

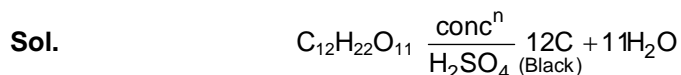
FIITJEE

NSEJS- 2012-13

Solutions

1. Charring of sugar in concentrated sulphuric acid is due to
(a) Oxidation of sugar (b) Reduction of sugar (c) Hydrolysis of sugar (d) Dehydration of sugar

Ans. (d)



It is a dehydration reaction.

2. Two wires made of same material have length l and $2l$. If the masses of the wires are same, the ratio of the resistance of shorter wire to that of longer wire is :

- (a) $1/2$ (b) 2 (c) $1/4$ (d) 4

Ans. (c)

Sol. As we know electrical Resistance is given as

$$\begin{aligned} R_1 &= \frac{\rho l}{A} \\ &= \frac{\rho l(l d)}{A(l d)} = \frac{\rho l^2 d}{M} \quad (d : \text{density of substance}) \\ \frac{R_1}{R_2} &= \frac{l_1^2}{l_2^2} = \frac{l}{2l} = \frac{1}{4} \end{aligned}$$

3. Find $x^2 + y^2 + z^2$ if $x^2 + xy + xz = 135$, $y^2 + yz + yx = 351$ and $z^2 + zx + zy = 243$
(a) 225 (b) 250 (c) 275 (d) 300

Ans. (c)

Sol. $x^2 + y^2 + z^2 + 2(xy + yz + zx) = 729$

$$\begin{aligned} x + y + z &= \pm 27 \\ x^2 + xy + xz &= 135 \\ x[x + y + z] &= 135 \\ x &= \pm 5 \\ \text{similary } y &= \pm 13 \\ \text{Similary } z &= \pm 9 \\ x^2 + y^2 + z^2 &= 275 \end{aligned}$$

4. Current passing through a wire increases by 20%. Due to joule heating the resistance increases by 20%. The percentage increase in the power is :

- (a) 72.8% (b) 44% (c) 33% (d) 40%

Ans. (a)

Sol. As we know electrical power is given as,

$$P = I^2 R$$

As per question new power is,

$$\begin{aligned} P' &= \left(\frac{6I}{5}\right)^2 \left(\frac{6R}{5}\right) = \frac{216}{125} P \\ \% \text{ increase in } P &= \frac{P' - P}{P} \times 100 \\ &= \frac{91}{125} \times 100 = 72.8\% \end{aligned}$$

5. In a certain number system $363 + 1056 = 1452$. Find the value of $(654 - 456)$ in the same number system?
 (a) 156 (b) 165 (c) 178 (d) 198

Ans. (b)

Sol. $(363)_7 + (1056)_7 = (1452)_7$
 $(654)_7 - (456)_7 = (165)_7$

6. A radioactive element ${}_{90}\text{R}^{232}$ emits one alpha (α) particle and then, two beta (β) particles. The daughter element will have :

- (a) Atomic no 90, Mass No. 228 (b) Atomic no. 90, Mass no. 232
 (c) Atomic no. 88, Mass No. 228 (d) Atomic no. 88, Mass no. 232

Ans. (a)

Sol. ${}_{90}\text{R}^{232} \longrightarrow \text{a}^{\text{Xb}} + 2\text{He}^4 + 2(-1\text{e}^0)$
 $232 = b + 4 \Rightarrow b = 228$
 $90 = a + 2 - 2 \Rightarrow a = 90$

7. Dwarfness is a desirable agronomic character since such cereals :

- (a) Produce grains faster (b) Produce grains of better quality
 (c) Prove easier to harvest (d) Require lesser nutrients and water

Ans. (b)

Sol. In a dwarf plant most of its energy is used up in increasing content of seed / grain, rather than increasing height.

8. The combination of the following structures possessing a single set of genome is :

- i. ovary ii, anther iii. egg
 iv. Zygote v. sepal vi. Petals vii. Pollen
 (a) I, ii, iv, v and vi (b) ii, iii, iv and vii (c) only iii and vii (d) only ii, iii and vii

Ans. (c)

Sol. Pollen and eggs are produced by meiosis so they have half no. of chromosomes.

9. The equilibrium constant for the gaseous reaction $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$ is K. The equilibrium constant for the formation of one mole of NO will be :

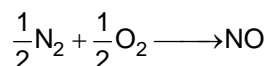
- (a) K/2 (b) K (c) 2K (d) \sqrt{K}

Ans. (d)

Sol. $\text{N}_2 + \text{O}_2 \longrightarrow 2\text{NO}$

$$K = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]}$$

for 1 mole NO = 1



$$K' = \frac{[\text{NO}]}{[\text{N}_2]^{1/2}[\text{O}_2]^{1/2}} = \sqrt{K}$$

10. A bar magnet is placed on a table. There are n number of field lines connecting North pole to South pole of the magnet. Another identical magnet is placed on the first magnet with North Pole on North Pole and South Pole on South Pole. The number of field lines are now :

- (a) n (b) n^2 (c) $n/2$ (d) 2n

Ans. (d)

Sol. \therefore Cross-sectional area is doubled so number of magnetic field lines originating is also doubled.

11. What is the radius of the circumcircle of a triangle whose sides are 30cm, 36cm and 30cm in length :

- (a) 18cm (b) 18.25cm (c) 18.50cm (d) 18.75cm

Ans. (d)

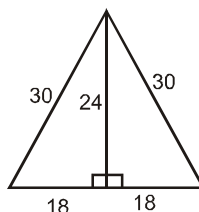
Sol.

$$\Delta = \frac{1}{2} \times 36 \times 24$$

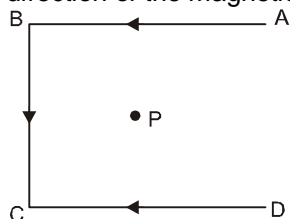
$$= 432$$

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

$$R = 18.75$$



12. A conducting wire shown in the figure carries current I. Segments AB, BC and CD are of same length. The direction of the magnetic field at point P is given by :

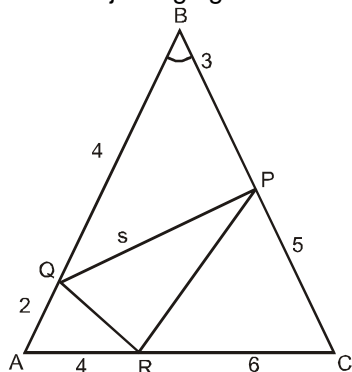


- (a) into the plane of the paper
 (b) out of the plane of the paper
 (c) Towards right
 (d) towards left

Ans. (b)

Sol. Direction of magnetic field at point P due to all three wires AB, BC and CD is out of the plane of paper as per Right hand rule.

13. In the adjoining figure AQ = 2, QB = 4, BP=3, PC=5, CR=6 and RA = 4. Find area of triangle PQR



- (a) 4.8
 (b) 5.2
 (c) 5.8
 (d) 6.2

Ans. (c)

Sol. $\angle B = 90^\circ$. Area $\triangle ABC = 24$
 so area $\triangle PQR = 5.8$

14. The solubility of a salt B_2D_3 is $X \text{ mol L}^{-1}$ Its solubility product :

- (a) X^5
 (b) $6X^5$
 (c) $36X^5$
 (d) $108X^5$

Ans. (d)

Sol. $B_2D_3 \rightleftharpoons 2B^{+3} + 3D^{2-}$
 $K_{sp} = (2x)^2 (3x)^3$
 $= 4x^2 \times 27x^3$
 $= 108 x^5$

15. If and when proteins are oxidized during respiration the energy yield is lesser than when carbohydrates or lipids are oxidized. This is primarily due to the fact that they have :

- (a) Relatively more oxygen
 (b) Relatively less carbon
 (c) Nitrogen that is not oxidized
 (d) Relatively less hydrogen

Ans. (d)

Sol. As less hydrogen content is there in protein as compared to carbohydrates and lipid, on its oxidation less amount of energy is released.

16. 8 Grams of oxygen at NTP contain :

- (a) 1.5×10^{23} molecules
 (b) 3.0×10^{23} molecules
 (c) 6.023×10^{23} molecules
 (d) 1.5×10^{22} molecules

Ans. (a)

Sol. wt. = 8 grams (O_2)
 moles = $\frac{8}{32} = \frac{1}{4}$
 no. of molecules = $\frac{1}{4} \times N_A$
 $= \frac{1}{4} \times 6 \times 10^{23}$
 $= 1.5 \times 10^{23}$ molecule

17. In a nuclear reactor the fission process of each ^{235}U -atom gives out an energy of 200MeV. According to Einstein's equation the amount of mass getting converted to energy in this process is :
- (a) 3.55×10^{-30} kg (b) 3.55×10^{-38} kg (c) 3.55×10^{-28} kg (d) 3.55×10^{-27} kg

Ans. (c)

Sol. By Einstein's mass energy equivalence, $E = mc^2$.

18. If $\sin x + \sin y = a$ and $\cos x - \cos y = b$. Then find the value of $\frac{1}{2}(2 - a^2 - b^2)$

- (a) $\cos(x+y)$ (b) $\cos(x - y)$ (c) $\sin(x + y)$ (d) $\sin(x - y)$

Ans. (a)

Sol. $\sin x + \sin y = a$

$\cos x - \cos y = b$

$$\frac{1}{2}[2 - a^2 - b^2] = 1 - \frac{1}{2}[a^2 + b^2]$$

$$= 1 - \frac{1}{2}[2 + 2\sin x \sin y - 2\cos x \cos y]$$

$$= 1 - \frac{1}{2}[2 - 2\cos(x + y)]$$

$$= 1 - 1 + \cos(x + y)$$

$$= \cos(x + y)$$

19. A ball is projected at an angle of 45° with horizontal. In the absence of air resistance, the ball follows :

- (a) Elliptical orbit (b) Sinusoidal path (c) Parabolic path (d) Linear path

Ans. (c)

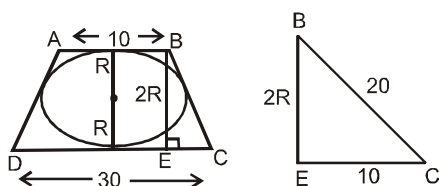
Sol. Ball will follow parabolic path.

20. A circle is inscribed in an isosceles trapezium ABCD in which AB is parallel DC. If AB = 10 and DC=30. Find the area of the circle :

- (a) 45π (b) 50π (c) 60π (d) 75π

Ans. (d)

Sol.



$$DC + AB = AD + BC$$

$$40 = 2BC$$

$$BC = 20$$

$$2R = \sqrt{800}$$

$$R = \frac{\sqrt{300}}{2}$$

$$\pi R^2 = \pi \times \frac{300}{4}$$

$$= 75\pi$$

21. When 1g of CaCO_3 reacts with 50 ml. of 0.1 M HCl, the volume of CO_2 produced is :

- (a) 11.2 mL (b) 22.4 mL (c) 112 mL (d) 224 mL

Ans. (options are not correct)

Sol. $\text{CaCO}_3 + 2\text{HCl} \longrightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$

wt. of $\text{CaCO}_3 = 1\text{gm}$

$$\text{mole of CaCO}_3 = \frac{1}{100} = 10^{-2}$$

$$\begin{aligned} \text{moles of HCl} &= \frac{61}{10} \times \frac{50}{1000} \\ &= 5 \times 10^{-3} \end{aligned}$$

Hence, HCl is a limiting reagent

So, moles of $\text{CO}_2 = \frac{1}{2} \times (5 \times 10^{-3})$
 $= 2.5 \times 10^{-3}$
 So volume $= 22.4 \times 2.5 \times 10^{-3}$
 $= 22.4 \times 2.5 \text{ ml}$

22. Neoteny or larva becoming large and developing into adult retaining larval features is common in amphibians since they are adapted to survive :
 (a) In fresh water bodies where temperature and / or iodine content is less
 (b) On insects that fail to supply enough nutrients
 (c) On a high protein diet that induces early maturation
 (d) In dark places and lack of light induces early sexual maturation

Ans. (a)

Sol. Iodine is required for formation of Thyroxin and due to less iodine less thyroxin is produced which makes them to retain there larval features.

23. Cheese is a colloidal system of :
 (a) Gas in solid (b) Gas in liquid (c) Liquid in gas (d) Liquid in solid

Ans. (d)

Sol. Cheese is a colloidal system
 dispersed phase = liquid
 dispersion medium = solid

24. 60g of ice at 0°C is added to 20g of water at 40° . The final temperature attained by the mixture is (given latent heat of melting of ice = 80 cal/g and specific heat of water is $1 \text{ cal/g}^\circ\text{C}$)
 (a) 0°C (b) 20°C (c) 10°C (d) 5°C

Ans. (a)

Sol. Heat loss = Heat gain
 $m_{\text{ice}}L = m_{\text{water}}S\Delta T$
 $m_{\text{ice}} \times 80 = 20 \times 1 \times 40$
 $m_{\text{ice}} = 10 \text{ gm}$

So, at thermal equilibrium temperature of system will be 0°C and only 10 gram of ice will melt.

25. y varies inversely as x. If x is increased by 25%, then the value of percentage change to y is :
 (a) 80% (b) 75% (c) 60% (d) 62.5%

25. (a)

Sol. $x - y = \text{constant}$
 $(1 - 25x) y' = xy$

$$y' = \frac{y}{1.25}$$

change in y% = 80%

26. Wavelength is :
 (i) The distance travelled by the wave in one period of oscillation of particles in the medium.
 (ii) The distance between two particles, which are in the same phase
 (iii) Half of the distance between two particles, which are in the same phase
 the correct definitions are :

(a) (i) and (iii) (b) (i) and (ii) (c) (i), (ii) and (iii) (d) (ii) and (iii)

Ans. (b)

Sol. Wavelength is the distance travelled by the wave in one period of oscillation of particles in the medium or the distance between two particles, which are in the same phase.

27. Find the value $\frac{2}{15} + \frac{2}{35} + \frac{2}{63} + \frac{2}{99} \dots\dots + \frac{2}{9999}$

(a) $\frac{8}{33}$ (b) $\frac{2}{11}$ (c) $\frac{98}{303}$ (d) $\frac{222}{909}$

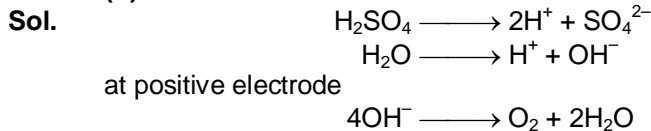
Ans. (c)

Sol. $\frac{2}{15} + \frac{2}{35} + \frac{2}{63} + \frac{2}{99} + \dots + \frac{2}{9999}$
 $= \frac{1}{3} - \frac{1}{5} + \frac{1}{5} - \frac{1}{7} + \frac{1}{7} - \frac{1}{9} + \dots - \frac{1}{99} + \frac{1}{101}$
 $= \frac{1}{3} - \frac{1}{101}$
 $= \frac{98}{303}$

28. When a dilute solution of sulphuric acid is electrolysed using platinum electrodes the gas evolved at the positive electrode is :

- (a) SO₂ (b) SO₃ (c) H₂ (d) O₂

Ans. (d)



29. To avoid damage to electricity cables trees are often trimmed before monsoon. Excessive trimming leaving only trunk often leads to death of the tree. The most probable reason is that :

- (a) No food can be synthesized
 (b) No buds are left to grow into new shoot
 (c) No auxins (growth promoters) can be synthesized
 (d) They succumb to the excessive trauma of wounds

Ans. (a)

Sol. Because only trunk remain left in trees so, photosynthesis stops and hence no food can be synthesized.

30. If equal weight of oxygen and nitrogen are kept in separate containers at the same temperature then :

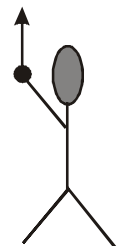
- (a) Both the containers have the same number of molecules
 (b) More molecules of the nitrogen container is greater than that of the oxygen container
 (c) The pressure of the nitrogen container is greater than that of the oxygen container
 (d) The pressure of the oxygen container is greater than that of the nitrogen container

Ans. (c)

Sol. Partial pressure of a gas is directly proportional to its no. of moles N₂ container will have more no., molecule so the pressure of Nitrogen container is greater than oxygen container.

31. A boy is standing on a truck which is moving with constant speed along a straight road. On a day when winds is negligible, the boy throws a ball vertically up with some velocity. The ball comes back and falls :

- (a) Into boy's hand
 (b) Behind the boy
 (c) In front of the boy
 (d) Behind or in front of the boy depending on the speed of the truck and ball



Ans. (a)

Sol. Ball will come back and falls into boys hand because horizontal speed of ball and boy is same throughout the motion.

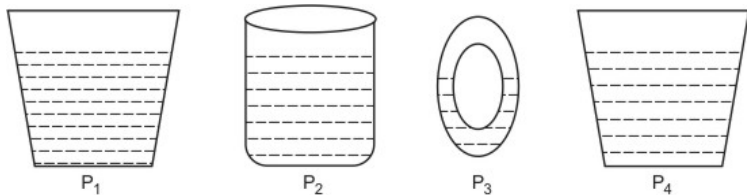
32. If $\sqrt[3]{75} = \sqrt[4]{45} = \sqrt[5]{15} = k$, then which of the statement is true :

- (a) $x + y = 2z$ (b) $x + y = 3z$ (c) $x - y = 2z$ (d) $x - y = 3z$

Ans. (b)

Sol. $\sqrt[3]{75} = \sqrt[4]{45} = \sqrt[5]{15} = k$
 so $75 = k^x$
 $45 = k^y$
 $15 = k^z$
 $75 \times 45 = 15^3$
 $k^x \times k^y = k^{3z}$
 $x + y = 3z$

33. The pressure at the bottom of the four vessels filled with water to the same level is p_1 , p_2 , p_3 and p_4 respectively. Then which of the following is correct



- (a) $P_1 > P_2 > P_3 > P_4$ (b) $P_1 < P_2 < P_3 < P_4$ (c) $P_1 = P_4 = P_2 > P_3$ (d) $P_1 = P_2 = P_3 = P_4$

Ans. (d)

Sol.

$$P = \rho gh$$

Pressure depends upon on density and height of fluid and it is independent of shape and size of the container.

34. $x + y + z = 1, x \neq y \neq z$; x, y, z are real numbers and $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = m$. How many of the following values of m are

always possible.

- (i) $m = 6$ (ii) $m = 8$ (iii) $m = 10$ and (iv) $m = 12$

- (a) 1 (b) 2 (c) 3 (d) all

Ans. (b)

Sol.

$$x + y + z = 1$$

$$\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = m$$

Applying A.M. and H.M.

$$\frac{x+y+z}{3} > \frac{3}{\frac{1}{x} + \frac{1}{y} + \frac{1}{z}}$$

$$\left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right)(x+y+z) > 9$$

$m > 9$ so, $m = 10$ and $m = 12$ are possible

35. Two litres of oxygen gas diffused through a membrane in 600 seconds. 0.6 litres of an unknown gas diffused through the same membrane in half the time required for oxygen to diffuse. the molecular weight of the unknown gas is

- (a) 16 (b) 44 (c) 89 (d) 64

Ans. (c)

Sol.

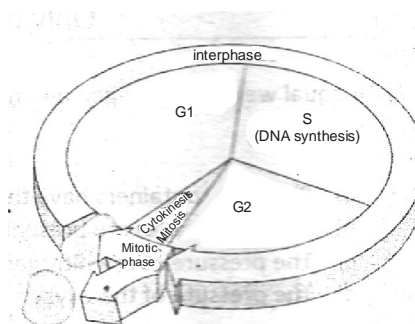
$$\frac{r_1}{r_2} = \frac{V_1/t_1}{V_2/t_2} = \sqrt{\frac{M_2}{M_1}}$$

$$\Rightarrow \frac{2/600}{0.6/300} = \sqrt{\frac{3M_2}{32}}$$

$$\Rightarrow \frac{M_2}{32} = \left(\frac{5}{3}\right)^2 \Rightarrow M_2 = \frac{25}{9} \times 32 = 89$$

Read the following carefully and answer the question from 36 to 39

A student treat some onion root tips with colchicine that is responsible for arresting cell division at the metaphase stage (by dissolving spindle fibres) and further prepared a slide of the root tip staining with acetoorcein (stain chromatin) and observed under high power of compound microscope. He is well aware of the cell cycle given alongside



36. Which of the following is not true about his observation

- (a) Most cells are in interphase
(b) Most cells are in the metaphase

- (c) No cells are in anaphase or telophase
 (d) Chromosome could be observed better than a slide prepared without colchicine treatment

Ans. (a)

Sol. As root cells were treated with colchicine that cease cell division in metaphase stage which is the most suitable stage for studying chromosomes.

37. Why did the student choose root tips of onion
 (a) Roots grow fast and considerable length of tips can be used
 (b) Root tips are easy to smear and stain
 (c) Root tips have meristematic tissue
 (d) Cell division occurs only at the root tips in plants

Ans. (c)

Sol. Root tips has actively dividing meristematic cells.

38. What might be the purpose of the student :
 (a) Observing chromosomes
 (b) Observing stages of cell division
 (c) Comparing number of cells in various stages of cell division
 (d) Preventing further growth of the root tips

Ans. (a)

Sol. Due to colchicine treatment cells are arrested in Metaphase state in which chromosomes are studied best.

39. Considering the action of colchicine, it may be considered the treatment of
 (a) Hairfall (b) Anemia (c) Cancer (d) Bacterial infection

Ans. (c)

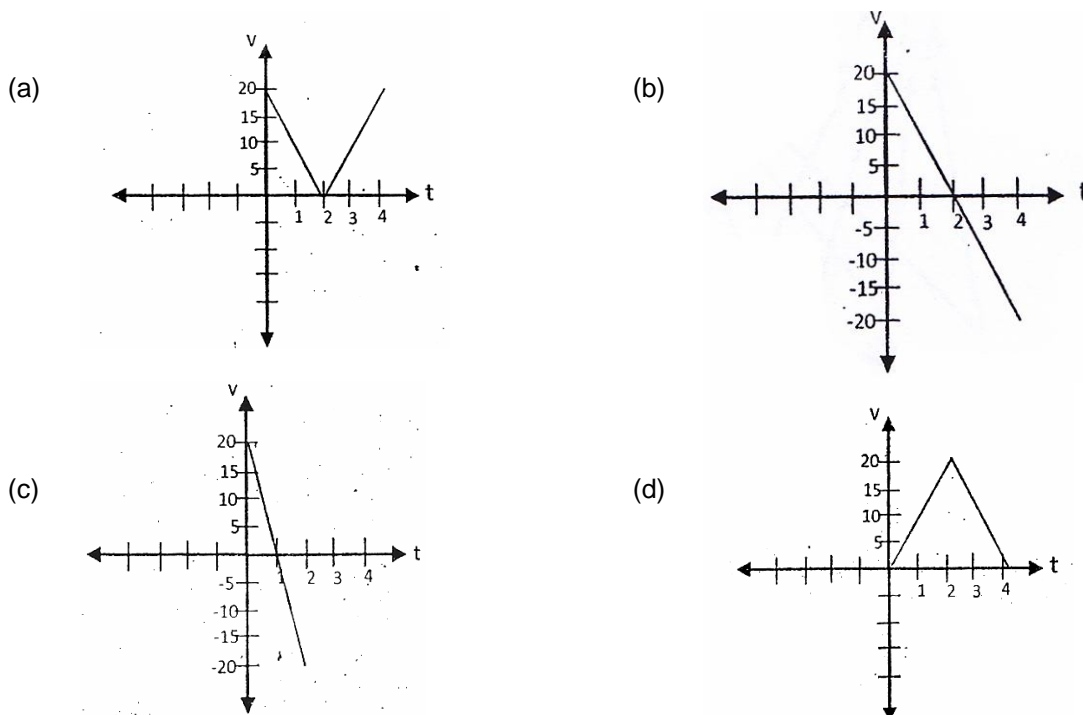
Sol. Colchicine cease cell in metaphase stage of cell cycle.

40. The element with electronic configuration $1s^2 2s^2 2p^6 3s^2$ is a/an
 (a) Metal (b) Non-metal (c) Metalloid (d) Inert gas

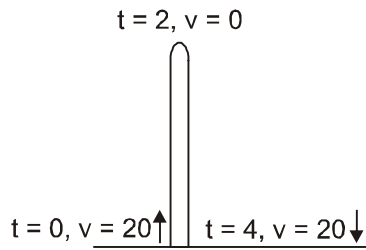
Ans. (a)

Sol. $1s^2 2s^2 2p^6 3s^2$ is the electronic configuration of Mg which is a metal.

41. A ball is thrown up vertically in still air with a velocity of 20ms^{-1} . It comes back to ground. The velocity-time graph is ($g = 10\text{ms}^{-2}$)



Ans. (b)
Sol.



Acceleration is constant throughout the motion so $v - t$ graph will be a straight line.

- 42.** The sixty sixth independence day was on Wednesday. After how many years the next independence Day will be on Wednesday
 (a) 6 years (b) 7 years
 (c) 11 years (d) 28 years

Ans. (a)

Sol. The sixty sixth Independence day was 15/8/2012 and was Wednesday. So the next Independence day having same day Wednesday is after 6 years.

- 43.** Sound waves travelling in air enters water at an angle i with the normal. It gets refracted at angle r with :
 (a) $i > r$ (b) $r > i$
 (c) $i = r$ (d) Sound waves do not refract

Ans. (b)

Sol. When sound waves moves from air to water angle of refraction is more than angle of incidence because speed of sound increases in water.

- 44.** What will be the remainder if the number 7^{2012} is divided by 25?
 (a) 24 (b) 18 (c) 7 (d) 1

Ans. (d)

Sol. $\frac{(7^2)^{1006}}{25}$
 $(-1)^{1006} \Rightarrow$ Remainder (1)

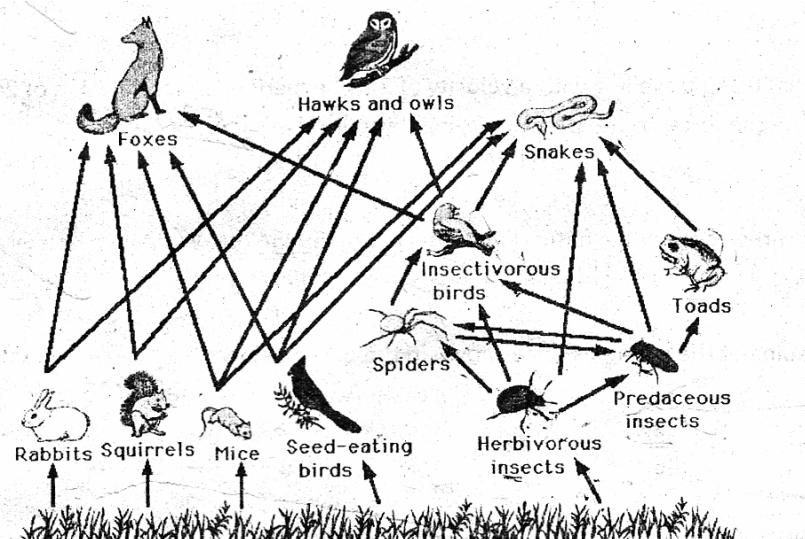
- 45.** The last electron of the element of atomic member 31 will have the following quantum numbers

	n	l	m	s
(a)	3	0	0	-1/2
(b)	3	1	1	+1/2
(c)	4	1	-1	-1/2
(d)	4	0	0	+1/2

Ans. (c)

Sol. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^1$
 So, $n = 4$
 $l = 1$
 $m = -1 / 0 / + 1$
 $s = \frac{+1}{2} / -\frac{1}{2}$

Study the following diagram and answer the questions 46 to 50



46. Which of the following are tertiary consumers
 (a) Snake, toads and spiders
 (b) Foxes, Hawks and Snakes
 (c) Rabbit, Squirrels and Mice
 (d) Spiders, Predacious insects and herbivorous insects

Ans. (a, b)

Sol. A and B both

47. The shortest and longest food chains have _____ and _____ numbers of organisms respectively
 (a) 2 and 6 (b) 2 and 5 (c) 3 and 5 (d) 3 and 6

Ans. (d)

Sol. In given diagram minimum and maximum number of organisms in food chain are 3 and 6 respectively.

48. An insecticide is sprayed to protect the plants. Which of the following statements is true ?
 (a) Toads and insectivorous birds will prosper as they will get ample supply of dead insects
 (b) Herbivores will be greatly affected, plants will be safe and carnivores will move to other areas and will not be affected greatly.
 (c) Some insects will die, some will become resistant and prolifer more and top carnivore will be affected most.
 (d) Some insects will die, but there will be no long term effects as the pesticides will get washed away.

Ans. (d)

Sol. Some insects will die, but there will be no long term effects as the pesticide will get washed away.

49. What should be the preferred food of snakes to ensure minimum loss of solar energy :
 (a) Mice (b) Toads (c) Insectivorous birds (d) Foxes

Ans. (a)

Sol. According to 10% law, if snake feeds on mice, he will get maximum energy and hence minimum loss of solar energy will take place.

50. Organisms having low chances of survival produce larger number of offsprings to ensure their survival. Which of the following can be a characteristic feature of such organisms:

- (a) Short lifecycle (b) Better defense strategies
 (c) Large body size (d) Good parental care

Ans. (a)

Sol. Since they have short life cycle, and low survival chances, they have to produce large number of individuals.

51. The compound which contains both ionic and covalent bonds is :
 (a) KCl (b) CS₂ (c) C₂H₆ (d) KCN

Ans. (d)

Sol. KCN contains both metals & non-metals so both ionic & covalent bonds are present.
 (K⁺)(C ≡ N⁻)

52. A particle of mass 0.5 kg traveling with a velocity of 2 ms^{-1} experiences acceleration of 2 ms^{-2} for 9s. The work done by the force on the particle during this period is :
 (a) 99 J (b) 101 J (c) 190 J (d) 396 J
- Ans. (a)**
Sol.
- $$F = ma$$
- $$= 0.5 \times 2$$
- $$= 1 \text{ newton}$$
- $$S = ut + \frac{1}{2}at^2$$
- $$= 2(9) + \frac{1}{2}(2)(9)^2$$
- $$= 99 \text{ m}$$
- $$W = FS$$
- $$= 99 \times 1$$
- $$= 99 \text{ J}$$
53. The product of three consecutive natural numbers is 124850054994. What is their average ?
 (a) 4993 (b) 4994 (c) 4997 (d) 4998
- Ans. (d)**
Sol. Let $(a - 1)$, a , $(a + 1)$ are in A.P
 $a \times (a - 1) \times (a + 1) = 124850054994$
 $a(a^2 - 1) = 124850054994$
 average = $[a + (a - 1) + (a + 1)] / 3$
 $= a$
 putting the value of a from the option (d) is correct answer.
54. What is the reading of the spring balance shown in the figure below ?
-
- (a) 0 (b) 2N (c) 4N (d) 6 N
- Ans. (b)**
Sol. Spring exerts equal and opposite force on its two ends, so reading of spring balance will be two newton.
55. If ABCD is a cyclic quadrilateral. $AB = 204$, $BC = 104$, $CD = 195$, $DA = 85$ and $BD = 221$. Then find AC :
 (a) 205 (b) 210 (c) 220 (d) 225
- Ans. (c)**
Sol. By Ptolemy theorem
 side AC = $\frac{204 \times 195 + 104 \times 85}{221} = 220$
56. Molality of a solution is the number of :
 (a) moles of the solute per 1000 mL of the solution
 (b) moles of the solute per 1000 mL of the solvent
 (c) moles of the solute per 1000 g of the solvent
 (d) moles of the solute per 100 g of the solvent
- Ans. (c)**
Sol. Molality is moles of solute present in 1 kg (1000 g) of the solvent.
57. A scientist wanted to check the effect of a certain hair straightening procedure on the tensile strength of hair. The scientist could take only 20 samples. Which of the following sampling pattern should she use to ensure that maximum parameters are controlled and the results reflect the effect of the straightening process alone.
 (a) 10 girls and 10 boys of age 18 before and after the straightening procedure
 (b) 10 girls and 10 boys one each of age 15, 16, 17, and so on upto 25 before and after the procedure.
 (c) 10 girls and 10 boys of age 18 after the straightening procedure and another similar set of sample group who did not undergo the procedure.
 (d) 10 girls and 10 boys one each of age 15, 16, 17, and so on upto 25 after the procedure and another similar set of sample group who did not undergo the procedure.
- Ans. (b)**
Sol. 10 girls and 10 boys one each of age 15, 16, 17, and so on upto 25 before and after the procedure.

58. A lady has 4 kids with blood group AB and 1 kid with blood group O. If the father of these kids have blood group B, what is the possible genotype of the lady ?

- (a) $I^A I^B$ (b) $I^A I^O$ (c) $I^A I^A$ (d) $I^B I^B$

Ans. (b)

Sol. The given genotypes of kids is possible only when genotype of the mother is $I^A I^O$.

59. The pH of blood is maintained within the range 7.36 – 7.42 by :

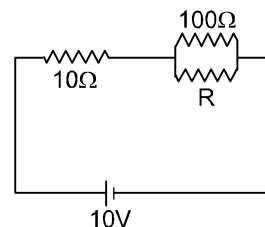
- (a) $\text{CH}_3\text{COONH}_4$ (b) $\text{CH}_3\text{COONa} / \text{CH}_3\text{COOH}$
 (c) $\text{HCO}_3^- / \text{CO}_3^{2-}$ (d) CH_3COOH

Ans. (c)

Sol. In presence of carbonate or bi carbonate ion, pH of blood will be maintained in the 7.36 – 7.42 range.

60. An ideal cell of emf 10 V is connected across the network of resistors as shown in the figure. The value of the resistance R for

- (a) 20Ω (b) 30Ω
 (c) 22.22Ω (d) 11.11Ω



Ans. (d)

Sol. Let power dissipated in 10Ω is P_1 and power dissipated in parallel combination is P_2 then,

$$P_1 = P_2$$

$$\Rightarrow I^2(10) = I^2 \left(\frac{100R}{100+R} \right)$$

$$\Rightarrow R = \frac{100}{9} = 11.11\Omega$$

61. If one of the roots of the equation $x^2 - px + q = 0$ is m times the other root then $m/(1 + m^2)$ is equal to :

- (a) $\frac{q}{p^2 - 2q}$ (b) $\frac{p}{q^2 - 2p}$ (c) $\frac{q}{q^2 - 2p}$ (d) $\frac{p}{p^2 - 2p}$

Ans. (a)

Sol. Let one root is α , other is $m\alpha$

$$\Rightarrow m\alpha + \alpha = p \text{ \& } m\alpha^2 = q$$

$$\alpha = \frac{p}{m+1} \text{ \& } m\alpha^2 = q$$

$$\Rightarrow m \cdot \frac{p^2}{(m+1)^2} = q \Rightarrow \frac{m}{(m+1)^2} = \frac{q}{p^2}$$

$$\Rightarrow \frac{m^2 + 2m + 1}{m} = \frac{p^2}{q}$$

$$\Rightarrow m + \frac{1}{m} = \frac{p^2}{q} - 2$$

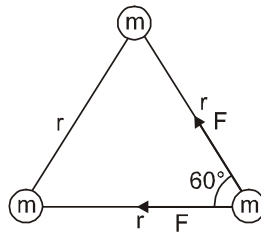
$$\Rightarrow \frac{m^2 + 1}{m} = \frac{p^2 - 2q}{q}$$

$$\Rightarrow \frac{m}{m^2 + 1} = \frac{q}{p^2 - 2q}$$

62. Three particles each of mass m are placed at the vertices of a triangle of sides r. The force experienced by each mass is :

- (a) $\sqrt{3} \left(\frac{Gm^2}{r^2} \right)$ (b) $\sqrt{2} \left(\frac{Gm^2}{r^2} \right)$ (c) $\frac{Gm^2}{r^2}$ (d) $2 \frac{Gm^2}{r^2}$

Ans. (a)
Sol.



$$F_{\text{net}} = \sqrt{F^2 + F^2 + 2F \cdot F \cos 60^\circ}$$

$$= \sqrt{3}F$$

$$= \sqrt{3} \frac{Gm^2}{r^2}$$

63. If $a + b + c = 1$, $a^2 + b^2 + c^2 = 12$ and $abc = 8$ then find the value of $(1 - a)(1 - b)(1 - c)$:
(a) -10 (b) -18 (c) -24 (d) -30

Ans. (No option is correct)

Sol. $(1-a)(1-b)(1-c) = 1 - (a+b+c) + (ab+bc+ca) - abc$
 $= 1 - 1 + (-11/2) - 8 = -27/2$

64. An alkaline solution of K_2HgI_4 is called :
(a) Fehling's reagent (b) Benedict's reagent (c) Nessler's reagent (d) Tollen's reagent

Ans. (c)

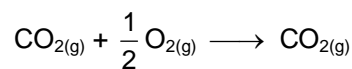
Sol. K_2HgI_4 = Nessler's is reagent

65. A film of oil on every water surface arrests the growth in mosquito population since :
(a) it blocks sunlight and mosquito larvae cannot get food
(b) mosquito larvae suffocate
(c) mosquito eggs cannot float on oil
(d) mosquitoes fail to mate if water surface is not available

Ans. (b)

Sol. due to layer of oil on water surface, larva are unable to get O_2 and suffocates.

66. At constant temperature and pressure which of the following statements is true for the reaction :



- (a) $\Delta E = \Delta H$ (b) $\Delta E > \Delta H$
(c) $\Delta E < \Delta H$ (d) ΔH and ΔE are independent of each other

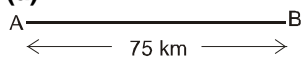
Ans. (b)

Sol. $CO_{2(a)} + \frac{1}{2} O_{2(a)} \longrightarrow CO_{2(a)}$
 $\Delta H = \Delta E + \Delta nRT$
 $\Delta n = 1 - 3/2 = -1/2$
 So, $\Delta H = \Delta E - \frac{1}{2}RT$
 $\Delta E > \Delta H$

67. When a car turns on a curved road, you are pushed against one of the doors of the car because of :
(a) inertia (b) the centripetal force (c) the centrifugal force (d) the frictional force

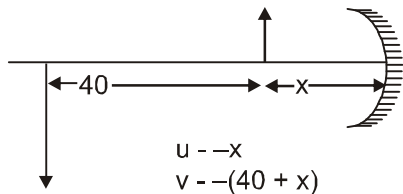
Ans. (a)

Sol. When a car turns on a curved road, you are pushed against one of the doors of the car because of inertia of direction.

68. The distance between two spots A & B on the same bank of the river 75 km. Speed of the boat in still water is twice as much as that of the speed of the water current of the river. The boat travels in the river from A to B and returns back to the spot in 16 hour. What is the speed of the boat in still water ?
 (a) 12.5 kmph (b) 15 kmph (c) 16 kmph (d) 18 kmph
- Ans. (a)**
- Sol.** 
 speed of boat in still water = x km/hr.
 speed of river = y km/hr
 Given $X = 2y$
 $\Rightarrow t = \frac{D}{S} \Rightarrow 16 = \frac{75}{x+y} + \frac{75}{x-y}$
 $x = 12.5 \text{ km/hr.}$
69. Michael Faraday a book binder got an opportunity to work with a scientist and later succeeded him. Name of the scientist is :
 (a) Hans Christian Oersted (b) Humphrey Davy
 (c) Heinrich Lenz (d) James Clerk Maxwell
- Ans. (d)**
- Sol.** Davy hired Faraday to cover for the assistant in his institution after an accident which made Davy temporarily blind.
70. Find the equation of the line parallel to $4x + 3y = 5$ and having x-intercept (-3) :
 (a) $3x + 4y + 12 = 0$ (b) $3x + 4y = 12$ (c) $4x + 3y - 12 = 0$ (d) $4x + 3y + 12 = 0$
- Ans. (d)**
- Sol.** A line parallel to the line $4x + 3y - 5 = 0$ is
 $4x + 3y + k = 0$
 $\Rightarrow \frac{x}{-k/4} + \frac{y}{-k/3} = 1$
 $\Rightarrow -k/4 = -3$
 $\Rightarrow k = 12$
 so line is $4x + 3y + 12 = 0$
71. The green coloured substance produced during the burning of ammonium dichromate in fireworks is :
 (a) CrO_3 (b) Cr_2O_3 (c) $\text{CrO}(\text{O}_2)_2$ (d) $\text{Cr}(\text{OH})_3$
- Ans. (b)**
- Sol.** $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \xrightarrow{\Delta} \underset{\text{(green)}}{\text{Cr}_2\text{O}_3} + \text{N}_2 + 4\text{H}_2\text{O}$
72. Mud flats with mangrove plants export a lot of organic matter to waters in contact. This is primarily because :
 (a) there are fewer consumers in mangrove community
 (b) excreta of animals in mangrove community is richer in fibers
 (c) detritivores are lacking in mangrove community
 (d) aerobic decomposers cannot survive in waterlogged mud
- Ans. (d)**
- Sol.** As aerobic decomposers can not survive in water logged mud, decomposition rate will be low and hence a lot of organic matter will be exported in water.
73. The oxidation number of chlorine in CaOCl_2 is :
 (a) 0 (b) -1 (c) +1 (d) +3
- Ans. (A)**
- Sol.** CaOCl_2
 $(\text{Ca}^{+2})(\text{OCl}^-)(\text{Cl}^-)$
 $\downarrow \quad \downarrow$
 $+1 \quad -1$
 So average oxidation no, = 0

74. The real image of an extended object placed in front of a concave mirror is formed at a distance of 40 cm from the object. If the image is 3 times bigger than the object, the magnitude of focal length of the mirror is :
 (a) 15 cm (b) 10 cm (c) 20 cm (d) 5 cm

Ans. (a)
 Sol.



$$\begin{aligned}
 u &= -x \\
 v &= -(40 + x) \\
 m &= -3 \\
 \left[\frac{-(40 + x)}{-x} \right] &= -3 \\
 \Rightarrow x &= 20 \text{ cm} \\
 \frac{1}{u} + \frac{1}{v} &= \frac{1}{f} \\
 \frac{1}{-20} - \frac{1}{60} &= \frac{1}{f} \\
 f &= -15 \text{ cm}
 \end{aligned}$$

75. If $\cot^2 \theta (1 - 3 \sec \theta + 2 \sec^2 \theta) = 1$ and $\theta > 90^\circ$, then θ is equal to :
 (a) 120° (b) 210° (c) 300° (d) 330°

Ans. (c)

Sol. $1 - 3 \sec \theta + 2 \sec^2 \theta = \frac{1}{\cot^2 \theta}$
 $\Rightarrow 1 - 3 \sec \theta + 2 \sec^2 \theta = \tan^2 \theta$
 $\Rightarrow 1 - 3 \sec \theta + 2 \sec^2 \theta = \sec^2 \theta - 1$
 $\Rightarrow \sec^2 \theta - 3 \sec \theta + 2 = 0$
 $\sec \theta = 2 \Rightarrow \theta = 300^\circ$

76. A person suffering from short sight is advised to wear spectacles having concave lens of power 1.25 D. What is the farthest distance he can see clearly without spectacles ?

(a) 60 cm (b) 100 cm (c) 120 cm (d) 80 cm

Sol.

$$\begin{aligned}
 P &= -1.25 \text{ D} \\
 \therefore f &= \frac{1}{P} = -80 \text{ cm} \\
 \text{In concave lens} \\
 \frac{1}{f} &= \frac{1}{v} - \frac{1}{u} \\
 \text{here } f &= -80 \text{ cm, } u = -\infty \\
 \therefore -\frac{1}{80} &= \frac{1}{V} + 0 \\
 v &= -80 \text{ cm}
 \end{aligned}$$

77. Consider triangles having integer sides such that no side is greater than 4 units. How many such triangles are possible :

(a) 13 (b) 17 (c) 24 (d) 64

Ans. (a)

Sol. Total number of triangles possible are 13.

78. Green house effect is related to :

(a) Ozone layer depletion (b) Carbon dioxide emission and absorption
 (c) Nitrogen radiation (d) Oxygen radiation

Ans. (b)

Sol. CO_2 emission and absorption.

- 79.** What is the major difference between Bacteria and Virus :
- (a) Viruses are precursors to bacteria
 - (b) Viruses lack proteins that are present in viruses
 - (c) Viruses use host machinery to reproduce unlike bacteria
 - (d) Viruses have proteins, whereas bacteria do not.

Ans. (c)

Sol. Viruses use host machinery to reproduce unlike bacteria.

- 80.** Of the following the combination of processes related to sexual reproduction are :
- (i) Conjugation (ii) Fragmentation (iii) Gamete formation (iv) Zygote
 - (a) i, iii and iv
 - (b) i, ii and iv
 - (c) ii, iii and iv
 - (d) only iii and iv

Ans. (a)

Sol. Conjugation, gamete formation and zygote formation are part of sexual reproduction whereas fragmentation is a mode of asexual reproduction.
