PHYSICS

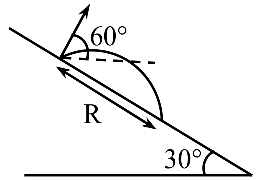
1. If the velocity V, acceleration A and force F are taken as fundamental quantities instead of mass M, length L and time T, the dimensions of Young's modulus Y would be :

(A) FA^2V^{-4} (B) FA^2V^{-5} (C) FA^2V^{-3} (D) FA^2V^{-2}

2. A body moving with uniform acceleration, after successive intervals of time, is at A, B, C, D, which are collinear and at distances a, b, c, d from some arbitrary point in the same straight line. Then, (d–a) is equal to

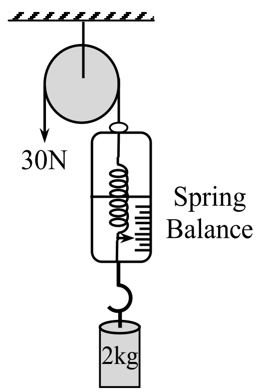
(A) (c – b) (B) 2 (c – d) (C) 3(c – b) (D) 4(c – b)

3. A projectile is launched with a speed of 10 m/s at an angle 60° with the horizontal from a sloping surface of inclination 30°. The range R is (Take $g = 10\ m/s^2$)



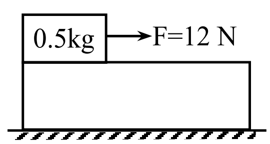
(A) 4.9 m (B) 13.3 m (C) 9.1 m (D) 12.6 m

4. In the adjacent figure, the spring balance and string are massless and the pulley is ideal. The reading of spring balance will be



(A) 2 kg (B) 3 kg (C) 2.5 kg (D) zero

5. A block of mass 0.5 kg is pulled by 12 N force on a fixed block. Speed of block is constant. Find total contact force applied by lower block on upper block.



(A) 12 N (B) 5 N (C) 13 M (D) 17 N

6. A machine delivers constant power to a body which is proportional to velocity of the body. If the body starts with a velocity which is almost negligible, then distance covered by the body is proportional to

(A) $\sqrt{v}$ (B) $\left(\frac{v}{2}\right)^{3/2}$ (C) $v^{3/5}$ (D) v^2

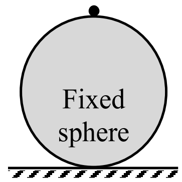
7. The potential energy of a 4 kg particle free to move along the x-axis is given by

$$U(x) = \frac{x^3}{3} - \frac{5x^2}{2} + 6x + 3$$

Total mechanical energy of the particle is 17 J. Then the maximum kinetic energy is

(A) 10 J (B) 2 J (C) 9.5 J (D) 0.5 J

8. A particle of mass m begins to slide down a fixed smooth sphere from the top as shown. What is its acceleration when it breaks off the sphere?



(A) $\frac{2g}{3}$ (B) $\sqrt{5}\frac{g}{3}$ (C) g (D) $\frac{g}{3}$

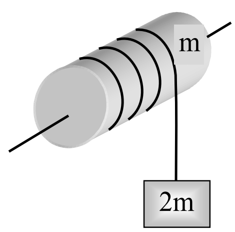
9. A man of mass M stands at one end of a plank of length L which lies at rest on a frictional surface. The man walks to the other end of the plank. If the mass of plank is $\frac{M}{3}$, the distance that the man moves relative to the ground is

(A) $\frac{3L}{4}$ (B) $\frac{L}{4}$ (C) $\frac{4L}{5}$ (D) $\frac{L}{3}$

10. A block of mass 2.0 kg moving at 2.0 m/s collides head on with another block of equal mass kept at rest. If the actual loss in kinetic energy is half of the maximum loss in kinetic energy, find the coefficient of restitution.

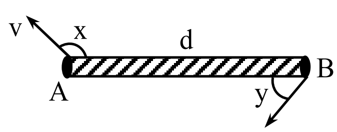
(A) 2 (B) $\frac{1}{2}$ (C) $\sqrt{2}$ (D) $\frac{1}{\sqrt{2}}$

11. A horizontal solid cylinder (of mass m) is pivoted about its longitudinal axis. To the end of a thread wrapped on the cylinder a block (of mass 2m) is attached, as shown. If the system is left free, acceleration of the block is (string is massless and there is no slipping anywhere)



(A) g (B) $\frac{g}{5}$ (C) $\frac{2g}{5}$ (D) $\frac{4g}{5}$

12. Velocities of ends A and B of a rod of length d are as shown. Angular speed of the rod is (Note that for end B only the direction of velocity is indicated in diagram)



(A) $\frac{v}{d}\frac{\cos(x-y)}{\cos y}$ (B) $\frac{v.\sin(x-y)}{d\cos y}$ (C) $\frac{v.\sin(x-y)}{d\sin y}$ (D) $\frac{v.\cos(x-y)}{d\sin y}$

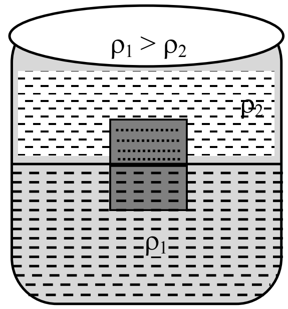
13. A wheel starts from rest on the application of a torque which gives it an angular acceleration $\alpha = 2t - t^2$ for first two seconds after which $\alpha = 0$. Then the angular velocity of the wheel after 4 seconds is

(A) $\frac{1}{3}$ rad / sec (B) $\frac{2}{3}$ rad / sec (C) $\frac{4}{3}$ rad / sec (D) 2rad / sec

14. Two soap bubbles of radii R and r come in contact. R is greater than r. Radius of curvature of common surface is :

(A) $\frac{Rr}{R-r}$ (B) $\frac{Rr}{R+r}$ (C) $\frac{(R+r)R}{r}$ (D) $\frac{(R-r)R}{r}$

15. A homogeneous solid cube of side length L is immersed such that it floats at the liquid-liquid interface with length L/4 in the denser liquid as shown in figure. The density of the solid is given by



(A) $\frac{\rho_1+3\rho_2}{4}$ (B) $\frac{\rho_1+\rho_2}{4}$ (C) $\rho_1+4\rho_2$ (D) $\frac{\rho_1+2\rho_2}{2}$

16. A large number of droplets, each of radius a, coalesce to form a big drop of radius b. Assume that the energy released in the process is converted into kinetic energy of the drop. The velocity of the drop is (σ = surface tension, ρ = density of droplet)

(A) $\left[\frac{\sigma}{\rho}\left(\frac{1}{a}-\frac{1}{b}\right)\right]^{1/2}$ (B) $\left[\frac{2\sigma}{\rho}\left(\frac{1}{a}-\frac{1}{b}\right)\right]^{1/2}$ (C) $\left[\frac{3\sigma}{\rho}\left(\frac{1}{a}-\frac{1}{b}\right)\right]^{1/2}$ (D) $\left[\frac{6\sigma}{\rho}\left(\frac{1}{a}-\frac{1}{b}\right)\right]^{1/2}$

17. A uniform rod of length L has a mass per unit length λ and area of cross-section A. If the young's modulus of the rod is Y, then the elongation in the rod due to its own weight is

(A) $\frac{2\lambda gL^2}{AY}$ (B) $\frac{\lambda gL^2}{AY}$ (C) $\frac{\lambda gL^2}{4AY}$ (D) $\frac{\lambda gL^2}{2AY}$

CHEMISTRY

Note: Atomic mass: N = 14, O=16, S = 32,

18. Consider the following statements

1. If all the reactants in a chemical reaction are not taken in their stoichiometric ratio, then at least one reactant will be left behind.
2. 2 moles of $H_2(g)$ and 3 moles of $O_2(g)$ can produce a maximum of 2 moles of water
3. Equal weight of carbon and oxygen are taken to produce CO_2 then O_2 is limiting reagent.

The above statements 1, 2, 3 respectively are (T= true, F=False)

(A) TTT (B) FTF (C) FFF (D) TFT

19. Suppose you want an acidic solution to carry out a chemical reaction to completely react with 2 moles of NaOH. Which sample of acid is the best choice for you.

(A) 1 M H_2SO_4 (50 Rs per L) (B) 1 M H_3PO_3 (56 Rs per L)

(C) 1 M HCl (30 Rs per L) (D) 1 M HCl (27 Rs. Per L)

20. The difference in angular momentum associated with the electron in two successive orbits of hydrogen atom is (h = Planck's constant)

(A) $\frac{h}{\pi}$ (B) $\frac{h}{2\pi}$ (C) $\frac{h}{2}$ (D) $\frac{(n-1)h}{2\pi}$

21. The radial wave equation for hydrogen atom is :

$$\Psi = \frac{1}{16\sqrt{4}}\left(\frac{1}{a_0}\right)^{3/2}[(x-1)(x^2-8x+12)]e^{-x/2}$$

where, $x = 2r/a_o$; a_o = radius of first Bohr orbit.

The minimum and maximum distance of radial nodes from nucleus are :

(A) a_o, $3a_o$ (B) $\frac{a_0}{2}, 3a_0$ (C) $\frac{a_0}{2}, a_0$ (D) $\frac{a_0}{2}, 4a_0$

22. Hydrogen behaves as an oxidising agent in its reaction with

(A) Chlorine (B) Nitrogen (C) Sodium (D) Sulphur

23. Which compound has tetrahedral geometry?

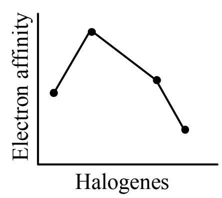
(A) XeF_4 (B) $XeOF_2$ (C) XeO_2F_2 (D) XeO_4

24. Arrange the following species in increasing order of bond angle NF_3, NCl_3, NBr_3, NI_3

(A) $NF_3 < NCl_3 < NBr_3 < NI_3$ (B) $NF_3 < NBr_3 < NI_3 < NCl_3$

(C) $NI_3 < NBr_3 < NCl_3 < NF_3$ (D) $NBr_3 < NI_3 < NF_3 < NCl_3$

25. Following graph shows the variation of electron affinity in group 17 of periodic table.



The element present at the peak of the curve is

(A) F (B) Cl (C) Br (D) I

26. Which of the following doesn't contain bond between identical atoms?

(A) $H_2S_2O_8$ (B) H_2SO_5 (C) $HClO_4$ (D) N_2O_4

27. There are 201 equidistant rows of spectators (audience) sitting in a hall. A magician releases laughing gas N_2O from the front and at the same time, tear gas (Mol Wt = 176) is released from the rear of the hall. The distance of magician from front row is equal to distance between rows. Which row spectators will have a tendency to smile and weep simultaneously? (Assume the last row is touching the wall).

(A) 130 (B) 120 (C) 160 (D) 134

28. Gases possess characteristic critical temperature which depends upon the magnitude of intermolecular forces between the particles. Following are the critical temperatures of some gases.

Gases	H_2	He	O_2	N_2
Critical temperature (K)	33.2	5.3	154.3	126

From the above data what would be the order of liquefaction of these gases? Start writing the order from the gas liquefying first.

(A) H_2, He, O_2, N_2 (B) He, O_2, H_2, N_2 (C) N_2, O_2, He, H_2 (D) O_2, N_2, H_2, He

29. Consider a collision between an oxygen molecule and a hydrogen molecule (assume ideal behaviour) in a mixture of oxygen and hydrogen kept at room temperature. Which of the following is/are possible?

(A) The kinetic energies of both the molecules increase.

(B) The kinetic energies of both the molecules decrease.

(C) kinetic energy of the oxygen molecule increases and that of the hydrogen molecule decreases.

(D) Both (A) and (B)

30. Na_2CO_3 can be manufactured by Solvay's process but K_2CO_3 cannot be prepared because

(A) K_2CO_3 is more soluble
(B) K_2CO_3 is less soluble
(C) $KHCO_3$ is more soluble than $NaHCO_3$
(D) $KHCO_3$ is less soluble than $NaHCO_3$

31. Stability of which of the following compounds of alkali metals decreases down the group?

(A) Fluoride
(B) Superoxides
(C) Carbonate
(D) Hydrogen carbonates

32. Which of the following is correct?

(A) BF_3 is much weaker Lewis acid than BBr_3

(B) H_3BO_3 behaves as a acid with basicity equal to 3.

(C) $H_2BO_3^-$ is a conjugate base produced when H_3BO_3 is present in aqueous solution

(D) BF_3 does not react with NH_3

33. Given below are a set of resonating structures and their stability order is provided in bracket. Select which one of the following is incorrectly matched.

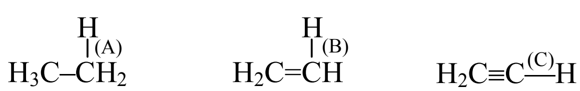
(A) $\underset{\text{(I)}}{CH_2 = CH - CH = CH_2} \longleftrightarrow \underset{\text{(II)}}{\bar{C}H_2 - CH = CH - \overset{+}{C}H_2}$ (I > II)

(B) $\underset{\text{(I)}}{\overset{+}{C}H_2 - O - CH_3} \longleftrightarrow \underset{\text{(II)}}{CH_2 = \overset{+}{O} - CH_3}$ (II > I)

(C) $\underset{\text{(I)}}{CH_2 = CH - Cl:} \longleftrightarrow \underset{\text{(II)}}{\bar{C}H_2 - CH = Cl^+}$ (II > I)

(D) Both (B) and (C)

34. In the given following structure,



(I) (II) (III)

If (A), (B) & (C) are the magnitude of bond energies of the C–H homolytic bond cleavage in the three structures (I), (II) and (III) respectively then which one of the following order is correct?

(A) (A) < (B) < (C)
(B) (B) < (A) < (C)
(C) (C) < (B) < (A)
(D) (C) < (A) < (B)

MATHEMATICS

35. If x is a real number such that $x\left(x^2+1\right), (-1/2)x^2, 6$ are three consecutive terms of an AP then the next two consecutive term of the AP are

(A) 14, 6 (B) $-2, -10$ (C) 14, 22 (D) None of these

36. If $a_1, a_2, a_3, \ldots.$ are in AP then a_p, a_q, a_r are in AP if p, q, r are in

(A) AP (B) GP (C) HP (D) None of these

37. Let $P=(1, 1)$ and $Q=(3, 2)$. The point R on the x-axis such that $PR+RQ$ is the minimum is

(A) $\left(\frac{5}{3}, 0\right)$ (B) $\left(\frac{1}{3}, 0\right)$ (C) $(3, 0)$ (D) None of these

38. The number of 6-digit numbers that can be made with the digits 0, 1, 2, 3, 4 and 5 so that even digits occupy odd places, is

(A) 24 (B) 36 (C) 48 (D) None of these

39. If $(a+ib)^5=\alpha+i\beta$ then $(b+ia)^5$ is equal to

(A) $\beta+i\alpha$ (B) $\alpha-i\beta$ (C) $\beta-i\alpha$ (D) $-\alpha-i\beta$

40. A horse is tied to a post by a rope. If the horse moves along a circular path always keeping the rope tight and describes 88 metres when it has traced out 72° at the centre, find the length of the rope.

(A) 70 m (B) 72 m (C) 75 m (D) 80 m

41. The number of ways to fill each of the four cells of the table with a distinct natural number such that the sum of the numbers is 10 and the sums of the numbers placed diagonally are equal, is

(A) $2!\times 2!$ (B) $4!$ (C) $2(4!)$ (D) None of these

42. If $\frac{3\pi}{4}<\alpha<\pi$, then $\sqrt{2\cot\alpha+\frac{1}{\sin^2\alpha}}$ is equal to

(A) $1-\cot\alpha$ (B) $1+\cot\alpha$ (C) $-1+\cot\alpha$ (D) $-1-\cot\alpha$

43. $\lim\limits_{h\to 0}\left\{\frac{1}{h\cdot\sqrt[3]{8+h}}-\frac{1}{2h}\right\}$ is equal to

(A) $\frac{1}{12}$ (B) $-\frac{4}{3}$ (C) $-\frac{16}{3}$ (D) $-\frac{1}{48}$

44. Let $n(A)=m$, and $n(B)=n$. Then the total number of non-empty relations that can be defined from A to B is

(A) m^n (B) n^m-1 (C) $mn-1$ (D) $2^{mn}-1$

45. The domain and range of the real function f defined by $f(x)=\frac{4-x}{x-4}$ is

(A) Domain = R, Range = $\{-1, 1\}$ (B) Domain = R − $\{1\}$, Range = R

(C) Domain = R − $\{4\}$, Range = R − $\{-1\}$ (D) Domain = R − $\{-4\}$, Range = $\{-1, 1\}$

46. If $\left(\frac{1+i}{1-i}\right)^x=1$, then

(A) $x=2n+1$ (B) $x=4n$ (C) $x=2n$ (D) $x=4n+1$

where, $n \in N$

47. If $|x-1|>5$, then

(A) $x\in(-4, 6)$ (B) $x\in[-4, 6]$

(C) $x\in(-\infty, -4)\cup(6, \infty)$ (D) $x\in(-\infty, -4)\cup[6, \infty)$

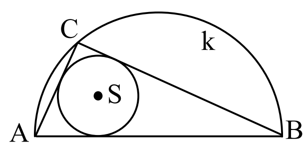
48. If $f(x)=1-x+x^2+x^3+...-x^{99}+x^{100}$, then $f'(1)$ is equal to

(A) 150 (B) −50 (C) −150 (D) 50

49. Three numbers are chosen from 1 to 20. Find the probability that they are not consecutive

(A) $\frac{186}{190}$ (B) $\frac{187}{190}$ (C) $\frac{188}{190}$ (D) $\frac{18}{^{20}C_3}$

50. AB is the diameter of a semicircle k, C is an arbitrary point on the semicircle (other than A or B) and S is the centre of the circle inscribed into triangle ABC, then measure of



(A) angle ASB changes as C moves on k.

(B) angle ASB is the same for all positions of C but it cannot be determined without knowing the radius.

(C) angle $ASB=135°$ for all C.

(D) angle $ASB=150°$ for all C.

* * * * *

CLASS 11th MATH MOVING TO CLASS 12th MATH

ANSWER KEY

SET A

PHYSICS

1. (A)
2. (C)
3. (B)
4. (B)
5. (C)
6. (D)
7. (C)
8. (C)
9. (B)
10. (D)
11. (D)
12. (B)
13. (C)
14. (A)
15. (A)
16. (D)
17. (D)

CHEMISTRY

18. (A)
19. (A)
20. (B)
21. (B)
22. (C)
23. (D)
24. (A)
25. (B)
26. (C)
27. (D)
28. (D)
29. (C)
30. (C)
31. (A)
32. (A)
33. (C)
34. (A)

MATHEMATICS

35. (C)
36. (A)
37. (A)
38. (A)
39. (A)
40. (A)
41. (D)
42. (D)
43. (D)
44. (D)
45. (C)
46. (B)
47. (C)
48. (D)
49. (B)
50. (C)

SOLUTION

PHYSICS

1. **(A)**

$[Y] = [V^a A^b F^c]$

$[ML^{-1}T^{-2}] = (LT^{-1})^a (LT^{-2})^b (MLT^{-2})^c$

$1 = c$

$-1 = a + b + c \Rightarrow a + b = -2$

$-2 = -a - 2b - 2C \Rightarrow -a - 2b = 0$

$-b = -2$

$b = 2$

$a = -4$

$[Y] = [V^{-4} A^2 F^1]$

2. **(C)**

$d = u(4t) + \frac{1}{2}a(4t)^2 = 4ut + 8a + t^2$

$c = u(3t) + \frac{1}{2}a(3t)^2 = 3ut + \frac{9}{2}at^2$

$b = u2t + \frac{1}{2}a(2t)^2 = 2ut + 2at^2$

$a = ut + \frac{1}{2}at^2 = ut + \frac{1}{2}at^2$

$d - a = 3ut + \frac{15}{2}at^2$

$= 3(ut + \frac{5}{2}at^2) = 3(c - b)$

3. **(B)**

$\left(\frac{2u\sin 90°}{g\cos 30°}\right)^2 \times \frac{1}{2} \times (g\sin 30°)$

$\Rightarrow \frac{1}{2} \times 5 \times \left(\frac{2 \times 10}{10\frac{\sqrt{3}}{2}}\right)^2$

$= \frac{5}{2} \times \frac{16}{3}$

$\Rightarrow \frac{80}{6} = \frac{40}{3}$

4. **(B)**

$30N \Rightarrow 3kg$

5. **(C)**

$\sqrt{12^2 + 5^2} = 13N$

6. (D)

$P = kv$

$\frac{d}{dt}\frac{1}{2}mv^2 = kv$

$\frac{1}{2}m\frac{dv^2}{dt} = kv$

$2v\frac{dv}{dt} = \frac{2kv}{m}$

$\Rightarrow \frac{dv}{dt} = \frac{k}{m}$

$\Rightarrow \frac{dv}{ds} \times \frac{ds}{dt} = \frac{k}{m}$

$vdv = \frac{k}{m}ds$

$\Rightarrow \frac{v^2}{2} = \frac{k}{m}s$

$s \propto v^2$

7. (C)

$U_{min} \Rightarrow \frac{dU}{dx} = 0$

$\Rightarrow x^2 - 5x + 6 = 0$

$\Rightarrow (x-3)(x-2) = 0$

$x = 3$ or $x = 2$

$\frac{d^2U}{dx^2} = (2x-5)$

at $x = 3 \Rightarrow \frac{d^2U}{dx^2} = 1 = +ve$.

$\Rightarrow x = 3$ min

$U_{min} = \frac{3^3}{3} - 5 \times \frac{3^2}{2} + 6 \times 3 + 3$

$= 9 - \frac{45}{2} + 18 + 3$

$= \frac{15}{2}J.$

$U_{min} + K_{max} = 17J$

$K_{max} = 17J - \frac{15}{2}J = \frac{19}{2}J$

$= 9.5J.$

8. (C)

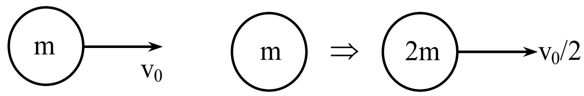
When breaks-off then only force is mg

$\therefore$ acceleration is g.

9. (B)

$$= \frac{\frac{M}{3}L}{M + \frac{M}{3}} = \frac{\frac{M}{3}L}{\frac{4M}{3}} = \frac{L}{4}$$

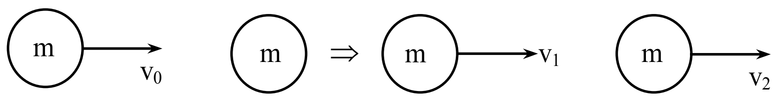
10. (D)



Maximum loss in kinetic energy

$$K_{max} = \frac{1}{2}mv_0^2 - \frac{1}{2}2m\frac{v_0^2}{4} = \frac{mv_0^2}{4}$$

For the given situation



$$mv_0 = mv_1 + mv_2$$

$$v_1 + v_2 = v_0 \quad ....(1)$$

$$e = \frac{v_2 - v_1}{v_0 - 0}$$

$$\Rightarrow -v_1 + v_2 = ev_0 \quad ....(2)$$

$$v_1 = \frac{v_0}{2}(1-e).$$

$$v_2 = \frac{v_0}{2}(1+e).$$

So considering the loss $\frac{1}{2}m\frac{v_0^2}{4}\left[(1-e)^2 + (1+e)^2\right] + \frac{mv_0^2}{8} = \frac{1}{2}mv_0^2$

$$2(1+e^2) = 3$$

$$e = \frac{1}{\sqrt{2}}.$$

11. (D)

$$2mg - T = 2ma$$

$$TR = \frac{mR^2}{2}\frac{a}{R}$$

$$T = \frac{ma}{2}$$

$$2mg - \frac{ma}{2} = 2ma$$

$$2mg = \frac{5ma}{2}$$

$$a = \frac{4g}{5}$$

12. (B)

$$v\cos(\pi - x) = u\cos y$$

$\Rightarrow -v\cos x = u\cos y$

Also,

$\omega = \dfrac{v\sin x + u\sin y}{d}$

$w = \dfrac{v\sin x - v\dfrac{\cos x}{\cos y}\sin y}{d}$

$= \dfrac{v\sin(x-y)}{d\cos y}$

13. (C)

$\omega = \alpha dt$

$= \int_0^2 (2t - t^2)\,dt$

$\omega = \left[t^2 - \dfrac{t^3}{3}\right]_0^2$

$= 4 - \dfrac{8}{3} = \dfrac{4}{3}\,\text{rad/s}$

$\omega = \dfrac{4}{3}\,\text{rad/s}$

14. (A)

Let it be r_1

then $P_0 + \dfrac{4s}{R} + \dfrac{4s}{r_1} = P_0 + \dfrac{4s}{r}$

$\dfrac{1}{R} + \dfrac{1}{r_1} = \dfrac{1}{r}$

$\dfrac{1}{r_1} = \dfrac{1}{r} - \dfrac{1}{R}$

$\dfrac{1}{r_1} = \dfrac{R-r}{rR}$

$r_1 = \dfrac{rR}{R-r}$

15. (A)

$\rho L^3 g = \rho_1 L^2 \times \dfrac{L}{4} g + \rho_2 L^2 \times \dfrac{3L}{4} g$

$\rho = \dfrac{\rho_1}{4} + \rho_2 \dfrac{3}{4}$

$\rho L = \dfrac{\rho_1 L + 3\rho_2 L}{4}$

$\rho = \left(\dfrac{\rho_1 + 3\rho_2}{4}\right)$

16. (D)

$$K.E. = N4\pi a^2\sigma - 4\pi b^2\sigma$$
$$K.E. = 4\pi\sigma(Na^2 - b^2)$$
$$\frac{1}{2}Mv^2 = 4\pi\sigma(Na^2 - b^2)$$
$$\frac{1}{2}\rho\frac{4}{3}\pi b^3v^2 = 4\pi\sigma(Na^2 - b^2)$$
$$\frac{\rho b^3v^2}{6} = \sigma(Na^2 - b^2)$$

Also,

$$Na^3 = b^3$$
$$\frac{\rho b^3v^2}{6} = \sigma\left(\frac{b^3}{a^3}a^2 - b^2\right)$$
$$\frac{\rho b^3v^2}{6} = \sigma\left(\frac{b^3}{a} - b^2\right)$$
$$\frac{\rho b^3v^2}{6} = \sigma b^2\left(\frac{b}{a} - 1\right)$$
$$\frac{\rho bv^2}{6} = \sigma\left(\frac{b}{a} - 1\right)$$
$$v^2 = \frac{6\sigma}{\rho}\left(\frac{1}{a} - \frac{1}{b}\right)$$
$$v = \left[\frac{6\sigma}{\rho}\left(\frac{1}{a} - \frac{1}{b}\right)\right]^{1/2}$$

17. (D)

$$\Delta L = \frac{WL}{2AY} = \frac{(\lambda Lg)L}{2AY}$$
$$= \frac{\lambda L^2 g}{2AY}$$

CHEMISTRY

18. (A)

Checking statement – 1: Reactants react in stoichiometric ratio, but if not taken in that ratio, at least one of the reactant will be left out

Checking statement – 2: $2H_2 + O_2 \rightarrow H_2O \Rightarrow$ For 2 mol H_2, 1 mole of O_2 is required to react. Hence H_2 is limiting reagent. 2 mol H_2 will give 2 mole of water.

Checking statement – 3: $C + O_2 \longrightarrow CO_2$. 1 mole carbon (12 g) will react with 1 mol oxygen (32 g) to give 1 mol CO_2 (44 g). Hence if equal mass of C and oxygen are taken then O_2 will be limiting reagent.

19. (A)

Choice – A: 1 mol H_2SO_4 will be required to react with 2 mol NaOH. To get 1 mol H_2SO_4, we need to take 1 L, 1 M solution, Hence net cost = 50 Rs

Choice – B: 1 mol H_3PO_3 will be required to react with 2 mol NaOH. To get 1 mol H_3PO_3, we need to take 1 L, 1 M solution, Hence net cost = 56 Rs

Choice – C: 2 mol HCl will be required to react with 2 mol NaOH. To get 2 mol HCl, we need to take 2 L, 1 M solution, Hence net cost = 60 Rs

Choice – C: 2 mol HCl will be required to react with 2 mol NaOH. To get 2 mol HCl, we need to take 2 L, 1 M solution, Hence net cost = 54 Rs

The best choice will be 1M H_2SO_4 (Rs. 50 per L)

20. **(B)**

Angular momentum (A) of an electron in two successive orbits of H–atom is gives by

$$A_n = n\frac{h}{2\pi},\ A_{(n+1)} = (n+1)\frac{h}{2\pi} \Rightarrow A_{(n+1)} - A_n = \frac{h}{2\pi}$$

21. **(B)**

At radial node $|\psi| = 0$

From given equation, $\Rightarrow x - 1 = 0$ and $x^2 - 8x + 12 = 0$

$x - 1 = 0 \Rightarrow x = 1 \Rightarrow \frac{2}{a_0} = 1;\ r = \frac{a_0}{2}$ (Minimum)

$x^2 - 8x + 12 = 0 \Rightarrow (x - 6)(x - 2) = 0$

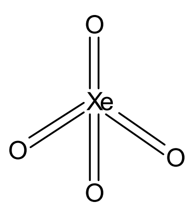
when $x - 2 = 0 \Rightarrow x = 2 \Rightarrow \frac{2r}{a_0} = 2$, i.e., $r = a_0$ (Middle value)

when $x - 6 = 0 \Rightarrow x = 6 \Rightarrow \frac{2r}{a_0} = 6 \Rightarrow r = 3a_o$ (Maximum)

22. **(C)**

$$Na + \frac{1}{2}H_2 \xrightarrow[\text{Reduction of H}]{\text{Oxidation of Na}} \overset{+}{Na}\overset{-}{H}$$

23. **(D)**



$XeO_4 \Rightarrow$ Steric number $= \sigma -$ bonds $+$ lone pair $= 4$

Hybridization – sp^3, Geometry - Tetrahedral

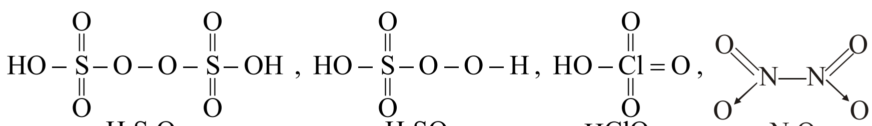
24. **(A)**

As the electronegativity of side atom decreases, bond angle increases. $NF_3 < NCl_3 < NBr_3 < NI_3$

25. **(B)**

Cl will have highest electron affinity.

26. (C)



$H_2S_2O_8$ H_2SO_5 $HClO_4$ N_2O_4

27. (D)

Let the distance between two rows = x

Let y^{th} row spectators will have a tendency to smile and weep simultaneously.

$\therefore$ Distance travelled by N_2O = yx

Distance travelled by tear gas = (201 – y)x

$$\frac{r_{N_2O}}{r_{\text{tear gas}}} = \frac{yx}{(201-y)x} = \sqrt{\frac{176}{44}} = 2$$

$y = 134$

28. (D)

Higher the critical temperature, more easily is the gas liquefied. Hence, order of liquefaction starting with the gas liquefying first will be : O_2, N_2, H_2, He.

29. (C)

According to Kinetic theory, postulates collision between molecules are elastic. This means that kinetic energy after any collision is conserved because while one gains kinetic energy, another loses it.

30. (C)

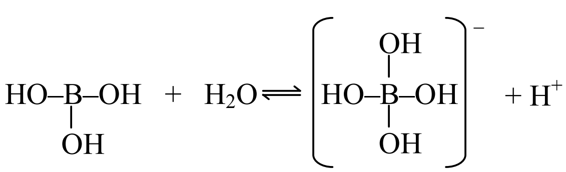
$KHCO_3$ being more soluble, remains in ionized form and cant be separated from solution.

31. (A)

Stability of Fluorides decreases down the group as lattice energy decreases

32. (A)

Due to back bonding by F-atom, BF_3 is weak lewis acid.



Conjugate base

33. (C)

In Option (C) positive charge is present on more electronegative atom and negative charge is on more electropositive atom.

34. (A)

The free radical formed in (I) will be most stable due to hyperconjugation.

MATHEMATICS

35. (C)

Using $2\left(-\frac{1}{2}x^2\right)=x\left(x^2+1\right)+6$, we get $x^3+x^2+x+6=0$. By trial $x=-2$ satisfies it.

$\therefore (x+2)\left(x^2-x+3\right)=0$

$\Rightarrow x=-2$ because $x^2-x+3=0$ has D < 0.

$\therefore$ the given terms are $-10, -2, 6$, where common difference = 8.

36. (A)

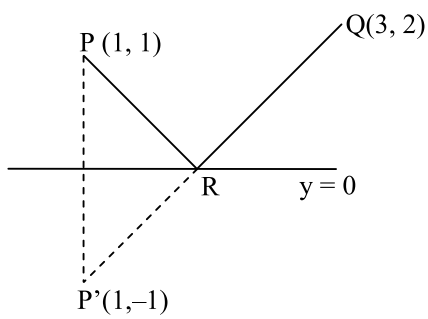
If p, q, r are in AP then in an AP or a GP or an HP $a_1, a_2, a_3, ...,$ etc., then term a_p, a_q, a_r are in AP, GP or HP respectively.

37. (A)

The point R should be such that PR is reflected along RQ from the line $y=0$.

The equation of $P^/Q$ (where $P^/$ is the image of P) is $3x-2y=5$.

R is the point of intersection of $y=0$ and $3x-2y=5$



38. (A)

$\times|\times|\times|$ Crosses can be filled in ${}^3P_3-{}^2P_2$ ways

($\because$ 0 cannot go in the first place from the left).

The remaining places can be filled in $3!$ ways.

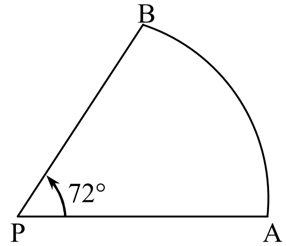
$\therefore$ the required number of numbers $=\left({}^3P_3-{}^2P_2\right)\times 3!$.

39. (A)

$(b+ia)^5=i^5(a-ib)^5=i(\alpha-i\beta)$

40. (A)

Let the post be at point P and Let PA be the length of the rope in tight position. Suppose the horse moves along the arc AB so that $\angle APB=72°$ and arc AB = 88 m. Let r be the length of the rope i.e., $PA=r$ metres.



Here, $\theta = 72^\circ = \left(72 \times \frac{\pi}{180}\right)^c = \left(\frac{2\pi}{5}\right)^c$ and $s = 88\,m$

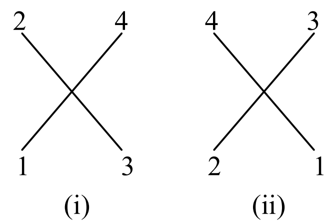
$\therefore \theta = \frac{\text{arc}}{\text{radius}} \Rightarrow \frac{2\pi}{5} = \frac{88}{r}$

$\Rightarrow r = 88 \times \frac{5}{2\pi} = 70$ metres.

41. (D)

The natural numbers are 1, 2, 3, 4.

Clearly, in one diagonal we have to place 1, 4 and in the other 2, 3.



The number of ways in (i) $= 2! \times 2! = 4$.

The number of ways in (ii) $= 2! \times 2! = 4$

$\therefore$ the total number of ways = 8.

42. (D)

$\because \sqrt{2\cot\alpha + \frac{1}{\sin^2\alpha}} = \sqrt{2\cot\alpha + \text{cosec}^2\alpha}$

$= \sqrt{2\cot\alpha + 1 + \cot^2\alpha} = \sqrt{(1+\cot\alpha)^2} = |1+\cot\alpha| = -(1+\cot\alpha)$

$\left(\because \frac{3\pi}{4} < \alpha < \pi \Rightarrow \cot\alpha < -1 \Rightarrow 1 + \cot\alpha < 0\right)$

43. (D)

$$\text{Limit} = \lim_{h\to 0} \frac{2 - \sqrt[3]{8+h}}{2h \cdot \sqrt[3]{8+h}}$$

$$= \lim_{h\to 0} \frac{8-(8+h)}{2h \cdot \sqrt[3]{8+h}\left\{8^{2/3} + 8^{1/3}\cdot(8+h)^{1/3} + (8+h)^{2/3}\right\}} = -\frac{1}{48}$$

44. (D)

We have, $n(A) = m$ and $n(B) = n$

$\therefore n(A\times B)=n(A)\cdot n(B)=mn$

Total number of relation from A to B = Number of subsets of $A\times B=2^{mn}$

So, total number of non-empty relations $=2^{mn}-1$.

45. (C)

We have, $f(x)=\dfrac{4-x}{x-4}=-1$ for $x\neq 4$

Thus, domain is $R-\{4\}$ and range is $R-\{-1\}$.

46. (B)

$$\left(\frac{1+i}{1-i}\right)^{x}=1$$

$$\Rightarrow\left[\frac{(1+i)(1+i)}{(1-i)(1+i)}\right]^{x}=1\Rightarrow\left[\frac{1+2i+i^2}{1-i^2}\right]^{x}=1\Rightarrow\left[\frac{2i}{1+1}\right]^{x}=1$$

$\Rightarrow i^{x}=1$

$\Rightarrow x=4n,\ n\in N$

47. (C)

Given that $|x-1|>5$ …(i)

We know that if $|x|>a$, then $x<-a$ or $x>a$ (if a > 0)

From (i), we get

$(x-1)<-5$ or $(x-1)>5$

$\Rightarrow x<-4$ or $x>6$

$\Rightarrow x\in(-\infty,-4)\cup(6,\infty)$

48. (D)

$f(x)=1-x+x^2+x^3+\ldots-x^{99}+x^{100}$

$\therefore f^{/}(x)=0-1+2x-3x^2+\ldots-99x^{98}+100x^{99}$

$\Rightarrow f^{/}(1)=(-1+2)+(-3+4)+\ldots.+(-99+100)$

$=1+1+1+\ldots.50$ times

$=50$

49. (B)

Since, the set of three consecutive numbers from 1 to 20 are $(1,2,3)$, $(2,3,4)$, $(3,4,5)$, ..., $(18,19,20)$, i.e., 18.

P (numbers are consecutive) $= \frac{18}{{}^{20}C_3} = \frac{18}{\frac{20\times19\times18}{3!}} = \frac{3}{190}$

P (three number are not consecutive) $= 1 - \frac{3}{190} = \frac{187}{190}$

50. **(C)**

General result: angle subtended by AB at its incentre $= 90° + \frac{C}{2} = 90° + 45° = 135°$

$\angle ASB + \frac{A}{2} + \frac{B}{2} = 180°$; But $\frac{A}{2} + \frac{B}{2} + \frac{C}{2} = 90°$; $\angle ASB = 180° - \left(90° - \frac{C}{2}\right) = 90° + \frac{C}{2}$

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