# 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.
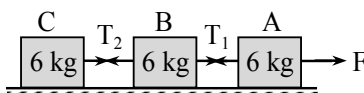
(A) F/3   (B) F/2   (C) F   (D) None of these

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?
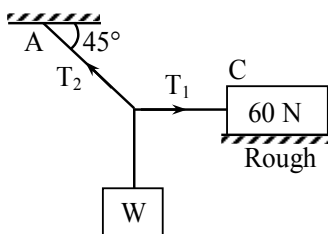

(A) 60 N   (B) $\dfrac{60}{\sqrt{2}}$ N   (C) 30 N   (D) $\dfrac{30}{\sqrt{2}}$

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 :
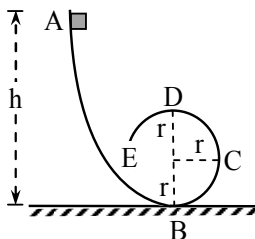

(A) $h \leq \dfrac{3}{2}r$ (B) $h \geq \dfrac{5}{2}r$ (C) $h \geq \dfrac{3}{2}r$ (D) $h \leq \dfrac{5}{2}r$

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
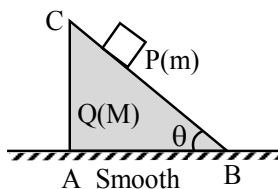
(A) $\dfrac{m}{M}L\cos\theta$ $\qquad$ (B) $\dfrac{m}{M+m}L$ $\qquad$ (C) $\dfrac{M+m}{mL\cos\theta}$ $\qquad$ (D) $\dfrac{m}{m+M}(L\cos\theta)$

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 $\qquad$ (B) 140 J $\qquad$ (C) 40 J $\qquad$ (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 $\qquad$ (B) 12 $\qquad$ (C) 4 $\qquad$ (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)
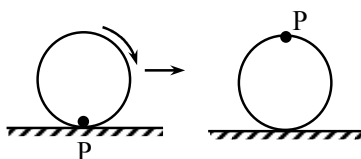

(A) 2m $\qquad$ (B) $\sqrt{\pi^2+4}$ m $\qquad$ (C) π m $\qquad$ (D) $\sqrt{\pi^2+2}$ m

12. The mass of a planet is $1/4^{th}$ 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) $\dfrac{g_e}{4}$ $\qquad$ (B) $\dfrac{g_e}{16}$ $\qquad$ (C) $\dfrac{g_e}{64}$ $\qquad$ (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
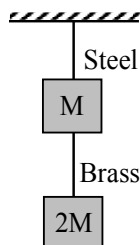
(A) $\dfrac{2a^2c}{b}$ $\qquad$ (B) $\dfrac{3a}{2b^2c}$ $\qquad$ (C) $\dfrac{2ac}{b^2}$ $\qquad$ (D) $\dfrac{3c}{2ab^2}$

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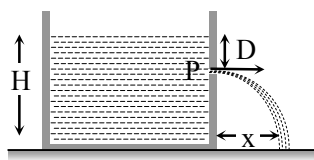

(A) $x = \sqrt{D(H-D)}$ (B) $x = \sqrt{\dfrac{D(H-D)}{2}}$ (C) $x = 2\sqrt{D(H-D)}$ (D) $x = 4\sqrt{D(H-D)}$

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$_2$SO$_4$ (50 Rs per L)   (B) 1 M H$_3$PO$_3$ (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) $NF_3 < NBr_3 < NI_3 < NCl_3$

(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.
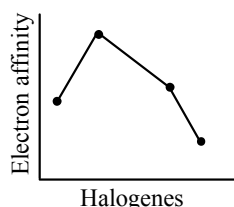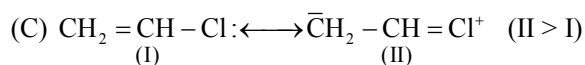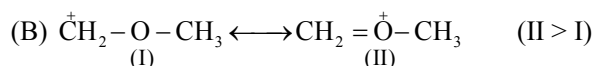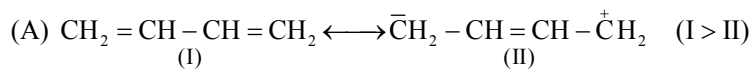

The element present at the peak of the curve is

(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. 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.

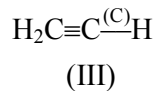| Gases	H_2	He	O_2	N_2
Critical temperature (K)	33.2	5.3	154.3	126

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

    (I)   (II)

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

    (I)   (II)

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

    (I)   (II)

    (D) Both (B) and (C)

34. In the given following structure,

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

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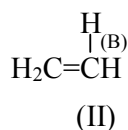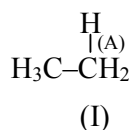
    If (A), (B) & (C) are the magnitude of bond energies of the C–H homolytic bond cleavage in the three structures (I), (II) and (III) respectively then which one of the following order is correct?

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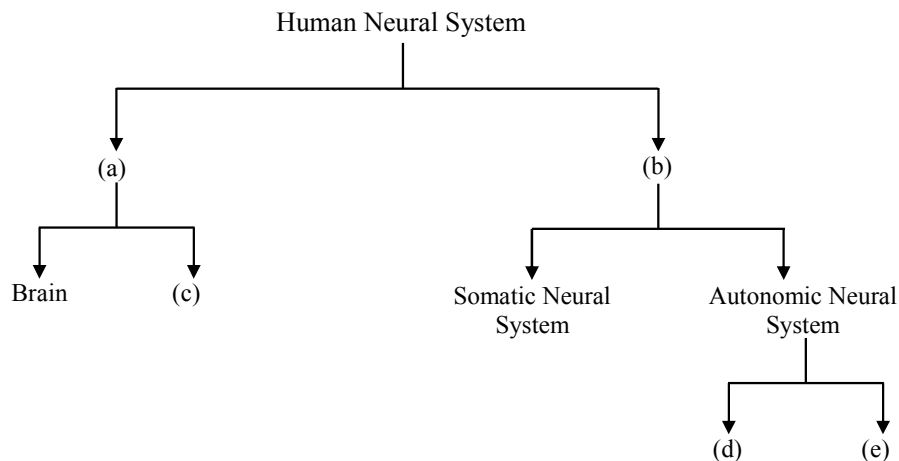
(A) (a) – Central Nervous System (CNS); (b) – Peripheral Nervous System (PNS); (c) – Spinal Cord; (d) – Sympathetic Neural System; (e) – Parasympathetic Neural System

(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

* * * * *