## PHYSICS

**1.** A particle moves in a straight line covers half the distance with speed of 3 m/s. The other half of the distance is covered in two equal time intervals with speed of 4.5 m/s and 7.5 m/s, respectively. The average speed of the particle during this motion is

(A) 4.0 m/s   (B) 5.0 m/s   (C) 5.5 m/s   (D) 4.8 m/s

2. A stone is thrown vertically upward with an initial velocity u from the top of a tower, reaches the ground with a velocity 3u. The height of the tower is

(A) $\dfrac{3u^2}{g}$ (B) $\dfrac{4u^2}{g}$ (C) $\dfrac{6u^2}{g}$ (D) $\dfrac{9u^2}{g}$

3. A force of F is applied as shown in the figure. Find the tension in the string between BC, if the friction force is negligible.
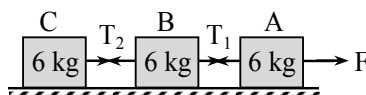
(A) F/3   (B) F/2   (C) F   (D) None of these

4. In the figure, a block of weight 60 N is placed on a rough surface. The coefficient of friction between the block and the surface is 0.5. What should be the maximum weight W such that the block does not slip on the surface?
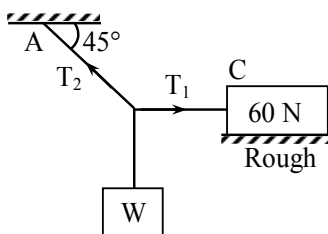

(A) 60 N   (B) $\dfrac{60}{\sqrt{2}}$ N   (C) 30 N   (D) $\dfrac{30}{\sqrt{2}}$

5. A body of mass M kg is on the top point of a smooth hemisphere of radius 5m. It is released to slide down the surface of the hemisphere. It leaves the surface when its velocity is 5 m/s. At this instant the angle made by the radius vector of the body with the vertical is : (Acceleration due to gravity = 10 ms^{-2})

(A) 30°   (B) 45°   (C) 60°   (D) 90°

6. A body of mass 6 kg is acted upon by a force which causes a displacement in it given by $x = \dfrac{t^2}{4}$ m where t is the time in second. The work done by the force in 2 second is

(A) 12 J   (B) 9 J   (C) 6 J   (D) 3 J

7. ABCDE is a channel in the vertical plane, part BCDE being circular with radius r. A block is released from A and slides without friction and without rolling. The block will complete the loop if h is :
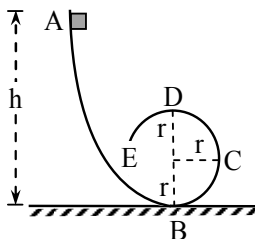

(A) $h \le \dfrac{3}{2}r$ (B) $h \ge \dfrac{5}{2}r$ (C) $h \ge \dfrac{3}{2}r$ (D) $h \le \dfrac{5}{2}r$

8. A block Q of mass M is placed on a horizontal frictionless surface AB and a body P of mass m is released on its frictionless slope. As P slides by a length L on this slope of inclination θ, the block Q would slide by a distance
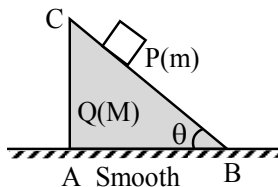
(A) $\dfrac{m}{M} L \cos\theta$ (B) $\dfrac{m}{M+m} L$ (C) $\dfrac{M+m}{mL\cos\theta}$ (D) $\dfrac{m}{m+M}(L\cos\theta)$

9. A metal ball of mass 2 kg moving with speed of 36 km/h has a head on collision with a stationary ball of mass 3 kg. If after collision, both the balls move as a single mass, then the loss in kinetic energy due to collision is

(A) 100 J   (B) 140 J   (C) 40 J   (D) 60 J

10. A wheel has angular acceleration of 3.0 rad/s^2 and an initial angular speed of 2.00 rad/s. In a time of 2 s, it has rotated through an angle (in radian) of

(A) 10   (B) 12   (C) 4   (D) 6

11. A point P consider at contact point of a wheel on ground which rolls on ground without slipping then value of displacement of point P when wheel complete half of rotation (If radius of wheel is 1 m)
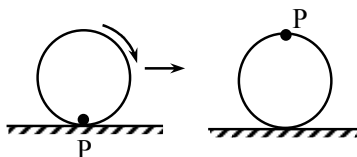

(A) 2m   (B) $\sqrt{\pi^2 + 4}$ m   (C) π m   (D) $\sqrt{\pi^2 + 2}$ m

12. The mass of a planet is 1/4th that of earth and diameter is four times that of earth. The acceleration due to gravity at the planet surface is (g_e : acceleration due to gravity at earth surface).

(A) $\dfrac{g_e}{4}$ (B) $\dfrac{g_e}{16}$ (C) $\dfrac{g_e}{64}$ (D) $4g_e$

13. If the ratio of lengths, radii and Young's modulus of steel and brass wires in the figure are a, b and c respectively, then the corresponding ratio of increase in their lengths would be
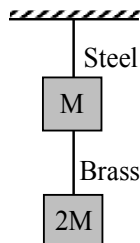
(A) $\dfrac{2a^2 c}{b}$ (B) $\dfrac{3a}{2b^2 c}$ (C) $\dfrac{2ac}{b^2}$ (D) $\dfrac{3c}{2ab^2}$

14. The parallel glass plates having separation d are dipped in water. Some water rises up in the gap between the plates. The surface tension of water is T, atmospheric pressure is P_0, pressure of water just below the water surface in the region between the plates is P. Find the relation between P, P_0, T and d

(A) $P = P_0 - \dfrac{2T}{d}$ (B) $P = P_0 + \dfrac{2T}{d}$ (C) $P = P_0 - \dfrac{4T}{d}$ (D) $P = P_0 + \dfrac{4T}{d}$

15. A tank is filled with water upto a height H. Water is allowed to come out of a hole P in one of the walls at a depth D below the surface of water. Express the horizontal distance x in terms of H and D
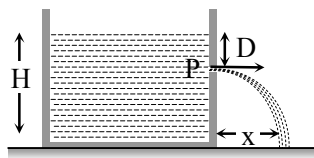

    (A) $x = \sqrt{D(H-D)}$ (B) $x = \sqrt{\dfrac{D(H-D)}{2}}$ (C) $x = 2\sqrt{D(H-D)}$ (D) $x = 4\sqrt{D(H-D)}$

16. The terminal velocity v_t of a small steel ball of radius r falling under gravity through a column of a viscous liquid of coefficient of viscosity η depends on mass of the ball m, acceleration due to gravity g, coefficient of viscosity η and radius r. Which of the following relations is dimensionally correct?

    (A) $v_t \propto \dfrac{mgr}{\eta}$ (B) $v_t \propto mg\eta r$ (C) $v_t \propto \dfrac{mg}{\eta r}$ (D) $v_t \propto \dfrac{\eta mg}{r}$

17. The measured mass and volume of a body are 22.42 g and 4.7 cm^3, respectively. The maximum possible error in density is approximately

    (A) 2%   (B) 4%   (C) 1%   (D) 10%

CHEMISTRY

18. $H_2 + \dfrac{1}{2}O_2 \longrightarrow H_2O$. 'x' g of hydrogen are mixed with 'y' g of 'O$_2$' to give water and (8x < y). Moles of water formed are

    (A) 9x   (B) $\dfrac{9y}{8}$ (C) $\dfrac{y}{32}$ (D) $\dfrac{x}{2}$

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

21. Which of the following statement is correct in relation to the hydrogen atom?

    (A) 3s–orbital is lower in energy than 3p–orbital.

    (B) 3p–orbital is lower in energy than 3d–orbital.

    (C) 3s and 3p–orbitals are of lower energy than 3d–orbitals.

    (D) 3s, 3p and 3d–orbitals have same energy.

22. The successive ionization energies for element X is given below

    IE$_1$: 150 kJ mol^{-1} IE$_2$: 820 kJ mol^{-1}

    IE$_3$: 1100 kJ mol^{-1} IE$_4$: 1400 kJ mol^{-1}

    Find out the number of valence electron for the element X.

    (A) 1   (B) 2   (C) 3   (D) 4

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) $NF_3 < NBr_3 < NI_3 < NCI_3$

    (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.
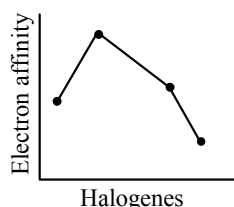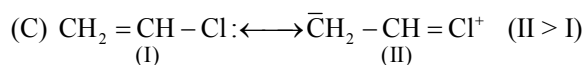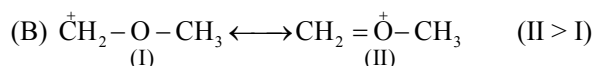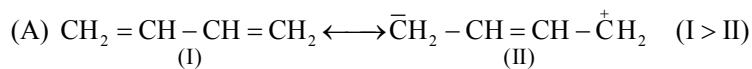

    The element present at the peak of the curve is

    (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. Compressibility factor for H_2 behaving as real gas is (R= Gas constant, T= Temperature, p=Pressure, V=Volume of container, a and b are vanderwaal's constant)

    (A) 1   (B) $\left(1 - \dfrac{a}{RTV}\right)$ (C) $\left(1 + \dfrac{pb}{RT}\right)$ (D) $\dfrac{RTV}{(1-a)}$

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) Fluorides

(B) Superoxides

(C) Carbonates

(D) Hydrogen carbonates

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

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

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) $CH_2 = CH - CH = CH_2 \longleftrightarrow \overline{C}H_2 - CH = CH - \overset{+}{C}H_2$ (I > II)
       (I)   (II)

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

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

(D) Both (B) and (C)

34. In the given following structure,

$$H_3C-CH_2 \overset{H}{\underset{|(A)}{}} \qquad H_2C=CH \overset{H}{\underset{|(B)}{}} \qquad H_2C\equiv C\overset{(C)}{-}H$$

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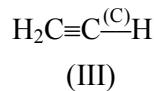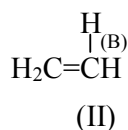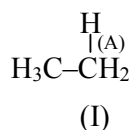
If (A), (B) & (C) are the magnitude of bond energies of the C–H homolytic bond cleavage in the three structures (I), (II) and (III) respectively then which one of the following order is correct?

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

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

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

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

BIOLOGY

35. Match Column-I with Column-II and choose the **correct** option.

Column-I		Column-II	
(a)	*Rhizopus*	(I)	Deuteromycetes
(b)	*Aspergillus*	(II)	Basidiomycetes
(c)	*Puccinia*	(III)	Ascomycetes
(d)	*Alternaria*	(IV)	Phycomycetes

(A) (a) – (I); (b) – (II); (c) – (III); (d) – (IV)

(B) (a) – (IV); (b) – (III); (c) – (I); (d) – (II)

(C) (a) – (IV); (b) – (III); (c) – (II); (d) – (I)

(D) (a) – (I); (b) – (III); (c) – (II); (d) – (IV)

36. Which of the following pteridophytes belong to class pteropsida?

(A) *Equisetum, Psilotum*

(B) *Lycopodium, Adiantum*

(C) *Dryopteris, Psilotum*

(D) *Pteris, Adiantum*

37. Match Column-I with Column-II and select the **correct** option.

	Column-I		Column-II
(a)	Choanocytes	(I)	Platyhelminthes
(b)	Cnidoblasts	(II)	Ctenophora
(c)	Flame cells	(III)	Porifera
(d)	Nephridia	(IV)	Coelenterata
(e)	Comb plates	(V)	Annelida

(A) (a) – (II); (b) – (I); (c) – (IV); (d) – (V); (e) – (III)

(B) (a) – (II); (b) – (IV); (c) – (I); (d) – (V); (e) – (III)

(C) (a) – (V); (b) – (I); (c) – (III); (d) – (II); (e) – (IV)

(D) (a) – (III); (b) – (IV); (c) – (I); (d) – (V); (e) – (II)

**38.** Which of the following is **incorrect** with respect to junction and its function ?

(A)	Tight junction	Promotes leaking of substances across a tissue
(B)	Adhering junction	Keeps neighbouring cells together
(C)	Gap junction	Connects the cytoplasm of adjoining cells for rapid transfer of ions and small molecules
(D)	Gap junction	Facilitates the cells to communicate with each other

39. Extranuclear genes/DNA are found in

(A) lysosome and chloroplast.　　　　　(B) Golgi bodies and ER.

(C) nucleus and mitochondria.　　　　　(D) mitochondria and chloroplast.

40. Which one of the following is the **correct** sequence of carbohydrates in order of increasing complexity of their chemical structure ?

(A) Sucrose, Starch, Oligosaccharide, Maltose, Triose

(B) Triose, Maltose, Sucrose, Oligosaccharide, Starch

(C) Triose, Glucose, Maltose, Oligosaccharide, Starch

(D) Oligosaccharide, Triose, Starch, Sucrose, Maltose

41. The following phase represents the phase between two successive M phases:

(A) Gap phase　　(B) Synthesis phase　　(C) Interphase　　(D) Cytokinesis

42. Which one is correct for C_4 plants?

	Mesophyll		Bundle sheath	
(A)	PEPcase	C_4 cycle	RuBisCo	C_3 cycle
(B)	PEPcase	Calvin cycle	RuBisCo	C_4 cycle
(C)	RuBisCo	C_4 cycle	PEPCase	C_3 cycle
(D)	RuBisCo	C_2 cycle	PEPCase	C_3 cycle

43. Which of the following relations shows substrate level phosphorylation?

(A) Citric acid $\rightarrow$ α-Ketoglutaric acid

(B) Malic acid $\rightarrow$ Oxalo-acetic acid

(C) α-Ketoglutaric acid $\rightarrow$ Succinic CoA

(D) Succinyl CoA $\rightarrow$ Succinic acid

44. Consider the following statements regarding gibberellins. Which of the following are **correct**?

(a) They cause fruits like apple to elongate and improve its shape.

(b) They promote bolting in beet and cabbages.

(c) They promote fruit ripening.

(d) They are used to synchronise fruit-set in pineapples.

(A) All of these.   (B) (a), (b) and (c)   (C) (a) and (b)   (D) (b), (c) and (d)

45. If a man from sea coast goes to Everest peak then

(A) his breathing and heart beat will increase

(B) his breathing and heart beat will decrease

(C) his respiratory rate will decrease

(D) his heart beat will decrease.

46. Cardiac output will be the _____, if heart has a stroke value of 0.07 L min^{-1} and is beating at the rate of 80 per minute.

(A) 56.0 L min^{-1} (B) 0.56 L min^{-1} (C) 5.6 L min^{-1} (D) 56.8 L min^{-1}

47. Which of the following is **incorrect** about proximal convoluted tubule (PCT)?

(A) It is lined with simple cuboidal brush border epithelium.

(B) All essential nutrients, 70–80% electrolytes and water are reabsorbed here.

(C) It helps in maintenance of pH of the body fluid by selective secretion of H$^+$ ion and absorption of HCO_3^-

(D) It does not help in maintenance of ionic balance of body fluid.

48. Choose the **correct** order for muscle contraction

(A) Stimuli $\rightarrow$ Neurotransmitter $\rightarrow$ Release of Ca^{2+} $\rightarrow$ Cross bridge formation $\rightarrow$ Excitation of system $\rightarrow$ Sliding of actin filament

(B) Stimuli $\rightarrow$ Neurotransmitter $\rightarrow$ Excitation of system $\rightarrow$ Release of Ca^{2+} $\rightarrow$ Cross bridge formation $\rightarrow$ Sliding of actin filament $\rightarrow$ H band diminishes

(C) Stimuli $\rightarrow$ Excitation of system $\rightarrow$ Neurotransmitter secretion $\rightarrow$ Cross bridge formation $\rightarrow$ Sliding of actin filament $\rightarrow$ H band diminishes

(D) Stimuli $\rightarrow$ Neurotransmitter $\rightarrow$ Cross bridge formation $\rightarrow$ Excitation of system $\rightarrow$ Sliding of actin filament

49. Identify (a)–(e) in the figure given below.

Human Neural System
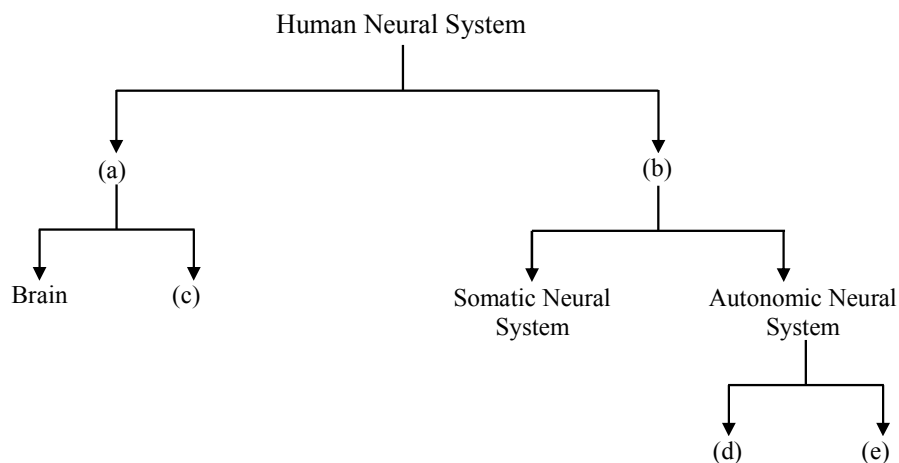
(A) (a) – Central Nervous System (CNS); (b) – Peripheral Nervous System (PNS); (c) – Spinal Cord; (d) – Sympathetic Neural System; (e) – Parasympathetic Neural System

(B) (a) – Peripheral Nervous System (PNS); Central Nervous System (CNS); (b) – Parasympathetic; Neural System; (c) –Central Neural System (CNS); (d) – Sympathetic Neural System; (e) – Spinal Cord

(C) (a) – Parasympathetic Neural System (CNS); (b) – Spinal Cord; (c) – Central Nervous System (CNS); (d) – Sympathetic Neural System; (E) – Peripheral Nervous System (PNS)

(D) (a) – Central Nervous System (CNS); (b) – Spinal Cord; (c) – Peripheral Nervous System (PNS); (d) – Sympathetic Neural System; (e) – Parasympathetic Neural System

50. Which of the following work through hormone receptor complex on the cell membrane ?

(A) Cortisol   (B) Testosterone   (C) Insulin   (D) Progesterone

* * * * *

CLASS 11th MOVING TO CLASS 12th (BIO)

ANSWER KEY

SET A

PHYSICS

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

CHEMISTRY

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

BIOLOGY

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

SOLUTION

PHYSICS

1. **(A)**

$$t_1 = \frac{x/2}{3} = \frac{x}{6}$$

$$x_1 = 4.5t_2 \qquad x_2 = 7.5t_2$$

Also, $x_1 + x_2 = x/2 = (4.5 + 7.5)t_2$

That is, $t_2 = \frac{x}{24}$

$$t = t_1 + 2t_2 = \frac{x}{6} + \frac{2x}{24} = \frac{x}{4}$$

2. **(B)**

Let h be the height of the tower.

Using $v^2 - u^2 = 2as$, we get :

$$(-3u)^2 - u^2 = 2(-g)(-h)$$

Here, $u = u, a = -g, s = -h$ and $v = -3u$

(upward direction +ve).

$$\therefore 9u^2 - u^2 = 2gh \qquad \text{or } h = 4u^2/g$$

3. **(A)**

$$T_2 = \frac{6}{6+6+6}F = \frac{F}{3}$$

4. **(C)**

Frictional force,

$$F = \mu N = 0.5 \times mg = 0.5 \times 60 = 30N$$

Now, $F = T_1 = T_2 \cos 45°$

$$\Rightarrow 30 = T_2 \cos 45°$$

and $W = T_2 \sin 45°$

$$\therefore W = 30N$$

5. **(C)**

If the radius vector makes an angle θ with the vertical, then

$$mg\cos\theta - N = \frac{mv^2}{r}$$

When the body leaves the surface, N = 0

$$\therefore mg\cos\theta = \frac{mv^2}{r}$$

or $\cos\theta = \frac{v^2}{rg} = \frac{(5)^2}{5 \times 10} = \frac{1}{2} \qquad \therefore \theta = 60°$

6. **(D)**

$$x = \frac{t^2}{4} \Rightarrow v = \frac{dx}{dt} = \frac{t}{2} \Rightarrow a = \frac{dv}{dt} = \frac{1}{2} m/s^2$$

$$\therefore F = ma = 6 \times \frac{1}{2} = 3N.$$

Displacement of the body in 2 second is

$$s = 0 + \frac{1}{2} \times \frac{1}{2} \times (2)^2 = 1m$$

Work done $= F.s = 3 \times 1 = 3J$

7. **(B)**

Loss in PE between A and D = gain in KE between A and D

$$mg(h - 2r) = \frac{1}{2}m(v^2 - 0) \qquad (\because K_A = 0)$$

$$\Rightarrow v^2 = 2g(h - 2r) \qquad ....(i)$$

If the block is to complete the loop path then at D

$$\frac{mv^2}{r} \geq mg \Rightarrow v^2 \geq rg \qquad ....(ii)$$

From Eqs. (i) and (ii)

$$2g(h - 2r) \geq rg \Rightarrow h \geq \frac{5}{2}r$$

8. **(D)**

Here, the horizontal position of centre of mass of the system remains unchanged when the mass m moved a distance L cos θ, let the mass (m + M) moves a distance x in the backward direction.

$\therefore (M + m)x - mL\cos\theta = 0 \therefore x = (mL\cos\theta)/(m + M)$

9. **(D)**

Mass of metal ball = 2 kg;

Speed of metal ball $v_1 = 36 km/h = 10 m/s$ and mass of stationary ball = 3 kg.

Applying law of conservation of momentum,

$$m_1 v_1 + m_2 v_2 = (m_1 + m_2)v$$

$$\Rightarrow \frac{m_1 v_1 + m_2 v_2}{m_1 + m_2} = \frac{(2 \times 10) + (3 \times 0)}{2 + 3}$$

$$= \frac{20}{5} = 4 m/s$$

Therefore loss of energy

$$= \left[\frac{1}{2}m_1 v_1^2 + \frac{1}{2}m_2 v_2^2\right] - \frac{1}{2} \times (m_1 + m_2)v^2$$

$$= \left[\frac{1}{2} \times 2 \times (10)^2 + \frac{1}{2} \times 3(0)^2\right] - \frac{1}{2} \times (2 + 3) \times (4)^2$$

$$= 100 - 40 = 60 J.$$

10. **(A)**

Given: Angular acceleration, $\alpha = 3 rad/s^2$

Initial angular velocity $\omega_i = 2 rad/s$

Time $t = 2s$

Using $\theta = \omega_i t + \frac{1}{2}\alpha t^2$, we get

$$\theta = 2 \times 2 + \frac{1}{2} \times 3 \times 4 = 4 + 6 = 10 \text{ radian}.$$

11. **(B)**

In half rotation point P has moved horizontally.

$$\frac{\pi d}{2} = \pi r = \pi \times 1m = \pi m. [\because radius = 1m]$$

In the same time, it has moved vertically a distance which is equal to its diameter = 2m.

$\therefore$ Displacement of $P = \sqrt{\pi^2 + 2^2}$

$= \sqrt{\pi^2 + 4}$ m.

12. **(C)**

As $g \propto \dfrac{M}{R^2}$

$\therefore \dfrac{g_p}{g_e} = \dfrac{M_p}{M_e}\left(\dfrac{R_e^2}{R_p^2}\right) = \dfrac{1}{4} \times \left(\dfrac{1}{4}\right)^2 = \dfrac{1}{64}$

$\Rightarrow g_p = \dfrac{g_e}{64}$

13. **(B)**

$\Delta l = \dfrac{FL}{AY}$

$\dfrac{\Delta l_s}{\Delta l_B} = \dfrac{F_s}{F_B} \times \dfrac{L_s}{L_B} \times \dfrac{A_B}{A_S} \times \dfrac{Y_B}{Y_S}$

$= \dfrac{3M}{2M} \times a \times \dfrac{1}{b^2} \times \dfrac{1}{c} = \dfrac{3a}{2b^2 c}$

14. **(A)**

The free liquid surface between the plates is cylindrical and hence is curved along one axis only (parallel to the plates). The radius of curvature

$r = \dfrac{d}{2} \qquad P_0 - P = \dfrac{T}{r}$

or $P = P_0 - \dfrac{T}{r} = P_0 - \dfrac{2T}{d}$,

15. **(C)**

$v = \sqrt{2gD}$

After coming from the hole the liquid adopts a parabolic path. If it takes t sec in falling through a vertical distance (H−D), then

$(H - D) = \dfrac{1}{2} gt^2$ or $t = \sqrt{[2(H - D)/g]}$

From equation (1) and (2).

$x = vt = 2\sqrt{[D(H - D)]}$.

16. **(C)**

According to Stoke's law $6\pi\eta r v_t = mg$

Hence, the valid relation is $v_t \propto mg/\eta r$

17. **(A)**

Density, $d = \dfrac{M}{V}$

The maximum possible error is

$\left(\dfrac{\Delta d}{d} \times 100\right)_{max} = \left(\dfrac{\Delta M}{M} + \dfrac{\Delta V}{V}\right) \times 100\%$

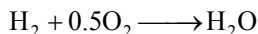$= \left(\dfrac{0.01}{22.42} + \dfrac{0.1}{4.7}\right) \times 100\%$

$= (0.000446 + 0.0212765) \times 100\%$

$= 0.0217225 \times 100\%$

$= 2.17\%$ or $\approx 2\%$

CHEMISTRY

18. **(D)**

$$H_2 + 0.5O_2 \longrightarrow H_2O$$

$$\frac{\text{mol of } H_2}{1} = \frac{(x/2)\,\text{mol}}{1} = \frac{x}{2}\,\text{mol} = \frac{8x}{16}\,\text{mol}$$

$$\frac{\text{mol of } O_2}{0.5} = \frac{(y/32)\,\text{mol}}{0.5} = \frac{y}{16}\,\text{mol}$$

$$8x < y \Rightarrow H_2 \text{ is L.R.}$$

$$\frac{\text{mol of } H_2}{1} = \frac{\text{mole of } H_2O}{1} \Rightarrow \text{mole of } H_2O = \frac{x}{2}$$

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

$$A_n = n\frac{h}{2\pi}, \; A_{(n+1)} = (n+1)\frac{h}{2\pi} \Rightarrow A_{(n+1)-A_n} = \frac{h}{2\pi}$$
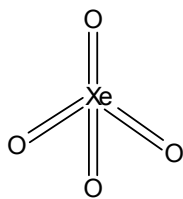
21. **(D)**

Energy of single electron system is only depend on the principle quantum number, so that energy of different orbitals of same principle quantum number is same.

22. **(A)**

Difference between IE_1 and IE_2 is highest then the number of valence electron in the element is one
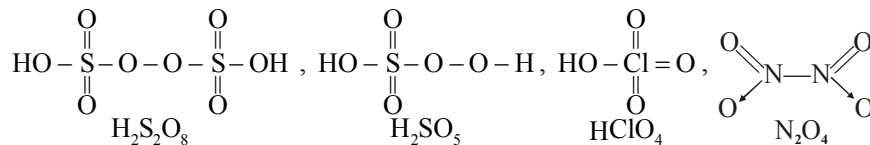
23. **(D)**

$XeO_4 \Rightarrow$ 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)**

27.   **(C)**

For H_2 attractive forces are neglected, hence $\dfrac{a}{V^2} = 0$.

$\therefore \quad p(V - b) = RT \Rightarrow pV = RT + pb$

$\therefore \quad \dfrac{pV}{RT} = \left(1 + \dfrac{pb}{RT}\right) = z$

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 one gains kinetic energy, another loses it.
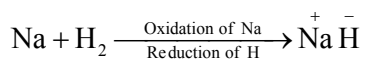
30.   **(C)**

$KHCO_3$ 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.   **(C)**

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

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.

BIOLOGY

35.   **(C)**

36.   **(D)**

Pteris, Adiantum (Walking fern) belongs to class Pteropsida and division-Pteridophyta.

37.   **(D)**

38. **(A)**

Tight junction prevent / stop leaking of substances across a tissue.

39. **(D)**

Mitochondria and Chloroplast are cell organelles which have their own DNA.

40. **(C)**

Triose is a 3-carbon sugar, glucose is a 6-carbon sugar, maltose is a disaccharide sugar made up of two monomer units, oligosaccharides have more than two sugar monomers and starch has a polymer of sugar monomers.

41. **(C)**

Interphase is the phase of preparation for a cell to divide Mitotically. It is differentiated into three stages viz., G_1, S and G_2. It represents the phase between two successive M phases.

42. **(A)**

43. **(D)**

Substrate-level phosphorylation is a type of reaction that results in the formation of ATP by direct transfer and donation of a phosphoryl (PO_3^-) group to ADP. During the conversion of succinyl CoA to succinic acid in Krebs cycle and substrate level phosphorylation takes place.

44. **(C)**

Gibberellin hormone causes fruits like apple to elongate and improve its shape. It also promotes bolting (internode elongation just prior to flowering) in beet, cabbages and many plants with rosette habit.

45. **(A)**

If a man goes to high altitude (e.g., sea coast to Everest peak), air pressure reduces Due to the low air pressure, there is less oxygen available. So, at high altitude, each breathe that a man take will contain fewer oxygen molecules. Hence, have to breathe faster and deeper to get oxygen into body.

46. **(C)**

Cardiac output = Stroke volume x Rate of hearbeat
= 0.07 L min^{-1} x 80 per minute = 5.6 L min^{-1}

47. **(D)**

PCT is lined by simple cuboidal brush border epithelium which increases the surface area for reabsorption. Nearly all of the essential nutrients, and 70-80 percent of electrolytes and water are reabsorbed by this segment. PCT also helps to maintain the pH and ionic balance of the body fluids.

48. **(B)**

49. **(A)**

50. **(C)**

The protein hormones (example-Insulin, FSH etc.) attach on specific receptor sites located on the cell membrane. Steroid hormones like testosterone enter the cytoplasm of a target cell and binds with specific receptor proteins to form a complex called **hormone-receptor complex** then diffuses into nucleus and activates specific genes.

* * * * *