

## SOLUTIONS

1. Rajiv, Nikhil, Shubha and Nilima wanted to establish a relationship between loss in weight of a solid with weight of water displaced by immersing it in tap water and sea water. After performing their experiment, they noted their observations for the same solid as follows :

Rajiv : Loss of weight of solid is more in tap water.

Nikhil : Loss of weight of solid is more in sea water.

Shubha : Loss of weight of solid is equal in the tap water and the sea water.

Nilima : Loss of weight of solid may be more in tap water or sea water, depending upon how deeply it is immersed, identify the correct observation.

(a) Nikhil

(b) Nilima

(c) Shubha

(d) Rajiv

**Ans. (a)**

**Sol.**  $\delta_{\text{sea water}} > \delta_{\text{tap water}}$

So, weight of water displaced in sea water > in tap water.

2. The ratio of atoms present in 4 g of magnesium and 4 g of sulphur is (Mg = 24 ; S = 32)

(a) 1 : 1

(b) 2 : 1

(c) 3 : 2

(d) 3 : 4

**Ans. (d)**

**Sol.** Ratio =  $\frac{\frac{4}{24} \times 1}{\frac{4}{32}} = \frac{4}{3}$

3. If Z = 10 the valency of the element is.....

(a) zero

(b) one

(c) two

(d) three

**Ans. (a)**

**Sol.** Z = 10 is for neon (noble gas)

Hence, valency is zero.

4. The average atomic mass of an element X is 80 u. The present of isotopes  $^{79}\text{X}_{35}$  and  $^{82}\text{X}_{35}$  in the sample is

(a) 90.99 and 9.01

(b) 80.8 and 19.2

(c) 66.67 and 33.34

(d) 50 and 50

**Ans. (c)**

**Sol.**  $80 = \frac{(79 \times x) + 82 \times (100 - x)}{100}$

$x = 66.67\%$

$\% ^{79}\text{X}_{35} = 66.67\% \ \& \ \% ^{82}\text{X}_{35} = 33.34\%$

5. An aqueous solution used to preserve biological specimen is  
 (a) Methane (b) Methanol  
 (c) Methanal (d) Methanoic acid

**Ans. (c)**

**Sol.** Biological specimen is stored in HCHO.

6. The molecular formulae of some organic compounds are given below, which of these compounds contains a Ketone group ?  
 (a)  $C_3H_6O_2$  (b)  $C_3H_6O$   
 (c)  $C_3H_4O$  (d)  $C_3H_8O$

**Ans. (b)**

**Sol.** Ketone has D.U. = 1

7. 'Duralumin' is an alloy of aluminium with  
 (a) iron, manganese and magnesium (b) copper, manganese and magnesium  
 (c) copper, chromium and magnesium (d) iron, nickel and magnesium

**Ans. (b)**

**Sol.** Duralumin contains : Al - 95%, Cu - 4%, Mg - 0.5%, Mn - 0.5%

8. Tooth decay starts when the pH around tooth is around  
 (a) 7.5 (b) 7  
 (c) 6.5 (d) 5.5

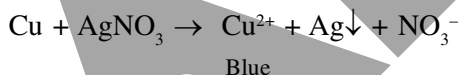
**Ans. (d)**

**Sol.** Tooth decay occurs in acidic medium, pH = 5.5.

9. What will happen if a copper piece is dipped in aqueous solution of silver nitrate for quite some time?  
 (i) Solution will remain colourless  
 (ii) Solution will turn blue  
 (iii) Silver will deposit on the copper piece  
 (iv) Bubbles of brown gas will be formed around copper piece  
 (a) i and iv (b) ii and iv  
 (c) ii and iii (d) iii and iv

**Ans. (c)**

**Sol.** Copper being more reactive than silver will displace it, so silver will be deposited & solution turns blue because of formation of  $Cu^{2+}$ .



10. Neeta mixed 10 mL of 0.1 M HCl solution with 15 mL of 0.067 M NaOH solution. She checked the pH of the resulting solution using pH paper. The colour obtained was

Red	Orange	Yellow	Green	Pale blue	Dark blue	Violet
Strong acid ← Weak acid		Neutral		Weak alkali ← Strong alkali		

- (a) Green (b) Yellow  
 (c) Pale blue (d) Violet

**Ans. (c)**

**Sol.**  $HCl + NaOH \rightarrow NaCl + H_2O$   
 $10 \times 0.1 \quad 15 \times 0.067$   
 1mmol      1.005 mmol

Solution is basic,  $[\text{OH}^-] = \frac{0.005}{25} = 2 \times 10^{-4}$

pOH = 3.7

pH = 10.3                      Pale blue – Dark blue

Appropriate answer (c)

11. (I)  $\text{Zn} + \text{CuSO}_4(\text{aq}) \rightarrow$  Reaction occurs  
(II)  $\text{Zn} + \text{Al}_2(\text{SO}_4)_3(\text{aq}) \rightarrow$  Reaction does not occur  
(III)  $\text{Zn} + \text{AgNO}_3(\text{aq}) \rightarrow$  Reaction does not occur  
(IV)  $\text{Zn} + \text{PbNO}_3(\text{aq}) \rightarrow$  Reaction occurs

Which of the above statements is not correct ?

- (a) I                              (b) II                              (c) III                              (d) IV

Ans. (c)

- Sol. (I)  $\text{Zn} + \text{CuSO}_4(\text{aq}) \rightarrow \text{ZnSO}_4 + \text{Cu}$  – True  
(II)  $\text{Zn} + \text{Al}_2(\text{SO}_4)_3(\text{aq}) \rightarrow$  No reaction – True  
(III)  $\text{Zn} + \text{AgNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + \text{Ag}$  – False  
(IV)  $\text{Zn} + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{Zn}(\text{NO}_3)_2 + \text{Pb}$  – True

12. An open vessel contains air at  $27^\circ\text{C}$ . The vessel is heated till two-fifth of the air in it has been expelled. Assuming the volume of the vessel remains constant, find the temperature to which the vessel has to be heated ?

- (a) 750 K                      (b) 700 K                      (c) 550 K                      (d) 500 K

Ans. (d)

Sol.  $T = 300 \text{ K}$ ;

$$n_1 T_1 = n_2 T_2$$

$$n \times 300 = \frac{3}{5} \times n \times T_2$$

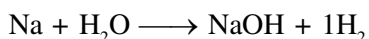
$$\Rightarrow T_2 = 500 \text{ K}$$

13. A teacher wanted to give acid base titration to her students. For that she prepared (i) HCl solution by dissolving 73 g of hydrochloric acid in one litre of water and (ii) sodium hydroxide solution by dissolving 0.46 g of sodium metal in one litre of water. Find the volume of the hydrochloric acid solution required for complete neutralisation of sodium hydroxide solution. (Cl = 35.5 ; Na = 23.0 ; O = 16.0)

- (a) 20 mL                      (b) 10 mL                      (c) 46 mL                      (d) 5 mL

Ans. (b)

Sol.  $[\text{HCl}] = \frac{73}{36.5} = 2\text{M}$



$$\frac{0.46}{23}$$

$$[\text{NaOH}] = 0.02 \text{ M}$$

$$0.02 \times 1 = 2 \times v$$

$$v = 0.01 \text{ L} = 10 \text{ mL}$$

14. What would be the atomic number of the next halogen element, if discovered in future ?

- (a) 103                      (b) 115                      (c) 117                      (d) 121

Ans. (c)

Sol. After Astatine next element will have atomic number =  $85 + 32 = 117$ .

15. A white solid known to be a compound of sodium, given rise to water vapour and a colourless gas on heating. The residual white powder is dissolved in water and when the solution is added to alum solution, a white gelatinous precipitate is obtained. The original solid was :

- (a) Sodium carbonate                      (b) Sodium bicarbonate  
(c) Sodium hydroxide                      (d) Sodium nitrate

Ans. (b)

Sol.  $\text{NaHCO}_3 \xrightarrow{\Delta} \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$

$\text{Na}_2\text{CO}_3$  solution alkaline

$\text{Al}^{3+} + \text{OH}^- \longrightarrow \text{Al}(\text{OH})_3$  (white gelatinous ppt)

16. Harsha was trying to neutralize phosphoric acid using various bases. Those available were caustic soda, lime water and hydrated alumina. If Harsha took 1 equivalent of phosphoric acid each time, what will be the ratio for moles of each of the above bases required for complete neutralization ?

- (a) 1 : 1 : 1                      (b) 1 : 0.5 : 0.33  
(c) 1 : 2 : 3                      (d) 1 : 0.33 : 0.5

Ans. (b)

Sol.

	n-factor	No. of moles
Caustic soda - NaOH	1	1
Lime water - $\text{Ca}(\text{OH})_2$	2	$\frac{1}{2}$
Hydrated Alumina - $\text{Al}(\text{OH})_3$	3	$\frac{1}{3}$

1 eq of phosphoric acid = 1 eq. of NaOH  
= 1 eq. of lime water = 1 eq. of  $\text{Al}(\text{OH})_3$

$$1 : \frac{1}{2} : \frac{1}{3}$$

17. A flask containing  $\text{SO}_2$  gas was weighed at a particular temperature and pressure. The flask was then flushed and filled with oxygen gas at the same temperature and pressure. The weight of  $\text{SO}_2$  in the flask will be about :

- (a) same as that of oxygen                      (b) one-fourth that of oxygen  
(c) four times that of oxygen                      (d) twice that of oxygen

Ans. (d)

Sol.  $\frac{w_1}{m_1} = \frac{w_2}{m_2}$                        $\frac{w_1}{61} = \frac{w_2}{32}$

$w_1 = 2w_2$   
( $\text{SO}_2$ )    ( $\text{CO}_2$ )

18. Arun needs 1.71 g of cane sugar ( $C_{12}H_{22}O_{11}$ ) to sweeten his tea. What would be the number of carbon atoms consumed through sugar in the tea ?

- (a)  $3.66 \times 10^{22}$                       (b)  $7.2 \times 10^{21}$                       (c)  $5 \times 10^{21}$                       (d)  $6.6 \times 10^{22}$

Ans. (a)

Sol.  $\frac{1.71}{342} \times 12 \times 6.023 \times 10^{23} = 3.61 \times 10^{22}$

19. Choose the correct sets which represent the oxides as Acidic : basic : neutral : amphoteric respectively

- (i)  $CO_2$  :  $MgO$  :  $N_2O$  :  $H_2O$                       (ii)  $SO_2$  :  $NO$  :  $CO$  :  $Al_2O_3$   
 (iii)  $P_2O_5$  :  $ZnO$  :  $NO$  :  $Al_2O_3$                       (iv)  $SO_3$  :  $CaO$  :  $N_2O$  :  $PbO$   
 (a) i and ii                      (b) ii and iii  
 (c) iii and iv                      (d) i and iv

Ans. (d)

Sol. (i)  $CO_2$  - Acidic  
 $MgO$  - Basic  
 $N_2O$  - Neutral  
 $H_2O$  - Amphoteric  
 (iv)  $SO_3$  - Acidic  
 $CaO$  - Basic  
 $N_2O$  - Neutral  
 $PbO$  - Amphoteric

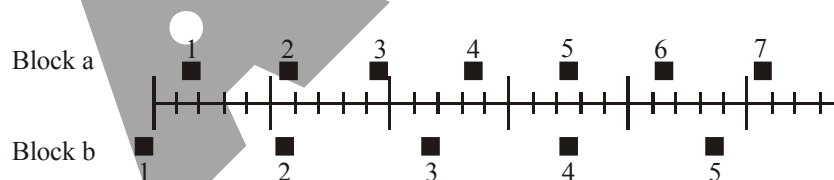
20. During a meteorite shower a few meteorites fell into a water body having pH around 7. The pH of the water body was measured after meteorite shower and found to be

- (a)  $> 7$   
 (b)  $< 7$   
 (c)  $= 7$   
 (d) no change in pH of water due to the meteorite shower

Ans. (a)

Sol. Meteorites are mainly composed of metal oxides hence solution formed is basic.  
 $pH > 7$

21. The position of two blocks at successive 0.20-second time intervals are represented by the numbered squares in the figure below. The blocks are moving towards right.



The acceleration of the blocks are related as follows :

- (a) acceleration of 'a' is greater than acceleration of 'b'.  
 (b) acceleration of 'a' equals acceleration of 'b'. Both accelerations are greater than zero.  
 (c) acceleration of 'b' is greater than acceleration of 'a'  
 (d) acceleration of 'a' equals acceleration of 'b'. Both acceleration are zero

Ans. (d)

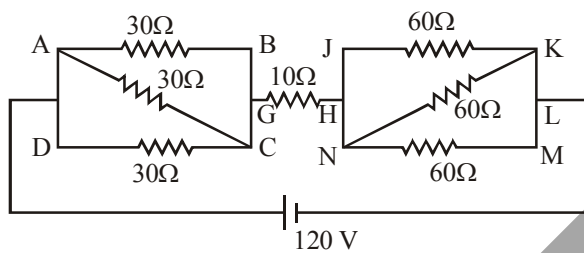
Sol. Velocity is constant for the blocks a and b, so acceleration will be zero.

22. In rural areas, an indigenous way of keeping kitchen materials cool is to put them in a box and wrap the box with weiblanket; the blanket is kept wet as tap is allowed to drip in to its comer. Choose the correct statement:
- This method works because the water from the tap is cold. If one uses room temperatufe water, it will not work.
  - Method will work only if the box is a bad Conductor of heat. If one uses tin box, it will not work.
  - Method doesn't work
  - method works because the latent heat necessary for evaporation of water in the blanket is taken from the box so the box and its content remain cool'

Ans. (d)

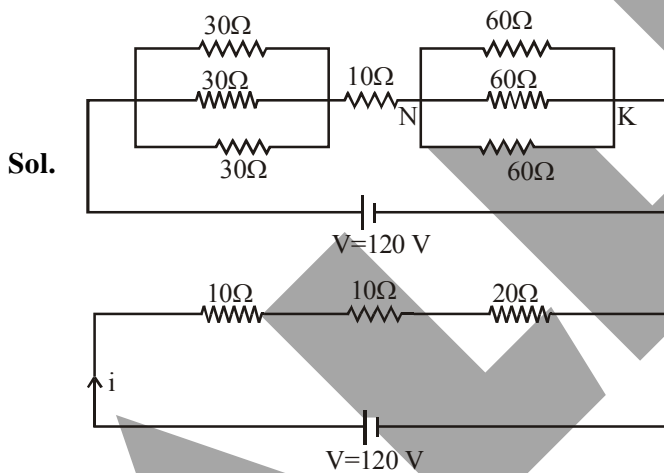
Sol. A wet blanket is wraped around a box so latent heat necessary for evaporation of water is the blanket is taken from the box so the box and its content remain cool.

23. In the adjacent circuit what is the current flowing from N to K?



- (a) 3A (b) 2A (c) 1A (d) 0.5 A

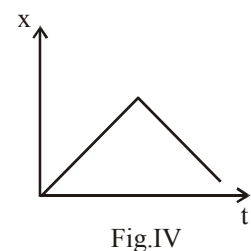
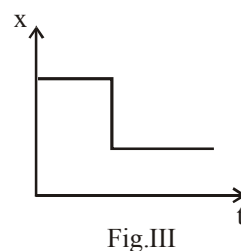
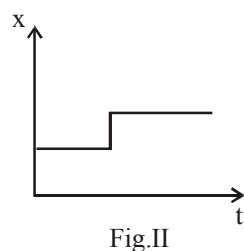
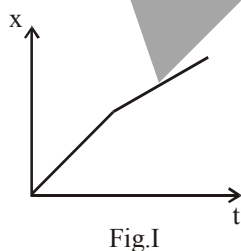
Ans. (c)



$$i = \frac{120}{40} = 3A$$

∴ in NK current will be 1A.

24. If  $x$ ,  $v$  and  $t$  represent displacement (m), velocity (m/s) and time (9s) respectively for a certain particle then which pair of the following figures can be best correlated to each other.



- (a) I & II (b) I & III (c) I & IV (d) None

Ans. (b)

Sol. Slope of x - t graph gives velocity

$$\text{Slope} = v = \tan \theta$$

if  $\theta$  will greater than  $v$  will be more.

25. The take off speed of Airbus A340 is 288 km/hr. From the taxi track it comes to the main runway and waits for a while for the final clearance from Air Traffic control. The aircraft then achieves this speed within 50 seconds. Neglecting the effect of the wind direction and friction, what should be the minimum length of main runway decided by civil engineers for this aircraft for a take-off?

- (a) 1800 m (b) 2000 m (c) 2200 m (d) 2400 m

Ans. (b)

Sol.  $u = 0, v = 288 \times \frac{5}{18} = 80 \text{ m/s}$

$$a = \frac{80 - 0}{50} = \frac{8}{5} \text{ m/s}^2$$

$$u = 0, v = 80 \text{ m/s}, a = \frac{8}{5} \text{ m/s}^2, s = ?, t = 50 \text{ sec}$$

$$s = \frac{1}{2} \times at^2 = \frac{1}{2} \times \frac{8}{5} \times 50^2 = 2500 = 2000 \text{ m}$$

26. An empty office chair is at rest on a floor. Consider the following forces :

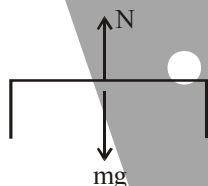
- I- A downward force of gravity,
- II- An upward force exerted by the floor,
- III- A net downward force exerted by the air.

Then, which of the force(s) is (are) acting on the office chair?

- (a) I only
- (b) I and II
- (c) I, II and III
- (d) None of the forces. (Since the chair is at rest there are no forces acting upon it.)

Ans. (b)

Sol.



But in air net force will be upward byount force.

27. The ability of eye to focus both near and distant objects, by adjusting its focal length, is called

- (a) Myopia (b) Presbyopia
- (c) accommodation of eye (d) Tyndall effect

Ans. (c)

Sol. Change in focal length of eye is known as accomodation of eye.

28. In bringing a  $\alpha$ -particle, the electrostatic potential energy of the system \_\_\_\_\_.

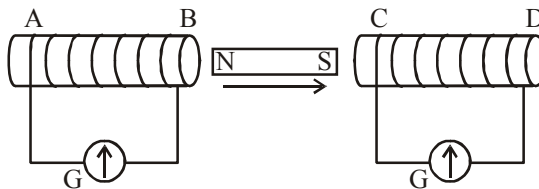
- (a) increases (b) decreases (c) remains unchanged (d) becomes zero

**Ans. (a)**

**Sol.** When  $\alpha$  particle are brought together electrostatic potential energy increase.

**29.** A magnet is placed between two coils AB and CD as shown. It is being moved in the direction as shown by the arrow, then which of the following statement is correct.

- (a) looking from end A, current in coil AB will be anticlockwise and looking from end D, the direction of current in coil CD will be anticlockwise.
- (b) looking from end A, current in coil AB will be clockwise and looking from end D, the direction of current in coil CD will be clockwise
- (c) looking from end A, current in coil AB will be clockwise and looking from end D, then direction of current in coil CD will be anticlockwise
- (d) looking from end A, current in coil AB will be anticlockwise and looking from end D, the direction of current in coil CD will be clockwise



**Ans. (a)**

**Sol.** Using Lenz's law.

**30.** A boy throws a steel ball straight up. Consider the motion of the ball only after it has left the boy's hand but before it touches the ground and assume that forces exerted by the air are negligible. For these conditions, the force(s) acting on the ball is (are) :

- (a) a downward force of gravity along with a steadily decreasing upward force.
- (b) a steadily decreasing upward force from the moment it leaves the boy's hand until it reaches its height point; on the way down there is a steadily increasing downward force of gravity as the object gets closer to the earth.
- (c) constant downward force of gravity along with an upward force that steadily decreases until the ball reaches its highest point; on the way down there is only a constant downward force of gravity.
- (d) constant downward force of gravity only.

**Ans. (d)**

**Sol.** In free fall only gravity acts.

**31.** A large truck collides head-on with a small compact car. During the collision :

- (a) the truck exerts a greater force on the car than the car exerts on the truck.
- (b) the car exerts a greater force on the truck than the truck exerts on the car.
- (c) the truck exerts a force on the car but the car does not exert a force on the truck.
- (d) the truck exerts the same force on the car as the car exerts on the truck.

**Ans. (d)**

**Sol.** According to Newton's III<sup>rd</sup> law for every action there is always equal and opposite reaction.

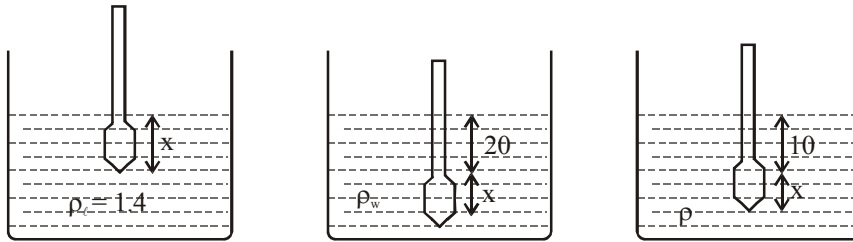
**32.** A common hydrometer has a uniform scale and its stem is graduated downwards from 0 to 20. While floating in water, it read 0 and while floating in a liquid of density  $1.40 \text{ g/cm}^3$ , it reads 20. Then the density of the liquid in which it will read 10 is

- (a)  $0.7 \text{ g/cm}^3$  (b)  $0.85 \text{ g/cm}^3$
- (c)  $1.17 \text{ g/cm}^3$  (d)  $2.8 \text{ g/cm}^3$

**Ans. (c)**



Sol.



Weight of body =  $A(20 + x) \times \rho_w$  in water.

Weight of body =  $A \times x \times 1.4$  in liquid.

Equating  $A \times x \times 1.4 = A \times (20 + x) \times \rho_w$

$$20 + x = 1.4x \Rightarrow 0.4x = 20$$

$$x = 50$$

Similarly in unknown liquid

$$\Rightarrow A \times (10 + x) \times \rho = A \times x \times 1.4$$

$$(10 + x) \times \rho = 1.4 \times x$$

$$60\rho = 1.4 \times 50$$

$$\rho = \frac{1.4 \times 50}{60} = \frac{7}{6} = 1.17 \text{ g/cm}^3$$

33. For the same angle of incidence, the angle of refraction in three different media A, B, C are  $15^\circ$ ,  $25^\circ$  and  $35^\circ$  respectively. Then which statement is correct : ( $\mu_A$  is refractive index of A)

- (a)  $\mu_A$  is maximum and velocity of light is maximum in medium A.
- (b)  $\mu_A$  is minimum and velocity of light is maximum in medium A.
- (c)  $\mu_A$  is maximum and velocity of light is minimum in medium A.
- (d)  $\mu_A$  is minimum and velocity of light is minimum in medium A.

Ans. (c)

Sol. As we known by Snell's law

A, B, C have  $r = 15^\circ, 25^\circ, 35^\circ$  respectively

$$\sin i \times 1 = \mu \sin r$$

$\sin i = \text{constant for all.}$

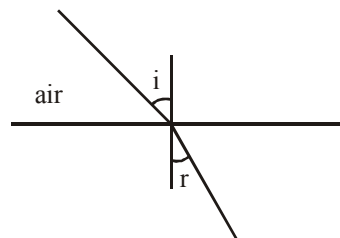
$$\mu \propto \frac{1}{\sin r} \quad (\because \text{sine is increasing function})$$

Hence as  $\sin r$  increase  $\mu$  decreases

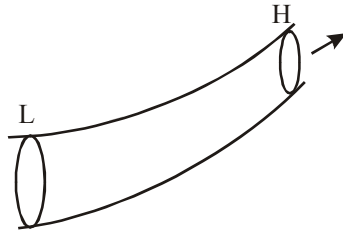
$$\therefore \mu_A > \mu_B > \mu_C$$

$$\text{and } \mu = \frac{c}{v} \Rightarrow \mu \propto \frac{1}{v}$$

$$v_A < v_B < v_C.$$



34. A liquid, whose density doesn't change during the motion, is flowing steadily through a pipe of varying cross sectional area as shown in the adjacent figure. If  $a_1$ ,  $a_2$  are the cross sectional areas,  $v_1$ ,  $v_2$  are the values of velocities (or speeds) at L and H respectively, then the correct relation between  $a_1$ ,  $a_2$  and  $v_1$ ,  $v_2$  is :

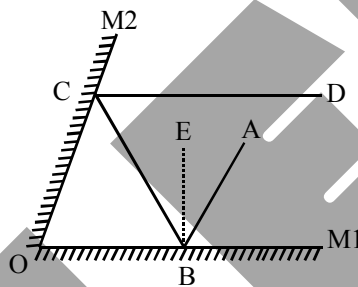


- (a)  $a_1 v_2 = a_2 v_1$       (b)  $a_1 v_1 = a_2 v_2$       (c)  $a_1^2 v_2 = a_2^3 v_1$       (d)  $a_1 v_1^2 = a_2 v_2^2$

Ans. (b)

Sol. Equation of continuity states that for steady flow  $A_1 V_1 = A_2 V_2$

35. As shown in adjacent figure two plane mirrors. M1 and M2 are inclined to each other at the angle  $70^\circ$  (angle M1OM2). Incident ray AB makes an angle of incidence  $\theta$  on M1. This ray after reflection at B on M1 and further at C on M2 travels along the direction CD, such that path CD is parallel to M1. Then angle  $q$  is \_\_\_\_\_.



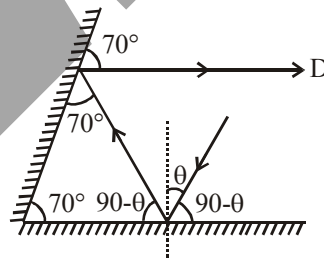
- (a)  $45^\circ$       (b)  $50^\circ$       (c)  $55^\circ$       (d)  $60^\circ$

Ans. (b)

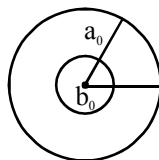
Sol.  $70^\circ + 70^\circ + 90^\circ - \theta = 180^\circ$

$$\theta = 230^\circ - 180^\circ$$

$$\theta = 50^\circ$$



36. A copper disc of radius  $a_0$  has a hole of radius  $b_0$  at the centre, at  $0^\circ\text{C}$ . The disc is now heated and maintained at  $200^\circ\text{C}$ . The new radii of disc and hole are  $a_1$  and  $b_1$  respectively. for the heated disc it can be concluded that.



- (a)  $a_0 < a_1$ ,  $b_0 < b_1$  and density of disc decreases      (b)  $a_0 < a_1$ ,  $b_0 > b_1$  and density of disc decreases  
(c)  $a_0 < a_1$ ,  $b_0 < b_1$  and density of disc increases      (d)  $a_0 < a_1$ ,  $b_0 > b_1$  and density of disc increases

Ans. (a)

Sol. On expansion of Annular disc.

Inner and outer both will expand uniformly

On increase in volume, density decreases

37. A concave mirror of radius of curvature 1m is placed at the bottom of a water tank. The mirror forms an image of the sun when it is directly overhead. If the depth of water in the tank is 80 cm, then the distance of the image formed is \_\_\_\_\_ (refractive index of water is 1.33)
- (a) on surface of water (b) 110 cm above mirror  
(c) 50 cm above mirror (d) image cannot be formed

Ans. (c)

Sol.  $R = 100 \text{ cm}$

$$f = -50 \text{ cm}$$

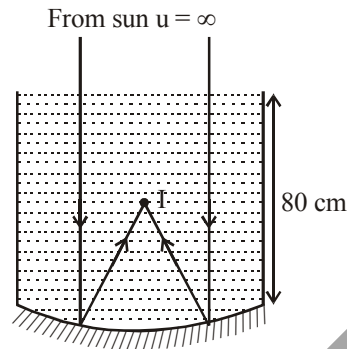
$$u = \infty$$

$$v = ?$$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$-\frac{1}{50} = \frac{1}{v}$$

$$v = -50 \text{ cm}$$



38. The equivalent resistance of two resistances in series is 'S'. These resistance are now joined in parallel. The parallel equivalent resistance is 'P'. If  $S = nP$ . Then the minimum possible value of n is
- (a) 2 (b) 3 (c) 4 (d) 5

Ans. (c)

Sol. Let  $r_1 = r_2 = r$  (where  $r_1$  and  $r_2$  are two resistors)

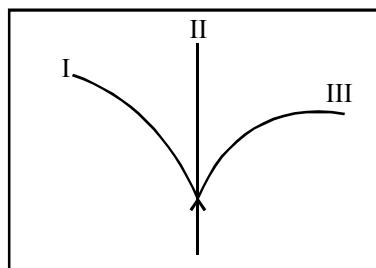
In series  $s = r_1 + r_2 = 2r \dots\dots (1)$

In parallel  $p = \frac{r_1 r_2}{r_1 + r_2} = \frac{r^2}{2r} = \frac{r}{2} \dots\dots(2)$

equation (1) / equation (2)

$$\frac{s}{p} = \frac{2r}{r/2} = 4$$

39. An electron and  $\alpha$ -particle enter a region of uniform magnetic field (of induction B) with equal velocities. The direction of B is perpendicular and into the plane of the paper. The qualitatively identify the direction of paths of electron and the  $\alpha$ -particle.

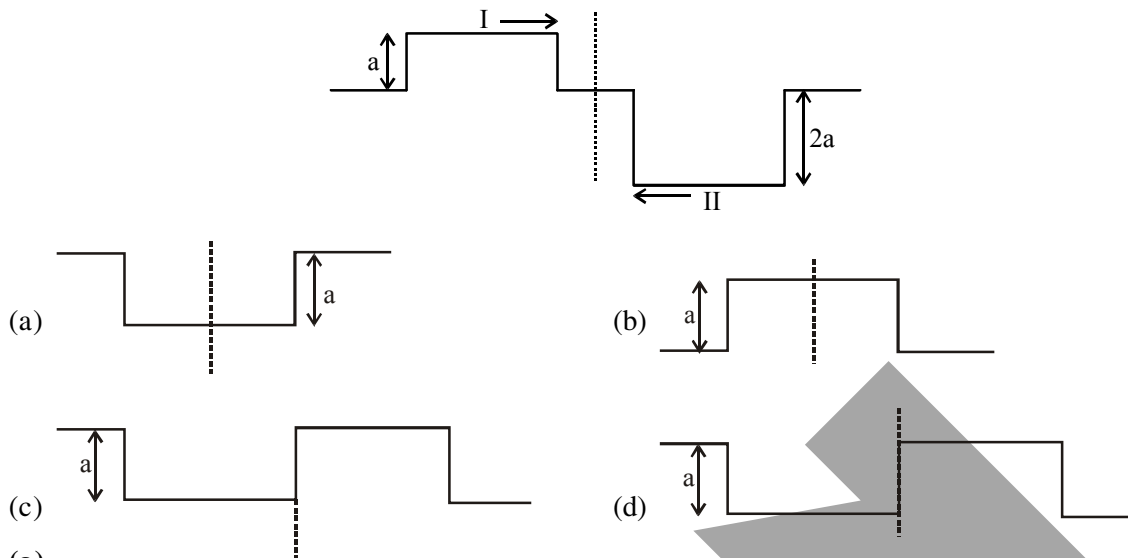


- (a) I for  $\alpha$ - particle, II for electron (b) I for electron, II for  $\alpha$ - particle  
(c) I for  $\alpha$ - particle, III for electron (d) I for electron, III for  $\alpha$ - particle

Ans. (c)

Sol. According to Fleming's left hand rule we can find force on charge particle.

40. Two wave pulses I and II and the same wavelenth. They are travelling in the directions as shown by the single headed arrows. The resultant sketch of the two wave pulses at some instant of time when P coincides with R is \_\_\_\_\_.



Ans. (a)

Sol. Due to superposition principle of wave having same wavelength & frequency, amplitude is simply added. Logic of standing waves.

41. Ravi mixed two substances A and B in a vessel and left it as it is. After few hours he detected an alcoholic smell emanating from the vessel. Identify what A and B are:

- (a) Salt solution and *Lactobacillus* (b) Fruit juice and *Saccharomyces*  
 (c) Fruit juice and *Lactobacillus* (d) Salt solution and *Saccharomyces*

Ans. (b) Fruit juice and *Saccharomyces*

Sol. Fruit juice  $\xrightarrow{\text{Saccharomyces}}$  Ethanol + CO<sub>2</sub>

42. Which amongst the following shows the characters of both plants and animals:

- (i) *Anabaena* (ii) *Paramecium* (iii) *Euglena* (iv) *Amoeba*  
 (a) i and iv (b) iii (c) ii (d) i and iii

Ans. (b) - (iii)

Sol. *Euglena* shows mixotrophic nutrition so it shows character of both plants and animals.

43. Which amongst the following are not plastids:

- (a) Leucoplasts (b) Chromoplasts (c) Amyloplasts (d) Tonoplasts

Ans. (d) Tonoplasts

Sol. Tonoplast is the outer membrane of plant vacuole. Remaining three are plastids.

44. During a study the number of cells was recorded to increase as follows:

64 → 128 → 256 → 512 → 1024. This represents:

- (a) Budding (b) Meiosis (c) Binary fission (d) Fragmentation

Ans. (c) Binary fission

Sol. In Binary fission each parent cell divides into two daughter cells.

45. A plant kept in a box with only a hole for entry of light shows bending, the process called phototropism. It occurs due to:

- (a) Synthesis and diffusion of cytokinin in the leaves
- (b) Breakdown of auxin in the shoot
- (c) Synthesis and diffusion of abscisic acid
- (d) Synthesis and diffusion of auxin in the shoot

Ans. (d) Synthesis and diffusion of auxin in the shoot.

Sol. Auxin accumulates in shaded area of shoot tip, and causes bending of shoot tip towards light i.e. phototropism.

46. What would be the minimum required length of codon to encode 400 amino acids, if there existed three purines and pyrimidines each?

- (a) 3
- (b) 4
- (c) 5
- (d) 6

Ans. (b) 4

Sol. 3 purines and 3 pyrimidines each so total 6 nitrogen base pairs. We require to encode 400 amino acids.

$$6^n > 400 \Rightarrow 6 \times 6 \times 6 \times 6 = 1296 \text{ codons}$$

So,  $n = 4$

Minimum required length of codon would be 4.

47. A 'life- style' disorder among these is:

- (a) Hypertension
- (b) Presbyopia
- (c) Herpes
- (d) Scurvy

Ans. (a) Hypertension

Sol. Life style disorders like stress, improper diet, lack of sleep etc. is responsible for causing hypertension. Presbyopia is due to hardening of lens of eye.

Herpes is caused due to *Herpes simplex* virus.

Scurvy is caused due to deficiency of Vitamin C.

48. Metamerism is a characteristic of

- (a) *Hirudinaria*
- (b) *Taenia*
- (c) *Asterias*
- (d) *Pila*

Ans. (a) *Hirudinaria*

Sol. Metamerism is the characteristic feature of phylum Annelids. eg. *Hirudinaria* (Leech)

49. Health is all about 'eating-fasting' balance. When you fast for extended periods, your cells clean out and recycle the intracellular garbage. The organelles responsible for this are:

- (a) Microtubules
- (b) Microfilaments
- (c) Golgi Apparatus
- (d) Lysosomes

Ans. (d) Lysosomes

Sol. Lysosomes contain digestive enzymes and help in cleaning of cells.

50. A plant may not exchange CO<sub>2</sub> or O<sub>2</sub> with air at:

- (a) twilight
- (b) mid-night
- (c) late hours in the morning
- (d) noon

Ans. (a) twilight

Sol. The (light) compensation point is the amount of light intensity where the rate of photosynthesis is equals to the rate of respiration that is at twilight.

51. If a small part of the esophagus of a person is excised, the consequence would be the person will have to eat \_\_\_\_\_.

- (a) larger portion of food with large time interval
- (b) small portions of food at small time interval
- (c) small portions of food at large time interval
- (d) majorly subsist on liquid diet

**Ans. (b) small portions of food at small time interval**

**Sol.** Because small part of esophagus is excised and the patient need to eat small portions of food at small time interval

52. When heated, the hydrogen bonds between the complementary strands of DNA break and the 2 strands separate in a process called melting. Which of the following pieces of DNA will require maximum temperature for melting?

- (a) 3' AAGGTATACAAT 5'  
5' TTCCATATGTTA 3'
- (b) 3' GAGCUAUCCGAG5'  
5'CUCGAUAGGCUC 3'
- (c) 3' ACGTCCGCTGCG 5'  
5' TGCAGGCGACGC 3'
- (d) 3' ATTAGCTAGCAA 5'  
5' TAATCGATCGTT 3'

**Ans. (c) 3' ACGTCCGCTGCG 5',  
5' TGCAGGCGACGC 3'**

**Sol.** 3' ACGTCCGCTGCG 5',  
5' TGCAGGCGACGC 3'

DNA fragments with more G/C base pairs will require higher temperature for melting. Option (c) has 9 G/C base pairs which is the maximum among all other options.

53. In a self-pollinated plant, what would be minimum number of meiotic divisions required for setting 400 seeds?

- (a) 100
- (b) 200
- (c) 400
- (d) 500

**Ans. (d) 500**

**Sol.** For pollen grain 1 microspore mother cell meiosis 4 microspores.  
1 megaspore mother cell meiosis 1 megaspore.

Total number of meiosis = 100 for pollen grains, 400 for megaspore = 500 meiosis to produce 400 seeds.

54. If a flower is producing a large number of minute and smooth pollen, the agency for cross pollination is most likely to be:

- (a) Air
- (b) Water
- (c) Insects
- (d) Bats

**Ans. (a) Air**

**Sol.** Wind pollinated pollen should be small in size, light in weight, large in number and non sticky.

55. To meet the increasing demand for food, there have been several 'revolutions'. Which of the following revolutions is likely to have contributed most to global warming?

- (a) Green
- (b) White
- (c) Blue
- (d) Silver

**Ans. (b) White**

**Sol.** White revolution has majorly contributed to increase milk production but the live stock produces numerous polluting gases specially methane which is a potent gas for global warming.

56. A mammal adapted to desert conditions is likely to have large:  
(a) Nostrils (b) Pinnae (c) Muzzle (d) Nails

Ans. (b) Pinnae

Sol. The large ears of the desert animals are used in cooling and dissipating heat.

57. Which of the following feature indicates omnivorous feeding of human species?  
(a) Presence of canines as well as premolars and molars  
(b) Presence of appendix  
(c) Presence of 11<sup>th</sup> and 12<sup>th</sup> pair of ribs  
(d) Presence of opposable thumb

Ans. (a) Presence of canines as well as premolars and molars

Sol. Presence of canines indicates carnivorous nature and presence of both pre molars and molars are indicative of herbivorous nature so humans has both the teeth present so that is suggestive of omnivorous nature.

58. In a dihybrid cross, what is the proportion of organisms with dihybrid genotype?  
(a) 2/16 (b) 6/16 (c) 4/16 (d) 9/16

Ans. (c) 4/16

Sol. In a dihybrid cross the proportion of organism with dihybrid genotype (RrYy) is 4/16.

59. If the cell is using less oxygen molecules than the molecules of carbon dioxide evolved in respiration, the substrate for respiration has to be:  
(a) simple sugars (b) organic acids  
(c) fatty acids (d) cholesterol

Ans. (b) organic acids

Sol. Respiratory quotient (RQ) is the ratio of volume of CO<sub>2</sub> produced to the volume of O<sub>2</sub> consumed in respiration.

RQ > 1 of organic acids.

RQ < 1 of fats

RQ = 1 of simple sugars.

60. Panting is a means of thermoregulation in dogs. This is due to:  
(a) high specific heat of water (b) high vapour pressure of water  
(c) high latent heat of vapourization (d) high specific gravity of water

Ans. (c)

Sol. Panting is a means of thermoregulation in dogs due to high latent heat of vaporization.

61. How many four digit numbers are there such that when they are divided by 101, they have 99 as remainder ?  
(a) 90 (b) 98 (c) 100 (d) 101

Ans. (a)

Sol. Number is of the form 101 K + 99

Then first four digit number = 101 × 9 + 99 = 1008

Last four digit number = 101 × 98 + 99 = 9997

So number of such four digit numbers is = 90

62. If  $x = (\sqrt{21} - \sqrt{20})$  and  $y = (\sqrt{18} - \sqrt{17})$ , then  
(a)  $x = y$  (b)  $x < y$  (c)  $x > y$  (d)  $x + y = 0$

Ans. (b)

**Sol.**  $x = \sqrt{21} - \sqrt{20}$ ,  $y = \sqrt{18} - \sqrt{17}$

$$\Rightarrow x \frac{(\sqrt{21} - \sqrt{20})(\sqrt{21} + \sqrt{20})}{\sqrt{21} + \sqrt{20}} = \frac{1}{\sqrt{21} + \sqrt{20}}$$

Similarly,  $y = \frac{1}{\sqrt{18} + \sqrt{17}}$

$$\Rightarrow x = \frac{1}{\sqrt{21} + \sqrt{20}}, y = \frac{1}{\sqrt{18} + \sqrt{17}}$$

$$\Rightarrow x < y$$

- 63.** What is the sum of all odd numbers between 500 and 600 ?  
 (a) 26000 (b) 27000 (c) 27500 (d) 29500

**Ans.** (c)

**Sol.** Odd numbers between 500 and 600 are 501, 503,..... 599.  
 So number of odd numbers are 50

$$\begin{aligned} \therefore \text{Sum of all odd number} &= \frac{50}{2} (501 + 599) \\ &= 25 \times 1100 = 27500 \end{aligned}$$

- 64.**  $1\frac{1}{2} + 1\frac{1}{6} + 1\frac{1}{12} + 1\frac{1}{20} + 1\frac{1}{30} + \dots + 1\frac{1}{380} = \underline{\hspace{2cm}}$   
 (a) 20.25 (b) 20.05 (c) 19.95 (d) 19.85

**Ans.** (c)

**Sol.**  $[1 + 1 + 1 + \dots + 1 \text{ (19 terms)}] + \left(\frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \dots + \frac{1}{380}\right)$

$$= 19 + \left(1 - \frac{1}{2} + \frac{1}{2} - \frac{1}{3} + \frac{1}{3} - \frac{1}{4} + \frac{1}{4} - \frac{1}{5} + \dots + \frac{1}{19} - \frac{1}{20}\right)$$

$$= 19 + \left(1 - \frac{1}{20}\right)$$

$$= 19 + \frac{19}{20} = 19.95$$

- 65.** A train is running at a speed of 54 km/hr. It is not stopping at a certain station. It crosses the person showing green flag in 20 seconds and crosses the platform in 36 seconds. What is the length of the train ?  
 (a) 240 m (b) 300 m (c) 320 m (d) 360 m

**Ans.** (b)

**Sol.** Let length of train = 'L' metre  
 Also, speed of train =  $54 \times \frac{5}{18} = 15$  m/s  
 then,  $20 = \frac{L}{15} \Rightarrow 300 = L$   
 $\Rightarrow L = 300$  m



66. In triangle ABC, segment AD, segment BE and segment CF are altitudes. If  $AB \times AC = 172.8 \text{ cm}^2$  and  $BE \times CF = 108.3 \text{ cm}^2$  then  $AD \times BC =$  \_\_\_\_\_.
- (a)  $136.8 \text{ cm}^2$       (b)  $132.4 \text{ cm}^2$       (c)  $129.2 \text{ cm}^2$       (d)  $128.6 \text{ cm}^2$

Ans. (a)

Sol. Given :  $AB \times AC = 172.8 \text{ cm}^2$ ,  $BE \times CF = 108.3 \text{ cm}^2$

$$\text{Area of triangle ABC} = \frac{1}{2} AD \times BC = \frac{1}{2} AC \times BE = \frac{1}{2} AB \times CF$$

$$AD \times BC = AC \times BE = AB \times CF$$

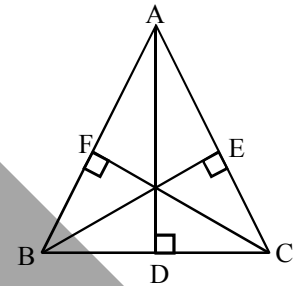
$$\Rightarrow (AD \times BC)^2 = (AC \times BE) \times (AB \times CF)$$

$$\Rightarrow (AD \times BC)^2 = (AB \times AC) (BE \times CF)$$

$$\Rightarrow (AD \times BC)^2 = 172.8 \times 108.3$$

$$\Rightarrow (AD \times BC)^2 = 18714.24$$

$$\Rightarrow AD \times BC = 136.8 \text{ cm}^2$$



67. Diagonals of a quadrilateral bisect each other. Therefore the quadrilateral must be a \_\_\_\_\_.
- (a) parallelogram      (b) rhombus      (c) rectangle      (d) square

Ans. (a)

Sol. If diagonals of a quadrilateral bisect each other, then it is a parallelogram.

68. If  $(a + b + c + d) = 4$ , then

$$\frac{1}{(1-a)(1-b)(1-c)} + \frac{1}{(1-b)(1-c)(1-d)} + \frac{1}{(1-c)(1-d)(1-a)} + \frac{1}{(1-d)(1-a)(1-b)} = \text{_____}.$$

- (a) 0      (b) 0.25      (c) 1      (d) 4

Ans. (a)

$$\text{Sol. } \frac{1}{(1-a)(1-b)(1-c)} + \frac{1}{(1-b)(1-c)(1-d)} + \frac{1}{(1-c)(1-d)(1-a)} + \frac{1}{(1-d)(1-a)(1-b)}$$

$$= \frac{1-d+1-a+1-b+1-c}{(1-a)(1-b)(1-c)(1-d)}$$

$$= \frac{4-(a+b+c+d)}{(1-a)(1-b)(1-c)(1-d)}$$

$$= \frac{4-4}{(1-a)(1-b)(1-c)(1-d)} = 0$$

69. The sum of two numbers is 13 and the sum of their cubes is 1066. Find the product of those two numbers.
- (a) 26      (b) 27      (c) 28      (d) 29

Ans. (d)

Sol. Let the two numbers be  $x$  and  $y$

$$\text{Then } x + y = 13 \text{ and } x^3 + y^3 = 1066$$

$$\Rightarrow x^3 + y^3 + 3xy(x + y) = 2197$$

$$\Rightarrow 1066 + 3xy(13) = 2197$$

$$\Rightarrow 39xy = 1131$$

$$\Rightarrow xy = 29$$

70. By which smallest number we should divide 198396198 to get a perfect square ?

- (a) 14 (b) 18 (c) 22 (d) 28

Ans. (c)

Sol. Here,  $198396198 = 2 \times 3^2 \times 7^2 \times 11^3 \times 13^2$

So, it should be divided by 22 to make it a perfect square.

71. What will be the remainder if the number  $(7)^{2017}$  is divided by 25?

- (a) 1 (b) 7 (c) 18 (d) 24

Ans. (b)

Sol.  $\frac{(7)^{2017}}{25} = \frac{(7^2)^{1008} (7)}{25}$

$$= \frac{(50-1)^{1008} (7)^1}{25}$$

$$= \frac{(50k+1)7}{25} \text{ (By Binomial expansion)}$$

$$= \frac{50k \times 7 + 7}{25}$$

$\Rightarrow$  Remainder = 7

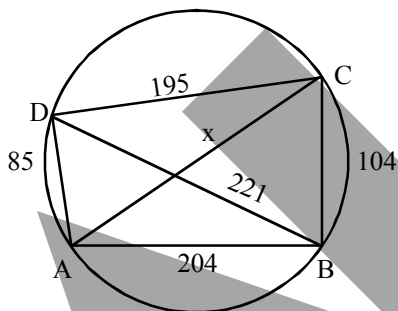
72. If  $\square ABCD$  is a cyclic quadrilateral  $AB = 204, BC = 104, CD = 195, DA = 85$  and  $BD = 221$ , then  $AC =$  \_\_\_\_\_.

- (a) 210 (b) 220 (c) 225 (d) 240

Ans. (b)

Sol. Let  $AC = x$

By Ptolemy's theorem



$$\Rightarrow AB \times CD + AD \times BC = AC \times BD$$

$$\Rightarrow 195 \times 204 + 85 \times 104 = 221 \times x$$

$$\Rightarrow 39780 + 8840 = 221x$$

$$\Rightarrow 48620 = 221x$$

$$x = 220 \text{ m}$$

73. If  $x^2 + xy + xz = 135, y^2 + yz + xy = 351$  and  $z^2 + xz + yz = 243$ , then  $x^2 + y^2 + z^2 =$  \_\_\_\_\_.

- (a) 225 (b) 250 (c) 275 (d) 300

Ans. (c)

**Sol.**  $x^2 + xy + xz = 135$  ... (1)  
 $y^2 + yz + xy = 351$  ... (2)  
 $z^2 + xz + yz = 243$  ... (3)

On adding the above equations we get  
 $x^2 + y^2 + z^2 + 2xy + 2yz + 2xz = 729$   
 $(x + y + z)^2 = 729$   
 $x + y + z = \pm 27$

By eqn (1),  $x(x + y + z) = 135$   
 $\Rightarrow x = \pm \frac{135}{27} = \pm 5$

By eqn. (2),  $y(y + z + x) = 351$   
 $\Rightarrow y = \pm 13$

By eqn. (3),  $z = \frac{243}{27} = \pm 9$

so  $x^2 + y^2 + z^2 = 25 + 169 + 81 = 275$

- 74.** What is the radius of the circumcircle of a triangle whose sides are 30 cm, 36 cm and 30 cm  
 (a) 15 cm (b) 16 cm (c) 17 cm (d) 18 cm

**Ans.** (NA)

**Sol.** Let  $a = 30$  cm,  $b = 36$  cm and  $c = 30$  cm and  $R$  be radius of circumcircle of triangle.

Here,  $R = \frac{abc}{4\Delta}$

Now,  $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$ , where  $s$  (Semi perimeter of triangle) =  $\frac{30+36+30}{2} = 48$

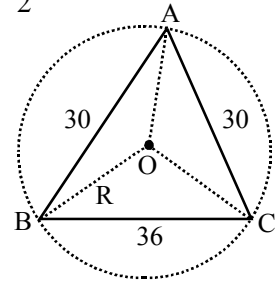
=  $\sqrt{48(48-30)(48-36)(48-30)}$

=  $\sqrt{48 \times 18 \times 12 \times 18}$

$\Delta = 18 \times 12 \times 2 = 432$  cm

Then  $R = \frac{30 \times 36 \times 30}{4 \times 432}$

$R = 18.75$  cm



- 75.** On seventy first 'Independence day' there are Tuesday. After how many years there will be Tuesday on 'Independence day' ?

- (a) 4 yrs. (b) 5 yrs (c) 6 yrs. (d) 7 yrs.

**Ans.** (c)

**Sol.** 71<sup>st</sup> 'Independence day' 15 Aug 2017

Year	Odd days
2017	→ 1
2018	→ 1
2019	→ 1
2020	→ 2
2021	→ 1
2022	→ 1

Now total odd days 7 = zero odd day, so  
 Calender will repeat in 2023 i.e. after 6 years.

76. If  $p + q + r = 2$ ,  $p^2 + q^2 + r^2 = 30$  and  $pqr = 10$ , the value of  $(1 - p)(1 - q)(1 - r)$  will be \_\_\_\_\_.
- (a) -18                      (b) -24                      (c) -27                      (d) -35

Ans. (c)

Sol. Given  $p + q + r = 2$ ,  $p^2 + q^2 + r^2 = 30$ ,  $pqr = 10$

$$\begin{aligned} \text{Now, } (1 - p)(1 - q)(1 - r) &= (1 - p - q + pq)(1 - r) \\ &= (1 - r - p + pr - q + qr - pqr + pq) \\ &= (1 - (p + q + r) + pr + qr + pq - pqr) \quad \dots(1) \end{aligned}$$

$$\begin{aligned} \text{Also } (p + q + r)^2 &= p^2 + q^2 + r^2 + 2pq + 2qr + 2rp \\ (2)^2 &= 30 + 2(pq + qr + rp) \\ \Rightarrow pq + qr + rp &= -13 \quad \dots (2) \end{aligned}$$

From (1) and (2)

$$\begin{aligned} \Rightarrow (1 - p)(1 - q)(1 - r) &= [(1 - 2 + (-13) - 10)] \\ &= 1 - 2 - 13 - 10 \\ &= -24 \end{aligned}$$

77. The mean of the following frequency distribution is \_\_\_\_\_.

Class interval	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
Frequency	4	6	8	10	12

- (a) 25                      (b) 28                      (c) 30                      (d) 32

Ans. (c)

Sol.

Class Interval	Frequency	$x_i$	$f_i x_i$
0 - 10	4	5	20
10 - 20	6	15	90
20 - 30	8	25	200
30 - 40	10	35	350
40 - 50	12	45	540

$$\Sigma f_i x_i = 1200, \quad \Sigma f_i = 40$$

$$\text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{1200}{40} = 30$$

78. If the roots of the equation  $\frac{x^2 - bx}{ax - c} = \frac{m-1}{m+1}$  are equal and of opposite signs, then the value of 'm' is \_\_\_\_\_.

- (a)  $\frac{a-b}{a+b}$                       (b)  $\frac{a+b}{a-b}$                       (c)  $\frac{ab}{a+b}$                       (d)  $\frac{a+b}{ab}$

Ans. (a)

Sol.  $(x^2 - bx)(m + 1) = (m-1)(ax - c)$   
 $(m + 1)x^2 - b(m + 1)x = a(m - 1)x - c(m - 1)$   
 $(m + 1)x^2 - [bm + b + am - a]x + c(m - 1) = 0$   
 Then sum of roots should be zero  
 $bm + b + am - a = 0$   
 $m = \frac{a-b}{a+b}$

79. If  $\left(x + \frac{1}{x}\right) = 5$ , then  $\left(x^3 + \frac{1}{x^3}\right) - 5\left(x^2 + \frac{1}{x^2}\right) + \left(x + \frac{1}{x}\right) = \underline{\hspace{2cm}}$ .

- (a) 0                                      (b) 5                                      (c) -5                                      (d) 10

**Ans. (a)**

**Sol.**  $x + \frac{1}{x} = 5$

$$\Rightarrow x^3 + \frac{1}{x^3} - 5\left(x^2 + \frac{1}{x^2}\right) + \left(x + \frac{1}{x}\right)$$

$$\Rightarrow \left(x + \frac{1}{x}\right)^3 - 3\left(x + \frac{1}{x}\right) - 5\left(x + \frac{1}{x}\right)^2 + 5.2 + \left(x + \frac{1}{x}\right)$$

$$\Rightarrow \left(x + \frac{1}{x}\right)^3 - 2\left(x + \frac{1}{x}\right) - 5\left(x + \frac{1}{x}\right)^2 + 5.2$$

$$\Rightarrow 5^3 - 2.5 - 5.5^2 + 5.2$$

$$\Rightarrow 0$$

80. If  $x^2 - 3x + 2$  is a factor of  $x^4 - px^2 + q$ , then p, q are

- (a) 2,3                                      (b) 4, 5                                      (c) 5,4                                      (d) 0, 0

**Ans. (c)**

**Sol.**  $x^2 - 3x + 2 = (x - 2)(x - 1)$

Put  $x = 1$  in  $x^4 - px^2 + q$  then

$$1 - p + q = 0$$

$$p - q = 1 \quad \dots(1)$$

Put  $x = 2$  in  $x^4 - px^2 + q$

$$16 - 4p + q = 0$$

$$4p - q = 16 \quad \dots(2)$$

from (1) and (2)

$$4p - q = 16$$

$$4p - 4q = 4$$

$$\underline{\hspace{1cm} + \hspace{1cm}} \\ 3q = 12$$

$$q = 4, p = 5$$