

**Set - A****PART - I****PHYSICS**

1. A stone is dropped into a well in which the level of water is  $h$  below the top of the well. If  $v$  is velocity of sound, the time  $T$  after which the splash is heard is given by :

(a)  $T = \frac{2h}{v}$

(b)  $T = \sqrt{\frac{2h}{g}} + \frac{h}{v}$

(c)  $T = \sqrt{\frac{2h}{v}} + \frac{h}{g}$

(d)  $T = \sqrt{\frac{h}{2g}} + \frac{2h}{v}$

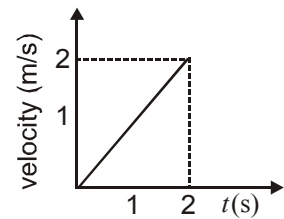
2. For a body of  $50\text{ kg}$  mass, the velocity time graph is shown in figure. Then force acting on the body is :

(a)  $25\text{ N}$

(b)  $50\text{ N}$

(c)  $12.5\text{ N}$

(d)  $100\text{ N}$



3. A body is thrown vertically upwards from the top  $A$  of a tower. It reaches the ground in  $t_1$  seconds. If it is thrown vertically downwards from  $A$  with the same speed it reaches the ground in  $t_2$ , seconds. If it is allowed to fall freely from  $A$ , then the time it takes to reach the ground is given by :

(a)  $t = \frac{t_1 + t_2}{2}$

(b)  $t = \frac{t_1 + t_2}{2}$

(c)  $t = \sqrt{t_1 t_2}$

(d)  $t = \sqrt{\frac{t_1}{t_2}}$

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SPACE FOR ROUGH WORK

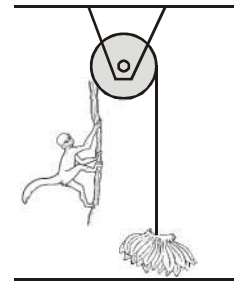
4. A particle of mass  $m$  is projected with a velocity  $v$  making an angle  $45^\circ$  with the horizontal. The magnitude of the angular momentum of the projectile about the point of projection when the particle is at its maximum height  $h$ , is :
- (a) Zero                      (b)  $\frac{mv^3}{4\sqrt{2}g}$                       (c)  $\frac{mv^3}{\sqrt{2}g}$                       (d)  $m^2\sqrt{2gh^3}$
5. Ten one rupees coins are put on top of each of on a table. Each coin has a mass ' $m$ ' kg, then force on the 7<sup>th</sup> coin (counted from the bottom) due to all the coins on its top is :
- (a)  $3mg$                       (b)  $7mg$                       (c)  $2mg$                       (d)  $5mg$
6. A block of mass  $2kg$  is placed on the floor. The coefficient of static friction is  $0.4$ . Force of  $2.8N$  is applied on the block. The force of friction between the block and the floor is
- (a)  $2.8N$                       (b)  $8N$                       (c)  $2.0N$                       (d) zero
7. The force required to just move a body up the inclined plane is double the force required to just prevent the body from sliding down the plane. The coefficient of friction is  $\mu$ . The inclination  $\theta$  of the plane is :
- (a)  $\tan^{-1}(\mu)$                       (b)  $\tan^{-1}(\mu/2)$                       (c)  $\tan^{-1}(2\mu)$                       (d)  $\tan^{-1}(3\mu)$

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8. As shown in figure, monkey of  $20\text{kg}$  mass is holding a light rope that passes over a frictionless pulley. A bunch of bananas of the same mass is tied to the other end of rope. In order to get access to the bunch of bananas the monkey starts climbing the rope. The distance between the monkey and the bananas is :



- (a) Decreasing                      (b) Increasing  
(c) Unchanged                      (d) Nothing can be stated
9. The atmospheric pressure and height of barometer column are  $10^5 P$  and  $760\text{ mm}$  respectively on the earth surface. If the barometer is taken to moon then column height will be :
- (a) zero                                  (b)  $76\text{ mm}$   
(c)  $126.6\text{ mm}$                       (d)  $760\text{ mm}$
10. If two bodies of mass  $M$  and  $m$  are revolving around the centre of mass of the system in circular orbit of radii  $R$  and  $r$  respectively due to mutual interaction. Which of the following formula is applicable :

(a)  $\frac{GMm}{(R+r)^2} = m\omega^2 r$     (b)  $\frac{GMm}{R^2} = m\omega^2 r$     (c)  $\frac{GMm}{r^2} = m\omega^2 R$     (d)  $\frac{GMm}{R^2 + r^2} = m\omega^2 r$

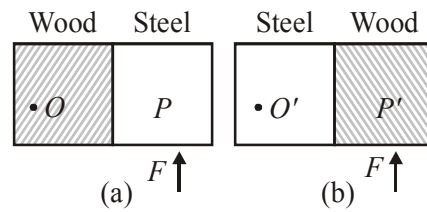
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11. Two artificial satellites of masses  $m_1$  and  $m_2$  are moving with speeds  $v_1$  and  $v_2$  in orbits of radii  $r_1$  and  $r_2$  respectively. If  $r_1 > r_2$  then which of the following statements is true :

- (a)  $v_1 = v_2$                       (b)  $v_1 > v_2$                       (c)  $v_1 < v_2$                       (d)  $v_1 / r_1 = v_2 / r_2$

12. In the fig.(a) half of the meter scale is made of wood while the other half of steel. The wooden part is pivoted at  $O$ . A force  $F$  is applied at the end of steel part. In figure (b) the steel part is pivoted at  $O'$  and the same force is applied at the wooden end :



- (a) More angular acceleration will be produced in (a)  
 (b) More angular acceleration will be produced in (b)  
 (c) Same angular acceleration will be produced in both conditions  
 (d) Information is incomplete

13. The equation of motion of a particle executing SHM is  $\left(\frac{d^2x}{dt^2}\right) + kx = 0$ . The time period of the particle will be :

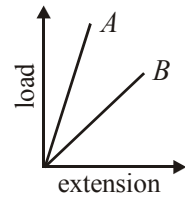
- (a)  $2\pi / \sqrt{k}$                       (b)  $2\pi / k$                       (c)  $2\pi k$                       (d)  $2\pi \sqrt{k}$

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14. A particle executes SHM of type  $x = a \sin \omega t$ . It takes time  $t_1$  from  $x = 0$  to  $x = \frac{a}{2}$  and  $t_2$  from  $x = \frac{a}{2}$  to  $x = a$ . The ratio of  $t_1 : t_2$  will be
- (a) 1:1                      (b) 1:2                      (c) 1:3                      (d) 2:1
15. The maximum velocity and maximum acceleration of a particle in SHM are  $100 \text{ cm/sec}$  and  $157 \text{ cm/sec}^2$  respectively. The time period will be :
- (a) 0.25 seconds      (b) 1.57 seconds      (c) 4 seconds      (d) 1 seconds
16. The dimensions of two wires  $A$  and  $B$  are the same. But their materials are different. Their load extension graphs are shown. If  $Y_A$  and  $Y_B$  are the values of Young's modulus of elasticity of  $A$  and  $B$  respectively then
- (a)  $Y_A > Y_B$                       (b)  $Y_A < Y_B$   
(c)  $Y_A = Y_B$                       (d)  $Y_B = 2Y_A$

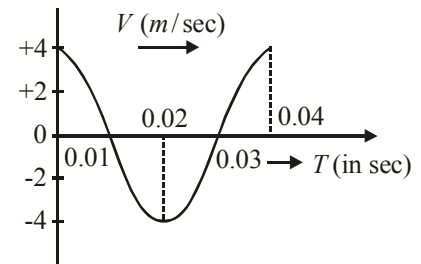


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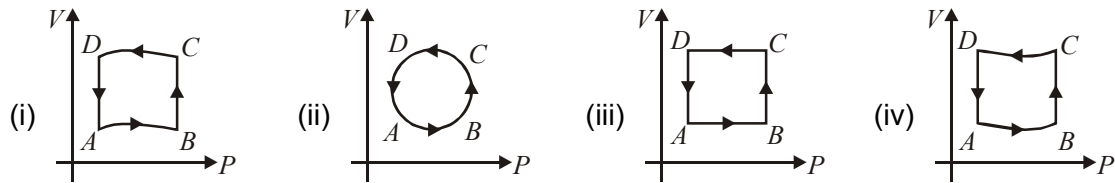
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17. The velocity time diagram of a harmonic oscillator is shown in the adjoining figure. The frequency of oscillation is :

- (a) 25 Hz                      (b) 50 Hz  
 (c) 12.25 Hz                (d) 33.3 Hz



18. In the diagrams (i) to (iv) of variation of volume with changing pressure is shown. A gas is taken along the path ABCDA. The change in internal energy of the gas will be :

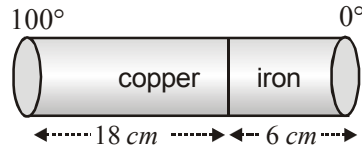


- (a) Positive in all cases (i) to (iv)  
 (b) Positive in cases (i), (ii) and (iii)  
 (c) Negative in cases (i), (ii) and (iii) but zero in case (iv)  
 (d) Zero in all the four cases

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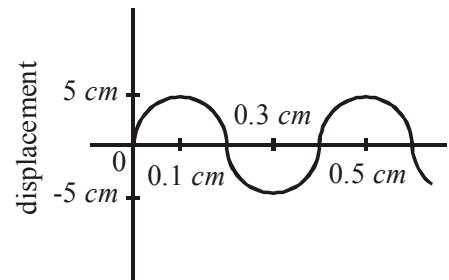
**Set - A**

19. The coefficient of thermal conductivity of copper is nine times that of steel. In the composite cylindrical bar shown in the figure what will be the temperature at the junction of copper and steel?



- (a)  $75^{\circ}\text{C}$                       (b)  $67^{\circ}\text{C}$                       (c)  $33^{\circ}\text{C}$                       (d)  $25^{\circ}\text{C}$
20. Figure shows the shape of a part of a long string . Wave pulse is produced by attaching one end of string to a tuning fork of frequency  $250\text{ Hz}$  . What is the velocity of the waves ?

- (a)  $1\text{ ms}^{-1}$                       (b)  $1.5\text{ ms}^{-1}$   
(c)  $2.0^{-1}$                       (d)  $2.5\text{ ms}^{-1}$



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## PART - II

## CHEMISTRY

21. The number of electrons having  $(n \times l \times m) = 0$  in  $\text{Na}^{\oplus}$  is :  
(a) 2 (b) 4 (c) 6 (d) 7
22. The frequency of radiation emitted when the electron falls from  $n = 4$  to  $n = 1$  in a hydrogen atom will be. (Given  $h = 6.625 \times 10^{-34}$  Js) :-  
(a)  $3.08 \times 10^{15} \text{ s}^{-1}$  (b)  $2.00 \times 10^{16} \text{ s}^{-1}$  (c)  $1.54 \times 10^{17} \text{ s}^{-1}$  (d)  $1.03 \times 10^{14} \text{ s}^{-1}$
23. The volumes of 4 N HCl and 10 N HCl required to make 1 litre of 6 N HCl are :-  
(a) 0.75 litre of 10 N HCl and 0.25 litre of 4 N HCl  
(b) 0.25 litre of 4 N HCl and 0.75 litre of 10 N HCl  
(c) 0.67 litre of 4 N HCl and 0.33 litre of 10 N HCl  
(d) 0.80 litre of 4 N HCl and 0.20 litre of 10 N HCl
24. In  $\text{ClO}_2$  unpaired  $e^{\ominus}$  reside in :-  
(a)  $sp^2$  hybridised orbital (b)  $sp^3$  hybridised orbital  
(c) p orbital (d) d orbital
25. Which of the following molecule/ion does not exist.  
(a)  $\text{PCl}_6^{\ominus}$  (b)  $\text{ICl}_3$  (c)  $\text{BF}_4^{\ominus}$  (d)  $\text{XeF}_3^{\ominus}$

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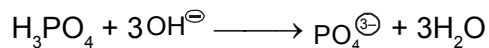
**Set - A**

26. The oxidation state of S in  $\text{Na}_2\text{S}_4\text{O}_6$  is :-
- (a) + 2.5  
(b) + 2 and +3 (two S have +2 and two S have +3)  
(c) + 2 and +3 (three S have +2 and one S has +3)  
(d) + 5 and 0 (two S have +5 and the other two S have 0)
27. The number of electrons required to **balance** the following equation –
- $$\text{NO}_3^- + 4\text{H}^+ + e^- \longrightarrow 2\text{H}_2\text{O} + \text{NO}$$
- (a) 5                      (b) 4                      (c) 3                      (d) 2
28. Which of the following equations is a **balanced** one –
- (a)  $5\text{BiO}_3^- + 22\text{H}^+ + \text{Mn}^{2+} \longrightarrow 5\text{Bi}^{3+} + 7\text{H}_2\text{O} + \text{MnO}_4^-$   
(b)  $5\text{BiO}_3^- + 14\text{H}^+ + 2\text{Mn}^{2+} \longrightarrow 5\text{Bi}^{3+} + 7\text{H}_2\text{O} + 2\text{MnO}_4^-$   
(c)  $2\text{BiO}_3^- + 4\text{H}^+ + \text{Mn}^{2+} \longrightarrow 2\text{Bi}^{3+} + 2\text{H}_2\text{O} + \text{MnO}_4^-$   
(d)  $6\text{BiO}_3^- + 12\text{H}^+ + 3\text{Mn}^{2+} \longrightarrow 6\text{Bi}^{3+} + 6\text{H}_2\text{O} + 3\text{MnO}_4^-$

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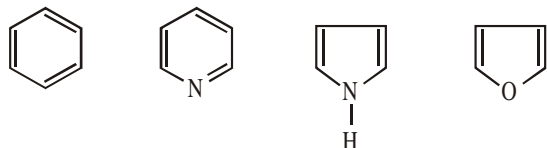
**SPACE FOR ROUGH WORK**

29. Equivalent wt. of  $\text{H}_3\text{PO}_4$  in each of the reaction **will** be respectively –



- (a) 98, 49, 32.67      (b) 49, 98, 32.67      (c) 98, 32.67, 49      (d) 32.67, 49, 98

30. Arrange the following molecules in **increasing** order of  $\sigma$  to  $\pi$  bond ratio

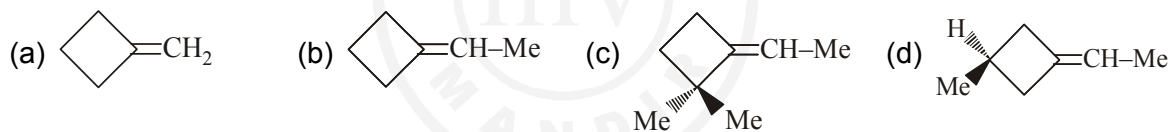


- (I)                      (II)                      (III)                      (IV)  
 (a) I < II < III < IV      (b) I < II < IV < III      (c) II < I < IV < III      (d) IV < II < I < III

31. Which of the following is **anti-aromatic** compound.



32. Which one of the following is **can** show geometrical isomersim.



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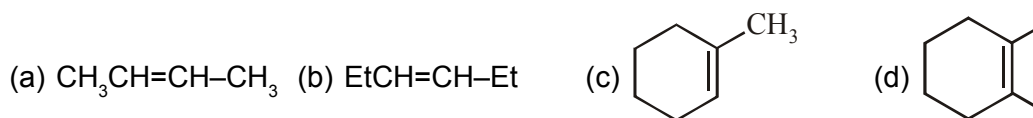
**Set - A**

33. At 27°C, 1 mol gas is allowed to expand reversibly and adiabatically then the final temperature of the system becomes 100 K. If  $C_v = 2.5 \text{ J/mol K}$  then calculate  $\Delta E$  for this?  
(a) – 2000 J/mol      (b) – 2500 J/mol      (c) – 500 J/mol      (d) zero
34. In the following solutions, the concentration of different acids are given, which **mixture** of the acid has highest pH :  
(a)  $\frac{M}{10} \text{ H}_2\text{SO}_4, \frac{M}{20} \text{ HNO}_3, \frac{M}{10} \text{ HClO}_4$       (b)  $\frac{M}{20} \text{ H}_2\text{SO}_4, \frac{M}{10} \text{ HNO}_3, \frac{M}{20} \text{ HClO}_4$   
(c)  $\frac{M}{20} \text{ H}_2\text{SO}_4, \frac{M}{10} \text{ HNO}_3, \frac{M}{40} \text{ HClO}_4$       (d)  $\frac{M}{20} \text{ H}_2\text{SO}_4, \frac{M}{5} \text{ HNO}_3, \frac{M}{5} \text{ HClO}_4$
35. Aluminium is extracted from alumina ( $\text{Al}_2\text{O}_3$ ) by electrolysis of a molten **mixture** of :-  
(a)  $\text{Al}_2\text{O}_3 + \text{HF} + \text{NaAlF}_4$       (b)  $\text{Al}_2\text{O}_3 + \text{CaF}_2 + \text{NaAlF}_4$   
(c)  $\text{Al}_2\text{O}_3 + \text{Na}_3\text{AlF}_6 + \text{CaF}_2$       (d)  $\text{Al}_2\text{O}_3 + \text{KF} + \text{Na}_3\text{AlF}_6$
36. Which of the following is **paramagnetic** :-  
(a)  $\text{Ni}^{++}$       (b)  $\text{Cu}^{\oplus}$       (c)  $\text{Zn}^{++}$       (d)  $\text{Sc}^{+++}$
37.  $\text{C}_4\text{H}_9\text{Cl}$  (A)  $\xrightarrow[\text{ether}]{\text{Na}}$   $\begin{array}{c} \text{H}_3\text{C} \\ \diagdown \\ \text{CH} \\ \diagup \\ \text{H}_3\text{C} \end{array} - \text{CH}_2 - \text{CH}_2 - \begin{array}{c} \text{CH} \\ \diagup \\ \text{CH}_3 \\ \diagdown \\ \text{CH}_3 \end{array}$  ; (A)  $\xrightarrow[\text{KOH}]{\text{alcoholic}}$  (B) ; (B) is -  
(a) 1-butene      (b) cis but-2-ene      (c) isobutene      (d) trans but-2-ene

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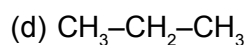
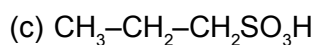
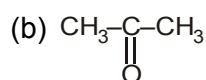
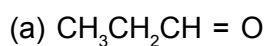
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38. Which compound on oxidative ozonolysis gives acetic acid ( $\text{CH}_3\text{CO}_2\text{H}$ ) as organic product?



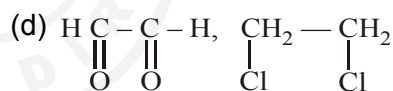
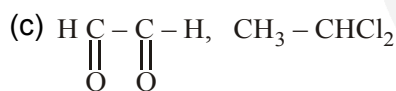
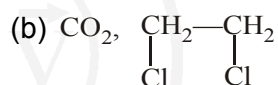
39. Propyne  $\xrightarrow{\text{HgSO}_4+\text{H}_2\text{SO}_4(1\%)} \text{Product (P)}$ ;

(P) is -



40.  $\text{(Y)} \xleftarrow[\text{excess}]{\text{HCl}} \text{HC}\equiv\text{CH} \xrightarrow[\text{Zn/H}_2\text{O}]{\text{O}_3} \text{(X)}$ .

(X), (Y) are -



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**PART - III****BIOLOGY**

41. Five kingdom system of classification suggested by R.H. Whittaker is **not** based on
- (a) Mode of reproduction (b) Mode of nutrition  
(c) Complexity of body organisation (d) Presence or absence of a wall defined nucleus
42. You are given a fairly old piece of dicot stem and a dicot root. Which of the following anatomical structures will you use to distinguish between the two?
- (a) Secondary phloem (b) Protoxylem  
(c) Cortical cells (d) Secondary xylem
43. The osmotic expansion of a cell kept in water is chiefly regulated by :
- (a) Vacuoles (b) Plastids (c) Ribosomes (d) Mitochondria
44. A few normal seedling of tomato were kept in a dark room. After a few days they were found to have become white-coloured like albinos. Which of the following terms will you use to describe them?
- (a) Embolised (b) Etiolated (c) Defoliated (d) Mutated
45. An aggregate fruit is one which develops from:
- (a) Multicarpellary apocarpus gynoecium (b) Complete inflorescence  
(c) Multicarpellary superior ovary (d) Multicarpellary syncarpous gynoecium

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46. Besides paddy fields, cyanobacteria are also found inside vegetative part of :  
(a) *Cycas*                      (b) *equisetum*                      (c) *psilotum*                      (d) *pinus*
47. In china rose the flower are :  
(a) Actinomorphic, epigynous with valvate aestivation  
(b) Zygomorphic, hypogynous with imbricate aestivation  
(c) Zygomorphic, epigynous with twisted aestivation  
(d) Actinomorphic, hypogynous with twisted aestivation
48. Seed coat is not thin, membranous in  
(a) Coconut                      (b) Groundnut                      (c) Gram                      (d) Maize
49. Pigment - containing membranous extensions in some cyanobacteria are :  
(a) Basal bodies                      (b) Pneumatophores                      (c) Chromatophores                      (d) Heterocysts
50. The pigment which absorbs red and far-red light as :  
(a) Phytochrome                      (b) Xanthophyll                      (c) Cytochrome                      (d) Carotene
51. Permeability of plasma membrane is accelerated by :  
(a) *K*                      (b) *Ca*                      (c) *Na*                      (d) Phosphorus

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**SPACE FOR ROUGH WORK**

**Set - A**

52. Choose the correct match :
- (a) Bladderwort - *Utricularia*  
(b) Sun dew plant - *Dionaea*  
(c) Pitcher plant - *Drosera*  
(d) Venus fly trap - *Nepenthes*
53. Metameric segmentation is the characteristic of
- (a) Mollusca and Chordata (b) Annelida and Arthropoda  
(c) Echinodermata and Annelida (d) Platyhelminthes and Arthropoda
54. Which of the following is required for the development of erythrocytes ?
- (a) Vitamin A (b) Vitamin B<sub>12</sub> (c) Vitamin E (d) Vitamin K
55. After deep inspiration, maximum expiration of lungs is called :
- (a) Vital capacity (b) Total lung capacity  
(c) Inspiratory capacity (d) Functional residual capacity
56. Which of the following amino acids are present in ornithine cycle ?
- (a) Valine and cysteine (b) Alanine and arginine  
(c) Arginine and citrulline (d) Glycine and methionine

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57. The cells lining the blood vessels belong to the category of  
(a) Columnar epithelium (b) Connective tissue  
(c) Smooth muscle tissue (d) Squamous epithelium
58. In allergic reaction which is secreted  
(a) Histamine (b) Neutrophil (c) Basophil (d) Acidophil
59. Inter-auricular septum in the embryonic stages has a / an  
(a) Foramen ovale (b) Fenestra ovalis  
(c) Fenestra rotunda (d) Inter-auricular aperture
60. Blood-brain barrier is formed by  
(a) Microglial cells (b) Astrocytes  
(c) Oligodendrocytes (d) Ependymal cells

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