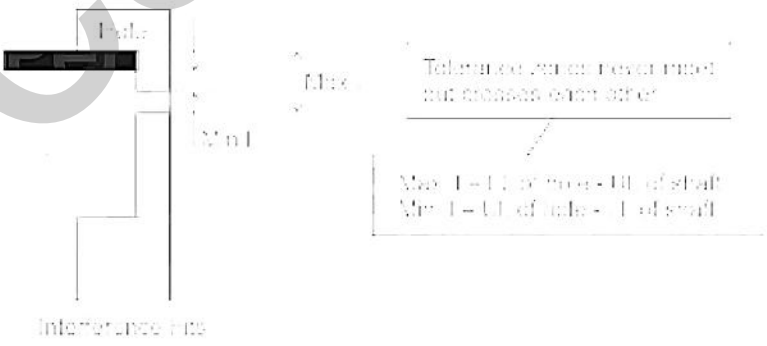
- Clearance fit: Clearance is the difference between the size of the hole and the size of the shaft which is always positive. Here the tolerance zone of the hole will be above the tolerance zone of the shaft.

  Examples: Slide fit, easy sliding fit, running fit, slack running fit and loose running fit.



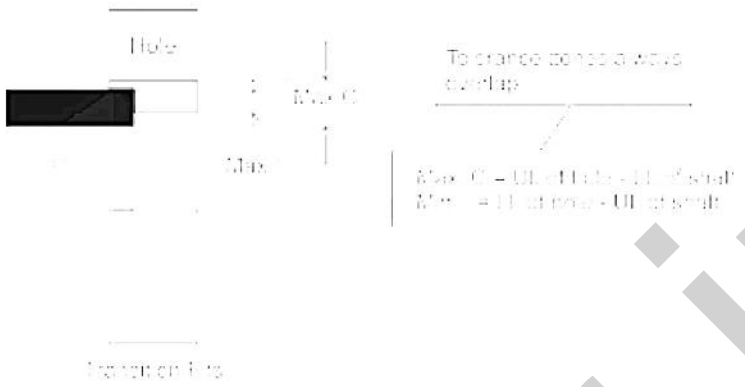
- Interference fit: Interference is the difference between the size of the hole and the size of the shaft which is always negative i.e. shaft is always larger than the hole size. Here, the tolerance zone of the hole will be below the tolerance zone of the shaft.

  Examples: Shrink fit, heavy drive fit and light drive fit.



- Transition fit: It may sometimes provide clearance and sometimes interference. Here the tolerance zones of the hole and shaft will overlap each other.

  Examples: Tight fit and push fit, wringing fit, press fit.



132. **Answer: a**

Explanation:

Concept:

Bayer's process:

In bauxite, in addition to Aluminium Oxide (Al 2 O3) impurities like Iron Oxide (Fe 2 O 3) and Sand (Si O 2) are also present.

On refining bauxite by Bayer's method, pure Aluminum Oxide is obtained which is also called Alumina .

Purification process:

- First, we dissolve Bauxite in an aqueous Sodium hydroxide (NaOH) by Digestion .
- The insoluble impurities are separated by Filtration .
- Purified Bauxite is then dissolved in Cryolite and electrolyzed at 950° C in a carbon lined steel cathode with hard carbon rods as the anode.

Li 2 CO 3is used to

- Lower the melting point of the electrolyte
- Permit larger current flow.
- Reduce Fluorine emission

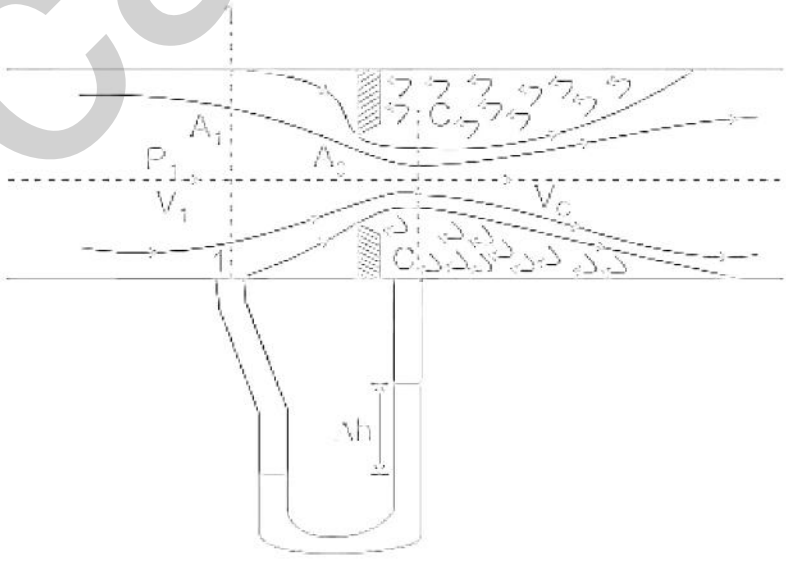
133. **Answer: c**

Explanation:

Explanation:

Orifice meter:

- The orificemeter, venturimeter and flow nozzle work on the principle of constant area variable pressure drop i.e. the area of obstruction is constant, and the pressure drop changes with the flow.
- An orifice meter is essentially a cylindrical tube that contains a plate with a thin hole in the middle of it.
- The thin hole essentially forces the fluid to flow faster through the hole to maintain the flow rate .
- The point of maximum convergence (vena-contracta) usually occurs slightly downstream from the actual physical orifice. This is the reason why orifice meters are less accurate than venturi meters .
- Beyond the vena contracta point, the fluid expands again and velocity decreases as pressure increases .



Flow through an Orificemeter

134. **Answer: c**

Explanation:

Explanation:

The dressing is the operation of cleaning and restoring the sharpness of the wheel face that has become dull or has lost some of its cutting ability because of loading and glazing.

In general practice there are five means by which an abrasive wheel may be dressed:

- Using a suitably mounted set of steel discs or wheels
- With an abrasive stick
- With a small wheel, suitably mounted
- With a diamond
- Using a crush dressing fixture

Trueing:

- Truing refers to the shaping of the wheel to make it run concentric with the axis .
- When a new grinding wheel is mounted, it must be dried before use.
- The cutting surface of a new wheel may run out slightly due to the clearance between the bore and the machine spindle.
- Grinding wheels, which are in use, also can run out of true, due to uneven loading while grinding.

---

135. **Answer: b**

Explanation:

Explanation:

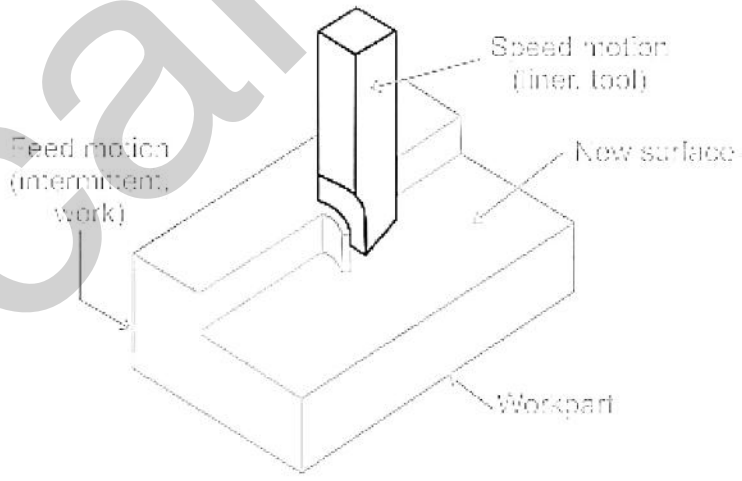
Shaping, planing and slotting similarities:

- Shaping, planning and slotting operations are the similar types of machining process which provide a cutting action as a result of straight-line reciprocating motion between the tool and the work.
- In all the processes single-point cutting tools are used .
- In shaping and planning operations, straight and flat surfaces are created.

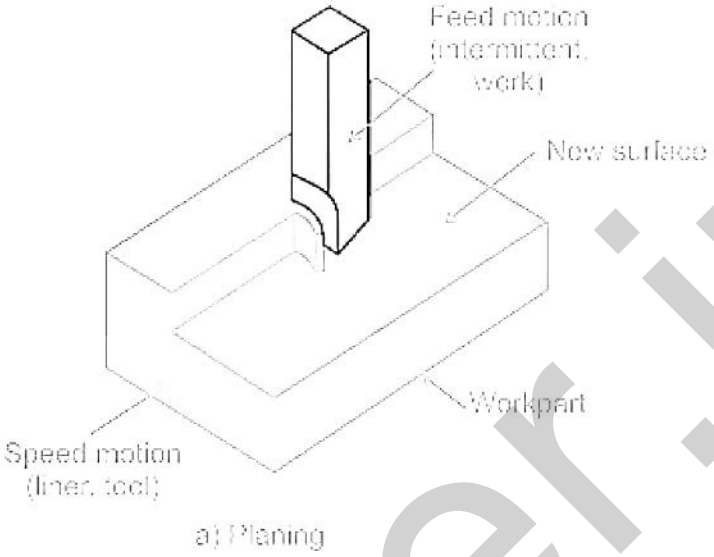
Shaping, planing and slotting difference:

- In shaping operation, the speed motion is accomplished by moving the cutting tool, while in planning the motion is accomplished by the workpiece.
- Shaping is performed in a machine tool called shaper whereas the machine tool for planning is called a planer.
- Slotting process is identical to shaping except that the motion of the ram is vertical instead of horizontal.

The size of the shaper is specified by the maximum length of stroke or cut it makes. The maximum stroke length of the shaper is 900 mm.



a) Shaping



136. **Answer: a**

Explanation:

Euler's theory:

- This theory is valid only for long columns only.
- This theory is valid only when slenderness ratio is greater or equal to critical slenderness ratio.
- For any slenderness ratio above critical slenderness ratio, column fails by buckling and for any value of slenderness ratio less than this value, the column fails in crushing not in buckling.

Euler's critical load formula is,

$P = \frac{n^2\pi^2 EI}{L^2}$

Euler's formula is applicable when, Crushing stress ≥ Buckling stress

$\sigma_{cr} \geq \frac{\pi^2 E}{\lambda_c^2} (\lambda_c \; is \; critical \; slenderness \; ratio)$

$\lambda_{min}^2 = \lambda_c^2 \geq \frac{\pi^2 E}{\sigma_{cr}}$

For mild steel,

$E = 2 \times 10\ 5\ N/mm\ 2$

$\sigma\ cr\ = 330\ N/mm\ 2$

$\therefore \lambda \geq 80\ N/mm\ 2$

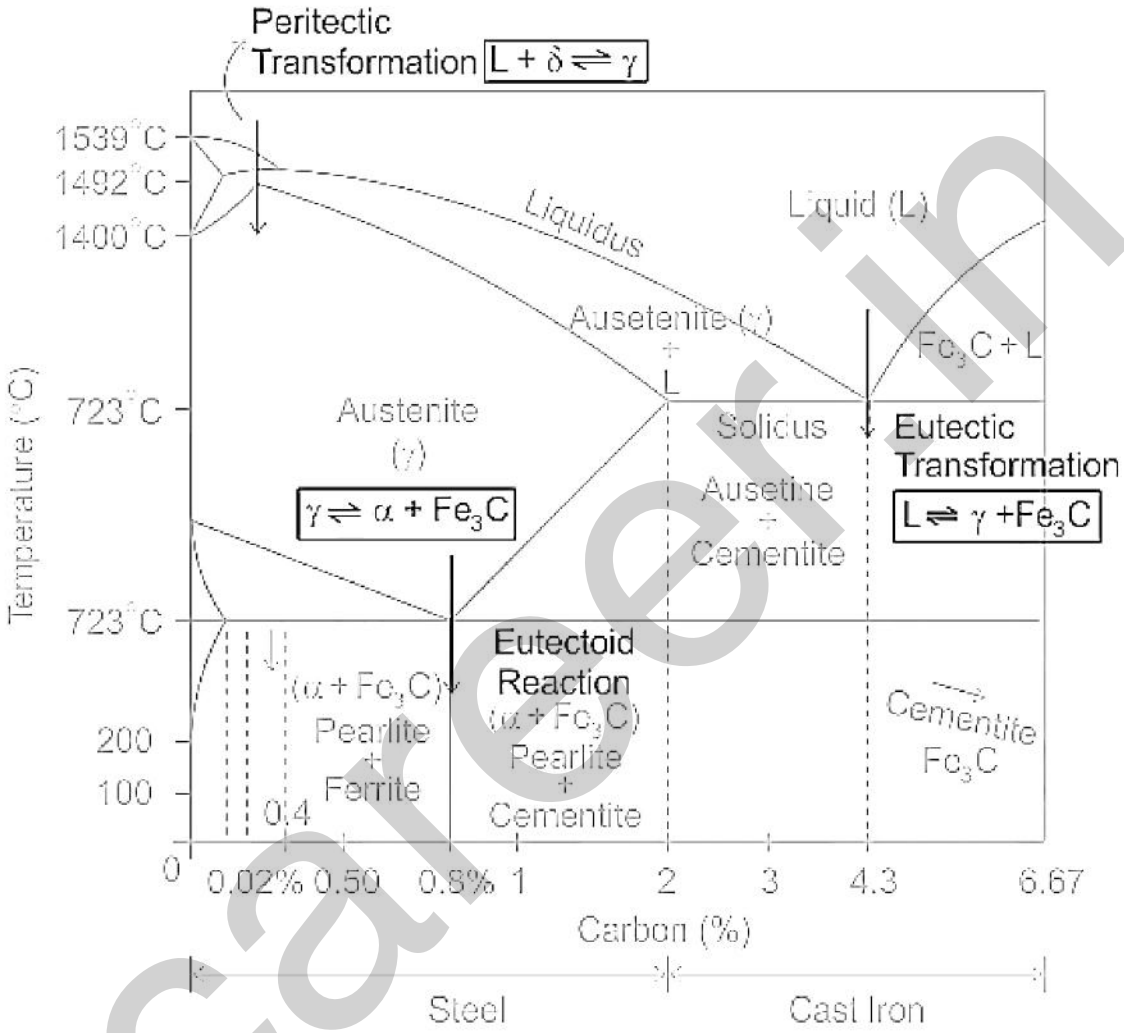
∴ When slenderness ratio for mild steel column is less than 80, the Euler's theory is not applicable.

---

137. Answer: b

Explanation:

Explanation



Iron Carbon Equilibrium Diagram

- The structural form of pure iron at room temperature is called ferrite or α-iron. Ferrite has a BCC structure.
- The face-centred (FCC) modification of iron is called Austenite or y-iron. It is a stable form of pure iron at a temperature between 910°C to 1400°C.
- Crystal structure of iron changes back to BCC structure above 1400° C called δ-iron.
- Carbon in excess limit in iron-carbon alloy forms a second phase called iron carbide or Cementite. Iron carbide has a chemical composition of Fe 3C and has an orthorhombic unit cell. Carbon percentage in Fe 3C is 6.67%.
- Eutectic mixture of α-iron and Fe 3C is called pearlite . In pearlite, Carbide is nearly 12% and Ferrite is 88% .

From the iron-carbon equilibrium diagram we can clearly see that, when cooling of plain carbon steel (0.4% C) is done at room temperature then the structural constituent obtained is Ferrite and Pearlite.

Three important transformations of the iron-carbon equilibrium diagram

Eutectoid Reaction

- At temperature 723° C and carbon composition 0.8%
- Austenite (γ) (S) ⇄ Ferrite (α-iron) (S) + Carbide (Fe3C) (S)
- One solid converted into two solids.

Eutectic reaction

- At temperature 1130° C and carbon composition 4.3%.
- Liquid Iron (L) ⇄ Austenite (S) + Cementite (S)
- One liquid converts in two solids.

Peritectic reaction

- At temperature 1498°C and carbon composition 0.09%
- δ –iron (S) + Liquid iron (L) ⇄ Austenite (S)
- One liquid and one solid converts into another solid.

Hence Curie point is not found on the iron-carbon equilibrium diagram.

---

138. Answer: b

Explanation:

Explanation :

Atomic Number:

- It is defined as a total number of protons or electrons present in an atom of an element.
- It is represented by Z.

- It is also known as the nuclear charge number.
- It is different for different elements.

Mass Number:

- It is the total sum of the number of protons and neutrons present in the nucleus of an atom of a given element.
- It is represented by A.
- It is also known as atomic mass.

Atomic Weight:

- It is the ratio of the average mass of a chemical element's atoms to some standard mass.
- It can be also said of relative atomic mass.
- It is measured in an atomic mass unit (amu).

Atomic Weight of one Carbon atom:

- Carbon has an atomic mass of A = 12u.
- Thus, one mole of carbon will contain 12 g of it.
- One mole of carbon contains 6.022×10^{23} atoms.
- One atom of carbon will have an atomic weight equal to $12 / 6.022 \times 10^{23}$ g = 1.99×10^{-23} g

Avogadro's Law:

Weight of one atom of an element = Atomic weight / 6.022×10^{23}.

---

139. **Answer: b**

Explanation:

The correct answer is **Periyar National Park**.

- **Periyar National Park is not a world heritage site.**

Key Points

- Periyar National Park and Wildlife Sanctuary (PNP) is a protected area located in the districts of Idukki and Pathanamthitta in Kerala, India.
- It is notable as an elephant reserve and a tiger reserve.
- The park is located high in the Cardamom Hills and Pandalam Hills of the South Western Ghats along the border withTamil Nadu.
- It is not a world heritage site.

Additional Information

- **UNESCO World Heritage sites:**
  - These sites are of cultural, historical, scientific or other forms of importance.
  - The **Galapagos Islands and Quito** were the first world heritage sites in the world.
  - **Ajanta Caves, Ellora Caves, Agra Fort, and Taj Mahal** were the **first World Heritage sites in India.**
  - There is a total of **40 world heritage sites in India.**
- Kaziranga National Park was declared a UNESCO Natural World Heritage Site in 1985.
- Manas National Park, located in the Himalayan foothills of Western Assam, was a game reserve since 1928 until it became a Tiger Reserve in 1974, a World Heritage Site in 1985.
- Nanda Devi National Park was declared a UNESCO World Heritage Site in 1988.

---

140. Answer: a

Explanation:

The correct answer is **Odissi**.

- **Minati Mishra is associated with Odissi.**

Key Points

- Odissi is one of the Classical dance forms of India which originates from the Odisha state of India
- The examples of this dance can be seen from the Udayagiri and Khandagiri Caves in the Odisha
- The name came from ' odra nritya ' which is mentioned in Natya Shastra
- Odissi" dance form represents Water.
- **Minati Mishra** was associated with this dance form.

Additional Information

- **Manipuri** is a classical dance form of **Manipur** .
- **Bharatnatyam** is a classical dance form of **Tamil Nadu.**
- **Kathakali** is a classical dance form of **Kerala** .

---

141. **Answer: d**

Explanation:

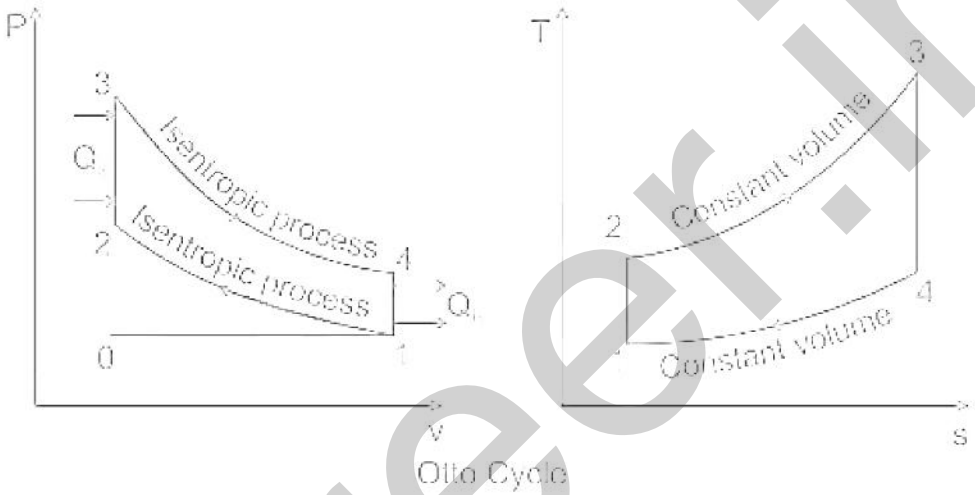
Concept:

Otto cycle:

The air-standard Otto cycle is the idealized cycle for the spark-ignition internal combustion engines.

The Otto cycle 1-2-3-4 consists of the following four process :

- Process 1-2: Reversible adiabatic compression of air
- Process 2-3: Heat addition at constant volume
- Process 3-4: Reversible adiabatic expansion of air
- Process 4-1: Heat rejection at constant volume



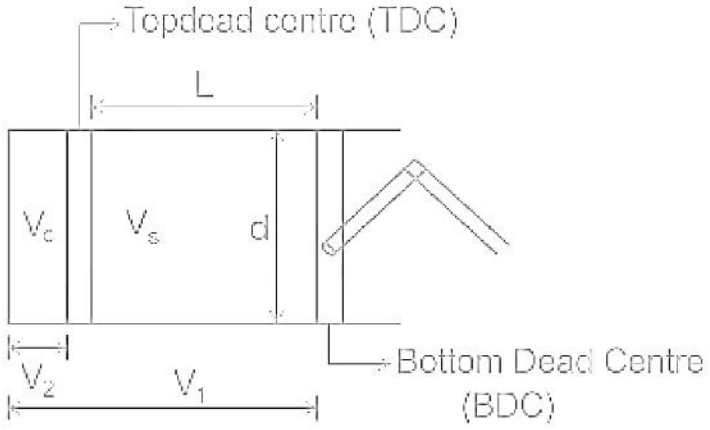
Otto Cycle

The thermal efficiency of the Otto Cycle:

$\eta_{otto} = 1 - \frac{1}{r^{\gamma-1}}$

Compression ratio:

The compression ratio is given by the ratio of volume before compression to volume after compression i.e., It is the ratio of maximum volume to minimum volume.



$Compression\ ratio\ (r) = \frac{V_1}{V_2} = \frac{V_c + V_s}{V_c}$

The air standard efficiency of an Otto cycle is $1 - \frac{1}{r_c^{\gamma-1}}$

Calculation:

Given:

compression ratio, r = 5.5

$\eta_{otto} = 1 - \frac{1}{r^{\gamma-1}} = 1 - \frac{1}{5.5^{1.4-1}} = 0.5$

---

142. Answer: b

Explanation:

Explanation:

In inventory management system there are two ways to review the inventory, they are

Fixed order system:

- In this system the reorder level of the inventory is fixed as soon as the inventory reaches the reorder level a prescribed quantity is ordered in this system the size of order is fixed while the time of order is variable . It is also called reorder level system or two-bin system or Q-system.

Periodic review system/periodic inventory system :

- In this system the period of time after which inventory is reviewed is fixed, after that particular period new order is placed at that point. In this system the time of order is fixed but the size of order is variable . It is also called fixed period system or **P-system.**

---

143. Answer: d

Explanation:

Explanation:

Scavenging:

- The process of driving exhaust gases out of the cylinder and replacing it with fresh air is called scavenging
- In two-stroke diesel engines, all four processes take place in one revolution of the crankshaft or two strokes of the piston
- During scavenging both inlet and exhaust ports are kept open
- A blower forces the air into the cylinder through the opened ports, expelling all the remaining exhaust gases through the open exhaust port and filling the cylinder with fresh air

Functions of scavenging:

1. It pushed the exhaust gases outside
2. It prevents the mixing of fresh air-fuel mixture with exhaust gases
3. It slightly increases the pressure a little above the atmosphere
4. Due to scavenging power does not increase

Supercharging:

The purpose of supercharging an engine is to raise the density of the air charge before it enters the cylinders.

Thus, the increased mass of air will be inducted which will then be compressed in each cylinder. This makes more oxygen available for combustion. Consequently, more air and fuel per cylinder will be forced into the cylinder, and this can be effectively burnt during the combustion process to raise the engine power output to a higher value.

Purpose of supercharging:

- Provides better mixing of the air-fuel mixture
- Increase the volumetric efficiency
- The mechanical efficiencies of supercharged engines are slightly better than the naturally aspirated engines.
- Increase the power output of the engine

- It tends to increase the possibility of detonation in an S.I. engine and lessen the possibility of knocking in a C.I. engine

Supercharging in SI and CI engine:

Supercharging increases the pressure and temperature of the charge at the end of compression. This reduces ignition delay in CI engine, thereby the combustion becomes smooth, and the tendency for knocking is avoided. In the SI engine, the short ignition delay promotes detonation.

Hence supercharging is preferred in a diesel engine than in a petrol engine.

Supercharging Limits:

The limit of supercharging for an SI engine is set by knock while that for a CI engine is set by thermal loading.

Knocking:

Knocking in CI engine occurs because of an ignition lag in the combustion of fuel between the time of injection and the time of actual burning.

As the ignition lag increases, the amount of fuel accumulated in the combustion chamber increases; and when combustion actually takes place, an abnormal amount of energy is suddenly release causing an excessive rate of pressure rise which results in a knock.

Hence a good CI engine fuel should have a short ignition lag so that will ignite more easily.

The CI engine knock can be controlled by reducing the delay period. The delay is reduced by the following :

- High charge temperature
- High fuel temperature
- Good turbulence
- Injection of fuel just before TDC

In order to decrease the tendency of knock, it is necessary to start the actual burning as early as possible after the injection begins. In other words, it is necessary to decrease the ignition delay and thus decrease the amount of fuel present when the actual burning of the first few droplets starts.

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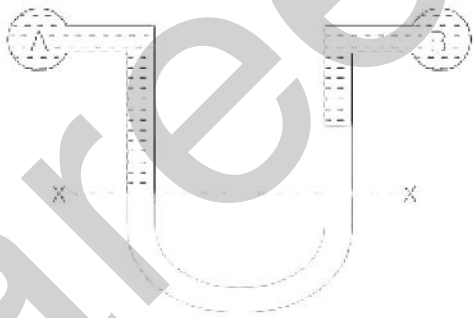
144. **Answer: c**

Explanation:

Explanation:



- Using Hydrostatic law which states the variation of pressure in the vertical direction in a fluid is equal to the specific weight.

P gauge = ρgh

- As we move vertically down in a fluid, the pressure increases as +ρgh.
- As we vertically move up in a fluid, the pressure decreases as -ρgh.

P o + ρ Agh 1 = P o + ρ Bgh 2

where ρ A and ρ B are densities of fluid A and B, h 1 and h 2 are heights of fluid in limbs 1 and 2, P o is the atmospheric pressure.

Calculation:

Given:

h 1 = 0.5 m and h 2 = 0.3 m

ρ Ah 1 = ρ Bh 2

$\frac{\rho_A}{\rho_B} = \frac{h_2}{h_1}$

$\frac{\rho_A}{\rho_B} = \frac{0.3}{0.5} = 0.6$

---

145. Answer: a

Explanation:

Explanation:

Darcy Weisbach Equation for friction losses in circular pipe:

$h_f = \frac{f \times L \times V^2}{2 \times g \times D}$ or $h_f = \frac{fLQ^2}{12.1d^5}$

where L = length of the pipe, D = diameter of the circular pipe, V = mean velocity of the flow, f = Darcy's friction factor = 4 × F', F' = coefficient of friction and h f = head loss due to friction

The energy loss over a length of the pipeline is $\frac{h_f}{L} = \frac{f \times V^2}{2 \times g \times D}$

Here f, g, and for a pipe D remains constant $\therefore \frac{h_f}{L} \propto V^2$

The energy loss over the length of the pipeline is proportional to V 2.

---

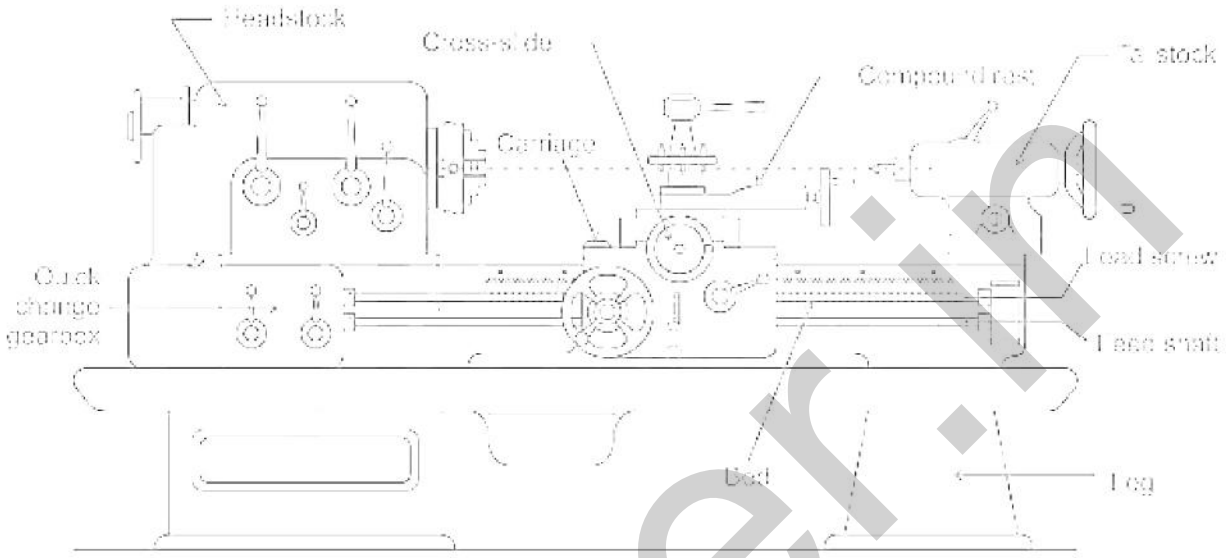
146. Answer: d

Explanation:

Explanation:

Capstan and Turret Lathes:

- Capstan Lathe is the modified form of Engine Lathe and Center Lathe in which the tailstock is replaced by a hexagonal turret tool head.



- Turret lathes are capable of performing multiple cutting operations, such as turning, boring, drilling, thread cutting, and facing on the same workpieces.
- Several cutting tools are mounted on the hexagonal main turret, which is rotated for each specific cutting operation.
- The lathe usually has a square on the cross slide, with as many as four cutting tools mounted on it.
- The workpiece, generally a long round rod, is advanced a preset distance through the chuck.
- After the parts are machined, it cut off by a tool mounted on the square turret which moves radially into the workpiece.
- The rod is then advanced the same present distance into the work area and the next parts machined.
- Turret lathes (bar type or bucking type) are versatile and operations may be carried out either by hand, using the turnstile (capstan wheel), or automatically one set up properly by a setup person, these machines do not require highly skilled operations.
- The turret lathe is also known as a ram-type turret lathe, one in which the ram turret lathe, one in which the ram slides in a spate base on the saddle.
- The sort stroke of the turret slides this machine to relatively short workpieces and light cuts in both small and medium quantity production.
- In another style, called saddle type, **the main turret is installed directly on the saddle, which slides directly on the bed** .
- The length of the stroke is limited only by the length of the bed.

- This type of lathe is more heavily constructed and is used to machine large workpieces.
- Because of the heavyweight of the components, saddle type lathe operations are slower than ram-type lathe operations.
- Vertical turret lathes are also short, heavy, workpieces with diameters as large as 102m.
- Turret lathe can be tape controlled using Numerical controlled lathes.

---

147. **Answer: c**

Explanation:

Explanation :

Insecticide:

- Insecticides are chemical substances used to kill insects.
- The uses chemicals like ovicides and larvicides against insect eggs and larvae.
- Insecticides are mostly used in agriculture, medicine industries etc.

Hydrocarbon:

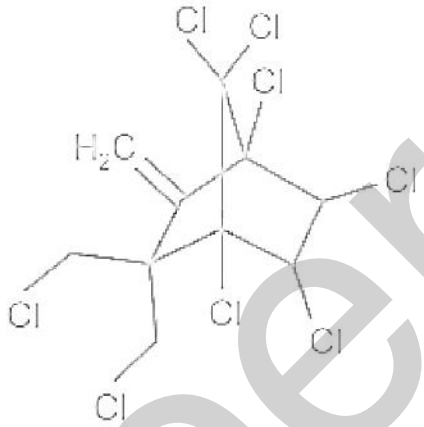
- Hydrocarbon is an organic compound containing hydrogen, oxygen, nitrogen and carbon in it.
- They form a covalent bond between them.
- Hydrocarbons are colourless and hydrophobic.

Chlorinated Hydrocarbon:

- Chlorinated hydrocarbons are compounds that contain chlorine, carbon and hydrogen.
- They are mostly used to make organochlorine pesticides like DDT.
- They are neurotoxic to humans.

Properties and uses of Toxaphene:

- Toxaphene is a commonly used insecticide in the agricultural sector.
- It is a non-synthetic pesticide as well.
- Toxaphene contains 67- 69 per cent chlorine in it.
- Under the influence of light or heat, it loses its toxicity toward insects.



Additional Information

Oxamyl:

- It is a chemical used as a pesticide.
- It has two different forms - granulated form and liquid form.
- Its chemical formula is $C_7 H_{13} N_3 O_3 S$.

Fenthion:

- It is an organothiophosphate insecticide.
- It is also used as avicide and acaricide.
- Its chemical formula is $C_{10} H_{15} O_3 PS_2$.

Allethrin:

- It is a synthetic chemical compound used as an insecticide.
- It is classified under pyrethroids.
- Its chemical formula is $C_{19} H_{26} O_3$.

---

148. **Answer: b**

Explanation:

Explanation:

Material handling:

Material handling involves the movement of materials, manually or mechanically in batches or one item at a time. The movement may be horizontal vertical, or a combination of horizontal and vertical.

Types of material handling equipment:

Conveyors:

Conveyors are employed to transport materials, over a fixed path that may be horizontal or inclined to different locations. A conveyor is economical when the flow of the material is continuous and the route does not vary.

- Belt conveyor - Used when the parts are small or granular and required to be transported separately. For example Limestone
- A fixed conveyor is used on the mass production shop floor , where portable conveyors are preferred for intermittent jobs like unloading of the freight car, etc
- Roller conveyors - may be gravity aided or powered and are employed for transporting products having flat bottoms .
- Bucket conveyors - It is used for liquid, powder, or granular materials. The buckets are mounted on a chain or belt.
- Chain conveyors - It consists of overhead mounted endless chains. It is supported from the ceiling and has a fixed path to travel. Chain conveyors are used in the refrigeration industry for painting and plating refrigerator shells .
- Pipeline conveyors - Used for transporting granular (wheat) or pulverized materials (salt) through the pipes.

Fork truck:

- In a fork-lift truck, the forks are attached to a column on the truck. Forks can be lifted to the desired height along with the materials (boxes etc) on them and the material can be stacked at the proper place.

- Fork-lift trucks are used for short-distance (40 to 70 metres) travel and find indoor applications normally.
- It is used for transporting material over varying paths.

Hoist:

- It may be mounted on a single rail.
- It finds application in wire drawing and many other factories employing chemical cleaning of material etc.

Monorail:

- An I section beam is attached to the ceiling and having either a trolley or carrier moving along it. The material can be transferred from one place to another along the beam.
- Employed for the intermittent material handling in a machine shop and other shops.

Cranes:

- Cranes are employed for lifting or lowering bulky items and packages.
- They find applications in heavy engineering and generally intermittent type of production .
- Overhead crane finds applications in most of the industries, making engines, compressors, and pressure vessels etc.
- Jib crane is preferred where lifting of the jobs is required in few locations only or where an overhead crane can not be erected .

Lifts:

- In multistory plants, the material is lifted up and transported by lifts.
- It is fast and flexible equipment for floor-to-floor travel.

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149. **Answer: b**

Explanation:

Concept :

Impulse:

- When a large force works on a body for a very small time interval , it is called impulsive force .
- An impulsive force does not remain constant, but changes first from zero to maximum and then from maximum to zero . In such a case we measure the total effect of force .
- The impulse caused by a force during a specific time interval is equal to the body's change of momentum during that time interval.
- Impulse, effectively, is a measure of the change in momentum .
- Impulse of a force is a measure of the total effect of force .
  $\vec I = \mathop \smallint \nolimits_{{t_1}}^{{t_2}} \overrightarrow {F\;} \cdot dt$ = F × t
  Where, I = impulse, F = force and dt = very small time interval
- Impulse is a vector quantity and its direction is the same as that of force .
- SI unit of impulse is Newton-second or kg-m-s -1.

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150. Answer: a

Explanation:

option 1) is correct answ

Antivirus software deals with the security of a computer system.

Key Points

- Antivirus software, or anti-virus software , is also known as anti-malware.
- It is a computer program used to prevent, detect, and remove malware.
- Various important Antivirus:
  - Bitdefender Antivirus Plus. Well, rounded everyday antivirus protection.
  - Norton AntiVirus Plus. Smooth protection for your system.

- Avira Antivirus Pro.
- F-Secure Antivirus SAFE.
- Kaspersky Anti-Virus.
- Trend Micro Antivirus+ Security.
- Webroot SecureAnywhere AntiVirus.
- ESET NOD32 Antivirus.

Additional Information

Worms

A worm virus is a malicious, self-replicating program that can spread throughout a network without human assistance.

Sasser

Sasser is a computer worm that affects computers running vulnerable versions of the Microsoft operating systems Windows XP and Windows 2000. Sasser spreads by exploiting the system through a vulnerable port.