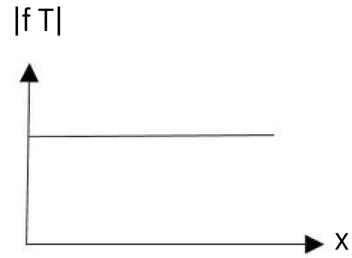
PHYSICS

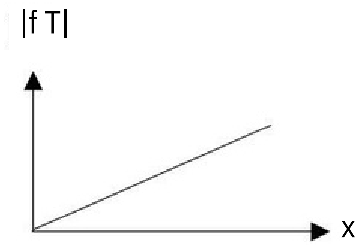
Category-1 (Q. 1 to 30)

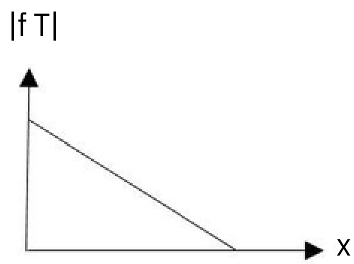
(Carry 1 mark each. Only one option is correct. Negative marks : – ¼)

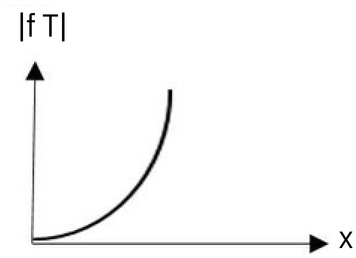
1. In a simple harmonic motion, let f be the acceleration and T be the time period. If x denotes the displacement, then |f T| vs. x graph will look like,

HL¢V plm c¡mN¢al rœ f q'm alÆZ J T q'm fk¡ÑuL¡m z k¢c x qu plZ ah |f T| he¡j x mM¢Qœ¢V qh,

(A) 

(B) 

(C) 

(D) 

2. The displacement of a plane progressive wave in a medium, travelling towards positive x-axis with velocity 4 m/s at t = 0 is given by y = 3 sin 2 □□ $\frac{x}{3}$ □

the displacement at a later time t = 4 sec will be

HL¢V j¡dÉj de¡aÈL x-Ar A¢ij¤M 4 m/s hN N¢an£m HL¢V pjam Qmal‰l t = 0 pju plZl pj£LlZ y = 3 s in 2 □□ $\frac{x}{3}$ □ z a¡qm t = 4 pL™ pju plZl l¡¢n¢V qh,

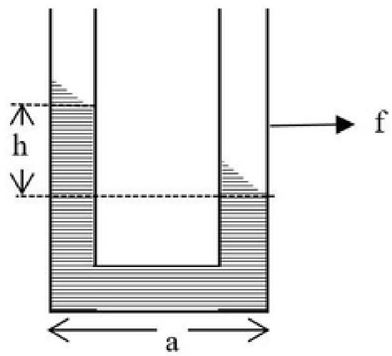
(A) y = 3 sin 2□ □ $\frac{x □16}{3}$ □

(B) y = 3 sin 2□ □ $\frac{x □16}{3}$ □

(C) y = 3 sin 2□ □ $\frac{□1}{3}$ □ x □

(D) y = 3 sin 2□ □ $\frac{□1}{3}$ □ x □

3. As shown in the figure, a liquid is at same levels in two arms of a U-tube of uniform cross-section when at rest. If the U-tube moves with an acceleration 'f' towards right, the difference between liquid heights between two arms of the U-tube will be, (acceleration due to gravity = g)



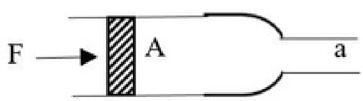
¢Qœ fcË¢naÑ ¢ÙlÛ AhÙ¡Ûu pjfÙËÛµRckš¤² -eml c¢¤V h¡ýa HL¢V alm pj¡e EµQa¡u b¡L z k¢c -em¢V alÆZ 'f' X¡e¢cL N¢an£m qu ah U-eml cC¤ h¡ýl alml EµQa¡l f¡bÑLÉ qh, (A¢iLoSÑ alÆZ = g)

(A) $\frac{f}{g}a$ (B) $\frac{g}{f}a$ (C) a (D) 0

4. Six molecules of an ideal gas have velocities 1, 3, 5, 5, 6 and 5 m/s respectively. At any given temperature, if $\bar{V}$ and V_{rms} represent average and rms speed of the molecules, then

HL¢V Bcn ÑNÉ¡pl Ru¢V AZl¤ hN kb¡œ²j 1, 3, 5, 5, 6 J 5 m/s z k¢c V J rms L¡e ¢e¢cøÑ a¡fj¡œ¡u AZ…¤¢ml NshN J rms hN h¡T¡u ah,

(A) $\bar{V} = 5$ m/s (B) $V_{rms} > \bar{V}$ (C) V_{rms}^2 □ $\bar{V}^2$ (D) $V_{rms} = \bar{V}$

5. 

As shown in the figure, a pump is designed as horizontal cylinder with a piston having area A and an outlet orifice having an area 'a'. The piston moves with a constant velocity under the action of force F. If the density of the liquid is ρ, then the speed of the liquid emerging from the orifice is, (assume A >> a)

¢Qœ fcË¢naÑ HL¢V f¡Çf Aeï¨¤¢jL Q¡Pl BL¡l N¢Wa k¡l ¢føel fÙËÛµRcl rœgm J A ¢eNjÑe j¤Ml fÙËÛµRcl rœgm 'a' z HL¢V ¢ÙlÛ hm F-Hl fËu¡N ¢føe¢V ¢ÙlÛ hN ANpËl qu z alml Oea Æk¢c ρ qu ah f¡Çfl jM¤ bL ¢eNaÑ alml hN qh (dl e¡J A >> a),

(A) $\sqrt{\frac{F}{\rho A}}$ (B) $\frac{a}{A}\sqrt{\frac{F}{\rho A}}$ (C) $\sqrt{\frac{2F}{\rho A}}$ (D) $\frac{A}{a}\sqrt{\frac{2F}{\rho A}}$

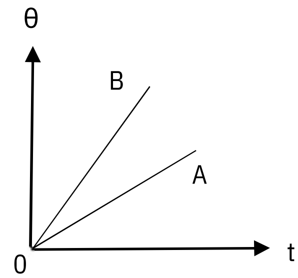
6. Two substances A and B of same mass are heated at constant rate. The variation of temperature θ of the substances with time t is shown in the figure. Choose the correct statement.

(A) Specific heat of A is greater than that of B.

(B) Specific heat of B is greater than that of A.

(C) Both have same specific heat.

(D) None of the above is true.



HLC ill c¢¤V fc¡b ÑA J B L HLC q¡l Ešç Ll¡ quR z pju (t)-Hl p¡b a¡fj¡œ¡ (θ)-Hl f¢lhaeÑ ¢Qœ cM¡e¡ quR z prœ p¢WL E¢š²¢V ¢eh¡ÑQe Ll z

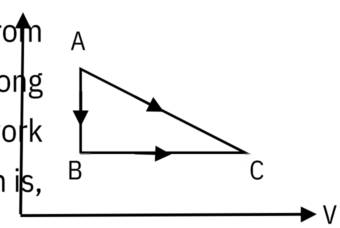
(A) B-Hl Qu A-Hl Bf¢rL a¡f h¢n z

(B) A-Hl Qu B-Hl Bf¢rL a¡f h¢n z

(C) c¢¤V fc¡blÑC Bf¢rL a¡f pj¡e z

(D) Efll L¡e¡ E¢š²C p¢WL eu z

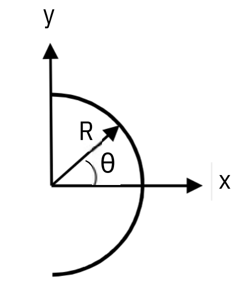
7. A given quantity of gas is taken from A to C in two ways; a) directly from A → C along a straight line and b) in two steps, from A → B and then from B → C. Work done and heat absorbed along the direct path A→C is 200 J and 280 J respectively. If the work done along A→B→C is 80 J, then heat absorbed along this path is,



HL¢V ¢e¢cøÑ f¢lj¡Z NÉ¡pL A b C AhÙ¡Ûe cC¤ i¡h ¢eu k¡Ju¡ q'm, a) A → C plm lM¡ hl¡hl J) J HC c¢B d¡f z fb A→C L¡kÉÑ J n¡¢oa a¡f kb¡œ²j 200 J J z 280 J z A→B→C L¡kÉÑ 80 J qu ah I fb n¡¢oa a¡f qh,

(A) 80 J (B) 0 (C) 160 J (D) 120 J

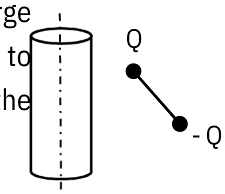
8. A thin glass rod is bent in a semicircle of radius R. A charge is non-uniformly distributed along the rod with a linear charge density □□□ 0sin□ (□0 is a positive constant). The electric field at the centre P of the semicircle is,



ĦL¢V pl¦ Ly¡Ql c™L hÉ¡p¡dlÑ AdÑhš^a¡L¡l h¡yL¡e¡ q'm z c™¢Va Apj ¢hÙa¹« Bd¡e kš¤² BR k¡l °l¢ML Oea Æq'm □ □ □0sin□ (□0 HL¢V de¡aÈL dËh¤L) z prœ AdhÑ^ašl L¾c ÊP-a a¢sv rœl j¡e qh,

(A) $-\frac{□_o}{8□□_o R}\hat{j}$ (B) $\frac{□_o}{8□□_o R}\hat{j}$ (C) $\frac{□_o}{8□□_o R}\hat{i}$ (D) $-\frac{□_o}{8□□_o R}\hat{i}$

9. Consider a positively charged infinite cylinder with uniform volume charge density ρ > 0. An electric dipole consisting of + Q and - Q charges attached to opposite ends of a massless rod is oriented as shown in the figure. At the instant as shown in the figure, the dipole will experience,



(A) a force to the left and no torque.

(B) a force to the right and a clockwise torque.

(C) a force to the right and a counter clockwise torque.

(D) no force but only a clockwise torque.

je Ll de¡aÈL Bd¡ekš¤² HL¢V A¢a c£OÑ Q¡Pl Bua¢eL Bd¡e OeaÆ ρ > 0 z Bh¡l HL¢V ilq£e c™l cC¤ f¡Ë¿ ¹+ Q J - Q Bd¡e kš¤² HL¢V a¢sv ¢àjl¦ ¢Qœ fcË¢naÑ A¢ij¤M l¡M¡ BR z ¢Qœ fcË¢naÑ jq¨¤a Ña¢sv ¢àjl¦¢Vl Efl ¢œ²u¡ Llh,

(A) h¡j A¢ij¤M HL¢V hm ¢L¿ ¹¥L¡e¡ ïjjL eu z

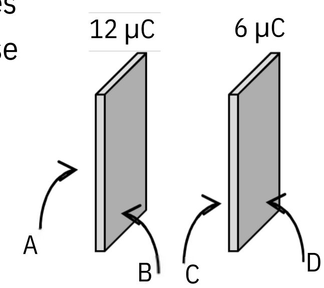
(B) X¡e A¢ij¤M HL¢V hm J O¢sl Ly¡V¡l A¢ij¤M HL¢V ïjjL z

(C) X¡e A¢ij¤M HL¢V hm J O¢sl Ly¡V¡l ¢hfl£a A¢ij¤M HL¢V ïjjL z

(D) L¡e hm eu, öd ¤O¢sl L¡yV¡l A¢ij¤M HL¢V ïjjL z

10. 12 μC and 6 μC charges are given to the two conducting plates having same cross-sectional area and placed face to face close to each other as shown in the figure. The resulting charge distribution in μC on surfaces A, B, C and D are respectively,

¢Qœ fcË¢naÑ HLC fÙËÛµRc kš¤² c¢¤V f¢lh¡g£ f¡aL kb¡œ²j 12 μC J 6 μC Bd¡e cJu¡ q'm Hhw Mh¤ L¡R¡L¡¢R j¤M¡j¤¢M l¡M¡ q'm z prœ A, B, C J D fªù h¢¸Va Bd¡el j¡e (μC HLL) qh kb¡œ²j,



(A) 9, 3, – 3, 9 (B) 3, 9, – 9, 3 (C) 6, 6, – 6, 12 (D) 6, 6, 3, 3

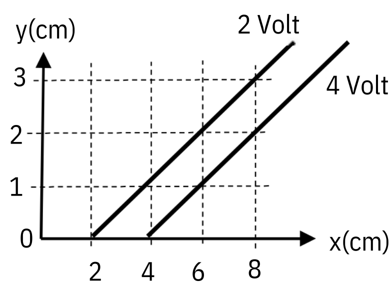
11. A wire carrying a steady current I is kept in the x-y plane along the curve $y = A\sin\left(\frac{2\pi}{\lambda}x\right)$. A magnetic field B exists in the z-direction. The magnitude of the magnetic force in the portion of the wire between x = 0 and x = λ is

¢ÙlÛ a¢svfhË¡q kš¤² HL¢V pl¦ a¡lL x-y am-H $y = A\sin\left(\frac{2\pi}{\lambda}x\right)$ œ²lM¡ hl¡hl l¡M¡ q'm z Ù¡Ûœ-Ar A¢ij¤M HL¢V Q±ðL rœ ¢œ²u¡ Ll z a¡qm a¡l¢Vl J -Hl jdÉha£ Ñ x = 0 x = λ Awnl Efl k Q±ðL hm ¢œ²u¡ Ll a¡l j¡e q'm,

(A) 0 (B) 2IλB (C) IλB (D) IλB/2

12. The figure represents two equipotential lines in x-y plane for an electric field. The x-component E_x of the electric field in space between these equipotential lines is,

x-y am HL¢V a¢sarœl jdÉ c¢¤V pj¢hih lM¡ ¢Qœ cM¡e¡ quR z I c¢¤V lM¡l jdÉhaÑ£ Ù¡Ûe a¢svrœl x-Ef¡wn E_x-Hl j¡e q'm,



(A) 100 V/m (B) –100 V/m (C) 200 V/m (D) –200 V/m

13. An electric dipole of dipole moment $\vec{p}$ is placed at the origin of the co-ordinate system along the z-axis. The amount of work required to move a charge 'q' from the point (a, 0, 0) to the point (0, 0, a) is,

p ¢àjl¦ ïjjLl HL¢V a¢sv-¢àjl¦ L¡VSÑ£u ¢ecnÑa¿l» jm§¢h¾c¤a l¡M¡ BR z ¢àjl¦¢Vl A¢ijM¤ z-Ar hl¡hl z a¡qm HL¢V Bd¡'q' ¢h¾c ¤bL (a, 0, 0) ¢h¾c¤a ¢eu ka fËu¡Se£u La«L¡kÉÑ q'm,

(A) $\frac{pq}{4\pi\varepsilon_0 a}$ (B) 0 (C) $\frac{\sqrt{2}pq}{4\pi\varepsilon_0 a^2}$ (D) $\frac{pq}{4\pi\varepsilon_0 a^2}$

14. The electric field of a plane electromagnetic wave of wave number k and angular frequency ω is given by $\vec{E} = E_0(\hat{i} + \hat{j})\sin(kz - \omega t)$. Which of the following gives the direction of the associated magnetic field $\vec{B}$?

al‰ pwMÉ¡ k J ω ®L±¢ZL LÇf¡˜l HL¢V pjam a¢sv ®Q±ðL£u al‰l a¢svrœ $\vec{E} = E_0(\hat{i} + \hat{j})\sin(kz - \omega t)$ z a¡qm ¢eQl L¡e¢V Bep¤¢‰L Q±ðLrœ B-Hl ¢cL ¢ecnÑ Ll ?

(A) $\hat{k}$ (B) $-\hat{i} + \hat{j}$ (C) $-\hat{i} - \hat{j}$ (D) $\hat{i} - \hat{k}$

15. A charged particle in a uniform magnetic field $\vec{B} = B_0\hat{k}$ starts moving from the origin with velocity $v = 3\hat{i} + 4\hat{k}$ m/s. The trajectory of the particle and the time t at which it reaches 2 m above x-y plane are,

(A) Circular path, ½ sec. (B) Helical path, ½ sec.

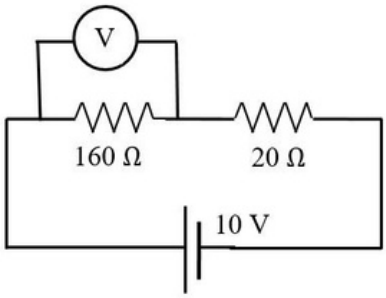
(C) Circular path, 2/3 sec. (D) Helical path, 2/3 sec.

po¤j a¢svrœ $\vec{B} = B_0\hat{k}$ -Hl jdÉ HL¢V B¢qa LZ¡ jm§¢h¾c ¤bL $v = 3\hat{i} + 4\hat{k}$ m/s hN Qma öl¦ Ll z LZ¡¢Vl Njefb J k pju t-a LZ¡¢V x-y-aml 2 m EµQa¡u f±Ryh a¡ q'm,

(A) hš ª¡L¡l fb, ½ pL™ (B) L™¥m¡¢ua fb, ½ pL™

(C) hš ª¡L¡l fb, 2/3 pL™ (D) L™¥m¡¢ua fb, 2/3 pL™

16. In an experiment on a circuit as shown in the figure, the voltmeter shows 8 V reading. The resistance of the voltmeter is,



¢Qœ fcË¢naÑ haeÑ£l fl£r¡u i¡ÒV¢jV¡l 8 V f¡W cu z a¡qm i¡ÒV¢jV¡ll l¡d La ?

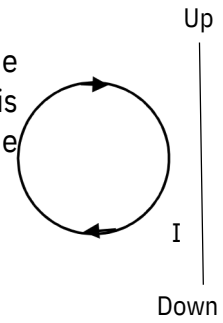
(A) 20 Ω (B) 320 Ω (C) 160 Ω (D) 1.44 k Ω

17. An interference pattern is obtained with two coherent sources of intensity ratio n:1. The ratio $\frac{I_{Max} - I_{Min}}{I_{Max} + I_{Min}}$ will be maximum if

f¡ËhmÉl Aef¤¡a n:1 ¢h¢nø c¤¢V pp¤wNa Evp à¡l¡ HL¢V hÉ¡¢aQ¡l f¢V N¢Wa q'm z prœ $\frac{I_{Max} - I_{Min}}{I_{Max} + I_{Min}}$ Aef¤¡a¢V ph¡ÑµQ qh kMe,

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

18. A circular coil is placed near a current carrying conductor, both lying on the plane of the paper. The current is flowing through the conductor in such a way that the induced current in the loop is clockwise as shown in the figure. The current in the wire is, (A) time dependent and downward.



(B) steady and upward.

(C) time dependent and upward.

(D) An alternating current.

HL¢V hš²¡L¡l L™¥m£L HL¢V a¢svh¡q£ f¢lh¡q£l L¡R l¡M¡ q'm; EiuC L¡NSl am Ah¢ÙaÛ z f¢lh¡q£l jdÉ ¢cu a¢sv Hje i¡h fhË¡¢qa qµR k L™¥m£a B¢hø a¢sv fhË¡ql A¢ijM¤ O¢sl L¡yV¡l ¢cL (¢Qœ fcË¢naÑ) z prœ f¢lh¡q£l jdÉ a¢svfhË¡q

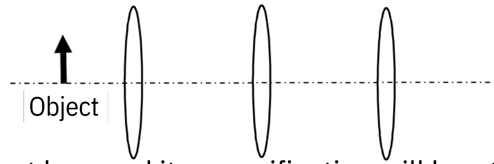
(A) pjul p¡b f¢lhaeÑn£m J ¢ejjÀM¤£

(B) FdÑjÄM¤£ J ¢ÙlÛfhË¡q

(C) pjul p¡b f¢lhaeÑn£m J FdjÑÄM¤£

(D) HL¢V f¢lha£Ñ a¢svfhË¡q

19. Three identical convex lenses each of focal length f are placed in a straight line separated by a distance f from each other. An object is located at f/2 in front of the leftmost lens. Then,

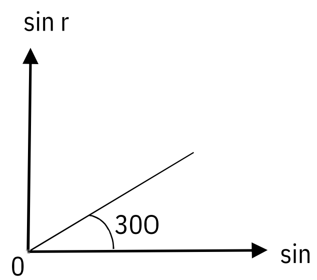


(A) Final image will be at f/2 behind the rightmost lens and its magnification will be −1.
(B) Final image will be at f/2 behind the rightmost lens and its magnification will be +1.
(C) Final image will be at f behind the rightmost lens and its magnification will be −1.
(D) Final image will be at f behind the rightmost lens and its magnification will be +1.

f g¡L¡p °cOÉÑl ¢ae¢V A¢iæ Ešm m¾pL HL¢V plm lM¡u HL Afl bL f cl§a ÄÙ¡Ûfe Ll¡ q'm z h¡y ¢cLl fbËj m¾p¢Vl p¡je f/2 cl§a ÄHL¢V hÙ ¹¥l¡M¡ q'm z prœ,

(A) A¢¿j¹ f¢Ëa¢hð¢V X¡e¢cLl no m¾pl ¢fRe f/2 c§la Äp¢ªø qh Hhw ¢hhdeÑ qh −1
(B) A¢¿j¹ f¢Ëa¢hð¢V X¡e¢cLl no m¾pl ¢fRe f/2 c§la Äp¢ªø qh Hhw ¢hhdeÑ qh +1
(C) A¢¿j¹ f¢Ëa¢hð¢V X¡e¢cLl no m¾pl ¢fRe f c§la Äp¢ªø qh Hhw ¢hhdeÑ qh −1
(D) A¢¿j¹ f¢Ëa¢hð¢V X¡e¢cLl no m¾pl ¢fRe f c§la Äp¢ªø qh Hhw ¢hhdÑe qh +1

20. A ray of monochromatic light is incident on the plane surface of separation between two media X and Y with angle of incidence ‘i’ in medium X and angle of refraction ‘r’ in medium Y. The given graph shows the relation between sin i and sin r. If V_X and V_Y are the velocities of the ray in media X and Y respectively, then which of the following is true ?



(A) $V_X = \frac{1}{\sqrt{3}} V_Y$
(B) $V_X = \sqrt{3} V_Y$
(C) Total internal reflection can happen when the light is incident in medium X.
(D) $\nu_X = \sqrt{3}\nu_Y$, where ν_X and ν_Y are frequencies of the light in medium X and Y respectively.

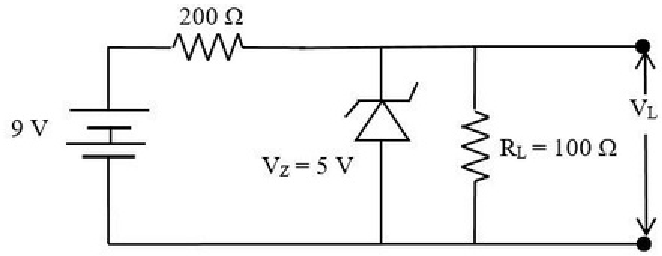
HL¢V HLhZ£Ñ Bm¡l l¢nÈ X J Y c¢¤V j¡dÉjl pjam ¢hµRc aml Efl Bf¢aa q'm, kM¡e X j¡dÉj Bfae L¡Z ‘i’ J Y j¡dÉj f¢Ëapla L¡Z ‘r’ z sin i J sin r-Hl jdÉ pÇfL Ñ¢Qœ cM¡e¡ quR z k¢c VX J VY kb¡œ²j X J Y j¡dÉj l¢nÈ¢Vl hN qu ah ¢eQl L¡e E¢š²¢V p¢WL ?

(A) $V_X = \frac{1}{\sqrt{3}} V_Y$
(B) $V_X = \sqrt{3} V_Y$
(C) l¢nÈ¢V X j¡dÉj Bf¢aa q'm BiÉ¿l¹£Z fZ§ Ñf¢Ëagme qa f¡l z
(D) $\nu_X = \sqrt{3}\nu_Y$, kM¡e νX J νY q'm kb¡œ²j X J Y j¡dÉj Bm¡Ll LÇf¡ˆ z

21. If the potential energy of a hydrogen atom in the first excited state is assumed to be zero, then the total energy of n = ∞ state is,

q¡CX¡ÊSe flj¡Zl¤ fbËj EŸ£¢fa Ù¹Il ¢Ù¢Ûan¢š² ne§É dlm n = ∞ Ù¹l j¡V n¢š² qh

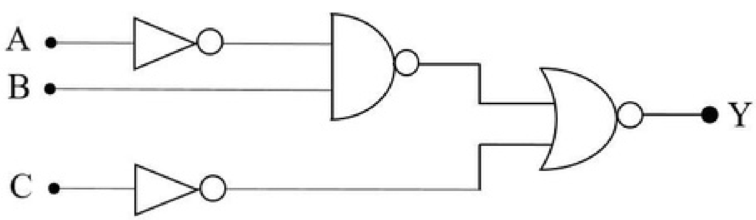
(A) 3.4 eV (B) 6.8 eV (C) 0 (D) ∞

22. 

In the given circuit, find the voltage drop V L in the load resistance RL.

fcËš haeÑ£a m¡X RL-H ¢hih fËic VL-Hl j¡e La ?

(A) 5 V (B) 3 V (C) 9 V (D) 6 V

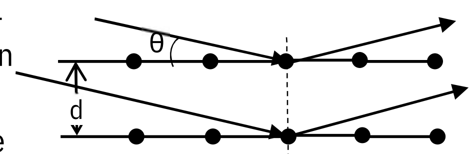
23. 

Consider the logic circuit with inputs A, B, C and output Y. How many combinations of A, B and C gives the output Y = 0 ?

CefV¤ A, B, C J BEVfV¤ Y-Hl fcËš haeÑ£¢V ¢hhQe¡ Ll z A, B J C -Hl La lLjl rœ Y = 0 qh ?

(A) 8 (B) 5 (C) 7 (D) 1

24. X-rays of wavelength λ gets reflected from parallel planes of atoms in a crystal with spacing d between two planes as shown in the figure. If the two reflected beams interfere constructively, then the condition for maxima will be, (n is the order of interference fringe)

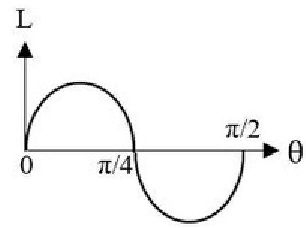


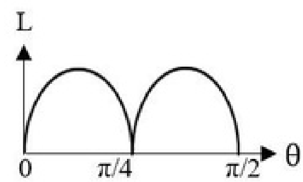
λ al‰°cOÉlÑ X-l¢nÈ HL¢V Lm¡pl pj¡¿l¹¡m c¤¢V am (k¡cl jdÉ cl§aÄ q'm d) bL f¢Ëag¢ma q'm z f¢Ëag¢ma l¢nÈc¤¢Vl NWejm§L hÉ¢aQ¡Il na Ñqh, (n q'm hÉ¢aQ¡l f¢Vl œ²j)

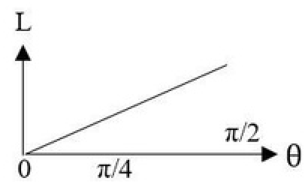
(A) d tan □ = n□ (B) d sin □ = n□ (C) 2d cos □ = n□ (D) 2d sin □ = n□

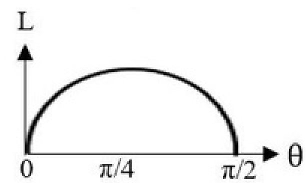
25. A particle of mass m is projected at a velocity u, making an angle θ with the horizontal (x-axis). If the angle of projection θ is varied keeping all other parameters same, then magnitude of angular momentum (L) at its maximum height about the point of projection varies with θ as,

m ill HL¢V hÙL1¥Z¡L u hN Aei¨¤¢jL (x-Arl) p‰ θ L¡Z fËrf Ll¡ q'm z AeÉ pjÙ 1 ¢LR ¥HLC lM k¢c öd ¤fËrfL¡Z θ f¢lhaeÑ Ll¡ qu ah I hÙL1¥Z¡l ph¡ÑµQ AhÙ¡Ûe fËrf ¢h¾cl¤ p¡fr L±¢ZL ilhNl (L) f¢lhaeÑ ¢eQl L¡e mM¢Qœ¢V à¡l¡ ¢ecnÑ Ll¡ k¡u ?

(A) 

(B) 

(C) 

(D) 

26. A body of mass 2 kg moves in a horizontal circular path of radius 5 m. At an instant, its speed is 2√5 m/s and is increasing at the rate of 3 m/s2. The magnitude of force acting on the body at that instant is,

2 kg ill HL¢V hÙ 1¥5 m hÉ¡p¡dlÑ Aei¨¤¢jL hšª¡L¡l fb Ol¤R z L¡e¡ HL jö¨¤a ÑhÙ¢1¥Vl â¢¤a 2√5 m/s Hhw I â¢¤a 3 m/s2 q¡l h¢ªÜ f¡µR z I jq¨¤ä ÑhÙ¢1¥Vl Efl ¢œ2u¡la hml j¡e q'm,

(A) 6 N (B) 8 N (C) 14 N (D) 10 N

27. In an experiment, the length of an object is measured to be 6.50 cm. This measured value can be written as 0.0650 m. The number of significant figures on 0.0650 m is

HL¢V fl£r¡u HL¢V hÙl1¥ °cOÉÑ jf f¡Ju¡ Nm 6.50 cm z f¢lj¡fl j¡e¢Vl HLL f¢lhaeÑ Ll mM¡ k¡u 0.0650 m z 0.0650 m-H a¡vfkfÑZ§ ÑAp^wMÉ¡ q'm

(A) 3 (B) 4 (C) 2 (D) 5

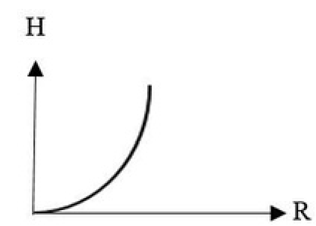
28. A mouse of mass m jumps on the outside edge of a rotating ceiling fan of moment of inertia I and radius R. The fractional loss of angular velocity of the fan as a result is,

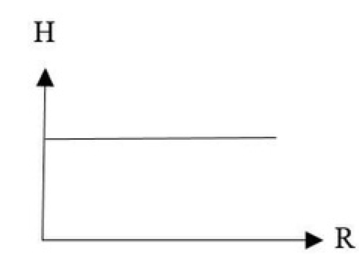
m ill HL¢V Ccyl¤ R hÉ¡p¡d ÑJ±S¡XÉï¡jL ¢h¢nø HL¢V OZ¤¡Ñuj¡e ¢p¢mw gÉ¡el h¢qxf¡Ë¿ ¹m¡g ¢cu EWm z a¡qm gÉ¡e¢Vl L±¢ZL hNl Bw¢nL q¡Êp La qh ?

(A) $\frac{mR2}{I\square mR2}$ (B) $\frac{I}{I\square mR2}$ (C) $\frac{I\square mR2}{I}$ (D) $\frac{I\ \square mR2}{I\square mR2}$

29. Acceleration due to gravity at a height H from the surface of a planet is the same as that at a depth of H below the surface. If R be the radius of the planet, then H vs. R graph for different planets will be,

HL¢V NËql fù^a bL H EµQa¡u J HLC Ni£la¡u A¢iLoSÑ alÄZl j¡e pj¡e z NqË¢Vl hÉ¡p¡dÑ k¢c R qu ah ¢h¢iæ NËql SeÉ H he¡j R mM¢Qœ¢V qh,

(A)


(B)


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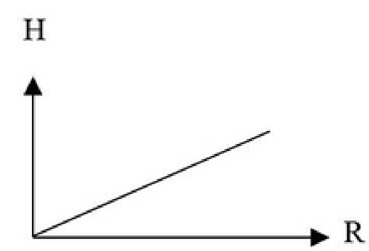

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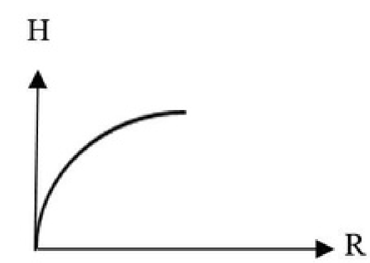


30. A uniform rope of length 4 m and mass 0.4 kg is held on a frictionless table in such a way that 0.6 m of the rope is hanging over the edge. The work done to pull the hanging part of the rope on to the table is, (Assume g = 10 m/s2)

0.4 kg ill J 4 m °cOÉlÑ HL¢V c¢sL HL¢V OoZÑ ¢hq£e V¢hml Efl Hje i¡h l¡M¡ BR k c¢s¢Vl 0.6 m Awn V¢hml h¡Cl Tm¥R z c¢s¢VL V¢hml Efl Ve am¥a La L¡kÉÑ Lla qh ? (dl e¡J g = 10 m/s2)

(A) 0.36 J (B) 0.24 J (C) 0.12 J (D) 0.18 J

Category-2 (Q. 31 to 35)
(Carry 2 marks each. Only one option is correct. Negative marks : – ½)

31. There are n elastic balls placed on a smooth horizontal plane. The masses of the balls are $m, \frac{m}{2}, \frac{m}{2^2}, \ldots, \frac{m}{2^{n-1}}$ respectively. If the first ball hits the second ball with velocity v_0, then the velocity of the nth ball will be,

HL¢V jpZª Aei¨¤¢jL aml Efl n pwMÉL ¢Ù¢ÛaÙÛ¡fL hm l¡M¡ q'm z hm…¢ml il kb¡œ²j $m, \frac{m}{2}, \frac{m}{2^2}, \ldots, \frac{m}{2^{n-1}}$ z fbËj hm¢V k¢c ¢àa£u hmL v_0 hN A¡O¡a Ll a¡qm -aj hml hN qh,

(A) $\frac{4}{3} v_0$ (B) $\left(\frac{4}{3}\right)^n v_0$ (C) $\left(\frac{4}{3}\right)^{n-1} v_0$ (D) v_0

32. An earth's satellite near the surface of the earth takes about 90 min per revolution. A satellite orbiting the moon also takes about 90 min per revolution. Then which of the following is true ?

(A) ρm < ρe

(B) ρm > ρe

(C) ρm = ρe

(D) No conclusion can be made about the densities.

[where ρm is density of the moon and ρe is density of the earth.]

f¢ªbh£ fªùl L¡R¡L¡¢R HL¢V EfNqÊ 90 min-H HLh¡l f¢ªbh£L fcË¢rZ Ll z Q¾cfÊªùl L¡R¡L¡¢R HL¢V EfNqÊJ 90 min-H HLh¡l Q¾cÊL fcË¢rZ Ll z prœ ¢eQl L¡e¢V p¢WL ?

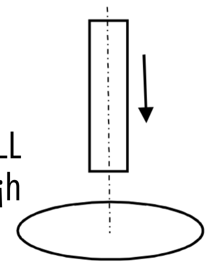
(A) ρm < ρe (B) ρm > ρe (C) ρm = ρe

(D) Oea ÄpÇfL ÑL¡e¡ Efpwq¡l Ll¡ pñh eu z

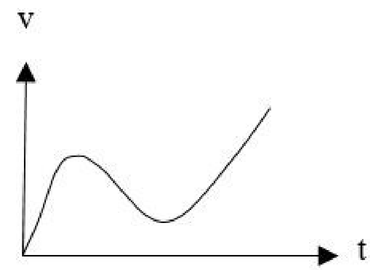
[kM¡e ρm q'm Q¾clÊ Oea ÄJ ρe q'm f¢ªbh£l OeaÄ z

33. A bar magnet falls from rest under gravity through the centre of a horizontal ring of conducting wire as shown in figure. Which of the following graph best represents the speed (v) vs. time (t) graph of the bar magnet ?

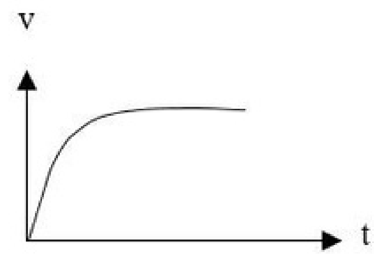
¢Qœ fcË¢naÑ f¢lh¡q£ a¡ll HL¢V Ae¤i¨¢jL ¢lw-Hl L¾c Êhl¡hl HL¢V c™Qð¥LL A¢iLolÑ fiË¡h Eõð i¡h ¢eQ gm¡ q'm z a¡qm ¢eQl L¡e¢V phQu p¢WL i¡h c™Qð¥L¢Vl hN (v) he¡j pju (t) mM¢Qœ¢V ¢ecnÑ Ll ?



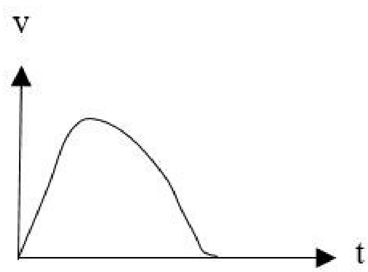
(A)



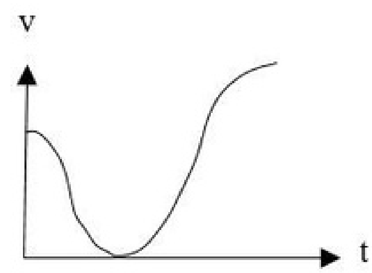
(B)



(C)



(D)



34. An amount of charge Q passes through a coil of resistance R. If the current in the coil decreases to zero at a uniform rate during time T, then the amount of heat generated in the coil will be,

R l¡jdl HL¢V Lä¥m£l jdÉ ¢cu Q Bd¡e Nje Ll z k¢c T pju L¥äm£a fhË¡q po¤j q¡l Lj ne§É qu a¡qm Lä¥m£a Evfæ a¡fl f¢lj¡Z qh,

(A) $\frac{4Q^2R}{3T}$ (B) $\frac{2QR}{3T}$ (C) $\frac{Q2T}{4R}$ (D) Q2RT

35. A modified gravitational potential is given by $V \square\square \frac{GM}{r} \square \frac{A}{r^2}$. If the constant A is expressed in terms of gravitational constant (G), mass (M) and velocity of light (c), then from dimensional analysis, A is,

je Ll HL¢V f¢lh¢aaÑ jq¡Lo£Ñu ¢hihl j¡e cJu¡ BR $V \square\square \frac{GM}{r} \square \frac{A}{r2}$ z dË¤hL A-L k¢c jq¡Lo£Ñu dËh¤L (G) il (M) J A¡m¡Ll hN (c)-Hl p¡q¡kÉ ¢eZuÑ Ll¡ k¡u a¡qm A q'm

(A) $\frac{G2M2}{c2}$

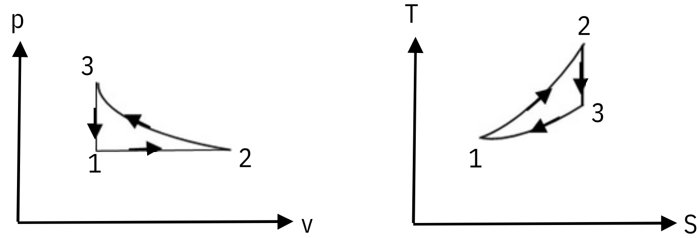
(B) $\frac{GM}{c^2}$

(C) $\frac{1}{c2}$

(D) Dimensionless (j¡œ¡¢hq£e)

Category-3 (Q. 36 to 40)
(Carry 2 marks each. One or more options are correct. No negative marks)

36.



A cyclic process is shown in p-v diagram and T-S diagram. Which of the following statement(s) is/are true ?

(A) 1→2: Isobaric, 2→3: Isothermal.

(B) 3→1: Isochoric, 2→3: adiabatic.

(C) Work done by the system in the complete cyclic process is non-zero.

(D) The heat absorbed by the system in the complete cyclic process is non-zero.

HL¢V Qœ²£u f¢Ëœ²u¡L p-v mM¢Qœ J T-S mM¢Qœl p¡q¡kÉ cM¡e¡ quR z ¢eQl L¡e E¢š²(…¢m) p¢WL ?

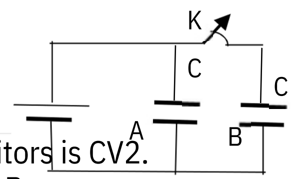
(A) 1→2: pjQ¡f£, 2→3: pj¡o·

(B) 3→1: pj¡uae£, 2→3: l©Üa¡f

(C) (D) p¢f¨ Z ÑQœ²£u f¢Ëœ²u¡¢Va La« L¡kÉÑ ne§É eu z

p¢f¨ Z ÑQœ²£u f¢Ëœ²u¡u a¡f ne§É eu z

37. The figure shows two identical parallel plate capacitors A and B of capacitances C connected to a battery. The key K is initially closed. The switch is now opened and the free spaces between the plates of the capacitors are filled with a dielectric constant 3. V Then which of the following statement(s) is/are true ?



(A) When the switch is closed, total energy stored in the two capacitors is CV2.

(B) When the switch is opened, no charge is stored in the capacitor B.

(C) When the switch is opened, energy stored in capacitor B is $\frac{3}{2}$ CV2.

(D) When the switch is opened, total energy stored in two capacitors is $\frac{5}{3}$ CV2.

¢Qœ fcË¢naÑ d¡lLa Ä¢h¢nøA J B c¤¢V pj¡¿l¹¡m f¡a d¡lLL HL¢V hÉ¡V¡l£l cC¤ f¡Ë¿ ¹kš¤² Ll¡ quR z K Q¡¢h¢V fbËj hå Ll¡ BR z Hh¡l Q¡¢h¢V M¤m ¢cu d¡lL c¤¢Vl f¡a c¢¤Vl jdÉ fl¡°hc¤É¢aL ¢ÙlÛ¡ˆ ¢h¢nø j¡dÉj ¢cu fZ§Ñ Ll¡ q'm z a¡qm ¢eQl L¡eÚ E¢š²(…¢m) p¢WL ? 3

(A) Q¡¢h¢V hå b¡L¡l pju d¡lLc¢¤Va p¢'a j¡V n¢š² q'm CV2

(B) Q¡¢h¢V kMe M¡m¡ qu aMe B d¡lL L¡e¡ Bd¡e p¢'a b¡L e¡ z

(C) Q¡¢h¢V kMe M¡m¡ qu aMe B d¡lL p¢'a n¢š² q'm $\frac{3}{2}$ CV2

(D) Q¡¢h¢V kMe M¡m¡ qu aMe d¡lL c¢¤Va p¢'a j¡V n¢š² q'm $\frac{5}{3}$ CV2

38. A charged particle of charge q and mass m is placed at a distance 2R from the centre of a vertical cylindrical region of radius R where magnetic field varies as $\vec{B} = (4t2 - 2t + 6)\hat{k}$, where t is time. Then which of the following statement(s) is/are true ?

(A) Induced electric field lines form closed loops.

(B) Electric field varies linearly with r if r < R, where r is the radial distance from the centerline of the cylinder.

(C) The charged particle will move in clockwise direction when viewed from top.

(D) Acceleration of the charged particle is $\frac{7q}{2m}$ when t = 2 sec.

R hÉ¡p¡d Ñ¢h¢nø HL¢V Eõð Q¡P¡L¢«a Ù¡Ûe Q±ðL rœ $\vec{B} = (4t2 - 2t + 6)\hat{k}$ Ae¤p¡¤ f¢lh¢aÑa qu,

kM¡e t q'm pju z pM¡e q Bd¡e J m il ¢h¢nø HL¢V hÙL¹¥Z¡L Q¡Pl ArlM¡ bL 2R

cl§a Äl¡M¡ q'm z a¡qm ¢eQl L¡e E¢š²(…¢m) p¢WL ?

(A) B¢hø a¢svhmlM¡…¢m hÜ m¤fl BL¡l qu z

(B) a¢svrœl j¡e r-Hl p‰ plm°l¢ML pÇfL Ñf¢lh¢aaÑ qu k¢c r < R qu, kM¡e r q'm Q¡Pl ArlM¡ bL hÉ¡p hl¡hl c§la Äz

(C) Efl bL cMm LZ¡¢V O¢sl L¡yV¡l ¢cL Ol¤h z

(D) t = 2 sec pju LZ¡¢Vl alÄZ q'm $\frac{7q}{2m}$ z

39. A uniform magnetic field B exists in a region. An electron of charge q and mass m moving with velocity v enters the region in a direction perpendicular to the magnetic field. Considering Bohr angular momentum quantization, which of the following statement(s) is/are true ?

(A) The radius of nth orbit r n □ $\sqrt{n}$.

(B) The minimum velocity of the electron is $\frac{\sqrt{qB□}}{m}$.

(C) Energy of the nth level En □□n.

(D) Transition frequency ω between two successive levels is independent of n.

L¡e¡ Ù¡Ûe HL¢V po¤j Q±ðL rœ B luR z I Ù¡Ûe HL¢V m il J Bd¡œ pÇfæ CmƒeÊ Q±ðL rœl Eõð ¢cL hl¡hl v hN fËhn Llm z h¡ll L±¢ZL ilhNl L¡u¡¾V¡CSne na ÑAek¤¡u£ ¢eQl L¡e ÚE¢š²(…¢m) p¢WL ?

(A) n-aj Lrl hÉ¡p¡dÑ r n □ $\sqrt{n}$.

(B) Cmƒ Êel eÉ¨ëaj h N $\frac{\sqrt{qB□}}{m}$

(C) n-aj Lrl n¢š² E n □□n.

(D) flØfl c¢¤V d¡fl jdÉ Ù¡Ûe¡¿¹l LÇf¡ˆ ω, n-Hl Efl ¢eilÑn£m eu z

40. A train is moving along the tracks at a constant speed u. A girl on the train throws a ball of mass m straight ahead along the direction of motion of the train with speed v with respect to herself. Then

(A) Kinetic energy of the ball as measured by the girl on the train is mv2/2.

(B) Work done by the girl in throwing the ball is mv2/2. (C) Work done by the train is mvu.

(D) The gain in kinetic energy of the ball as measured by a person standing by the rail track is mv2/2.

HL¢V VeÊ u ¢ÙÛl hN QmR z VÊel k¡œ£ HL¢V h¡¢mL¡ m ill HL¢V hmL VÊel N¢al A¢ij¤M pl¡p¢l p¡jel ¢cL v hN R¥ys ¢cm z a¡qm

(A) VÊel k¡œ£ h¡¢mL¡l p¡fr hm¢Vl N¢an¢š² qh mv2/2 z

(B) hm¢V R¡ys¡l SeÉ h¡¢mL¡ à¡l¡ La« L¡kÉÑ q'm mv2/2 z

(C) VeÊ¢V à¡l¡ La« L¡kÉÑ q'm mvu z

(D) lmm¡Cel d¡l cy¡s¡e¡ L¡e¡ hÉ¢š²l p¡fr hm¢Vl N¢an¢š² q'm mv2/2 z

CHEMISTRY

Category-1 (Q 41 to 70)

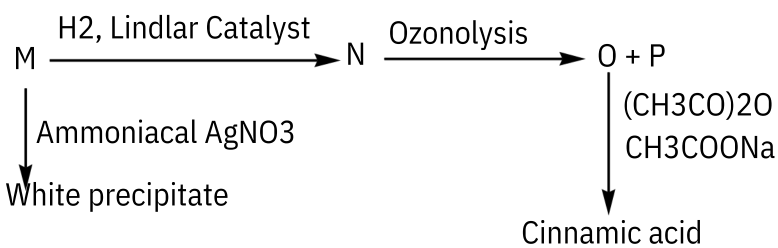
(Carry 1 mark each. Only one option is correct. Negative marks : – ¼)

41. The correct order of boiling points of N-ethylethanamine (I), ethoxyethane (II) and butan-2-ol (III) is

N-Cb¡CmCb¡eÉ¡¢je (I), Cb¢„Cbe (II) Hhw ¢hEV¡e-2-Am (III)-Hl ØgV¥e¡˜l p¢WL œ²j qm

(A) III < II < I (B) II < III < I

(C) II < I < III (D) III < I < II

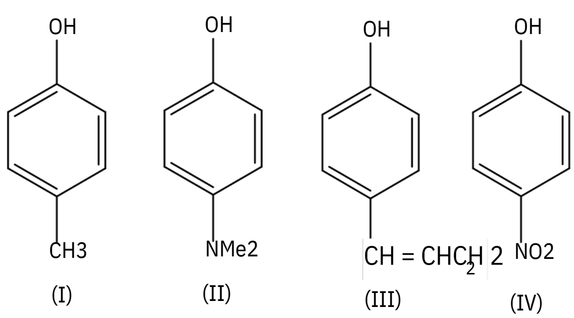
42. 

Structure of M is,

M-Hl NWe q'm

(A) Ph – C $\equiv$ CH (B) Ph – C $\equiv$ C – CH_3

(C) H_3C – C $\equiv$ CH (D) H_3C – C $\equiv$ C – CH_3

43. 

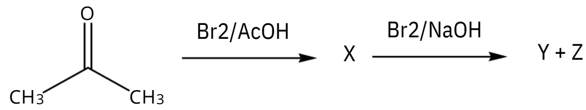
The correct order of acidity of above compounds is

Ef¢l¢õ¢Ma k±N…¢ml B¢ÇmLa¡l p¢WL œ²j qm

(A) II > IV > I > III (B) III > IV > II > I

(C) IV > II > III > I (D) IV > III > I > II

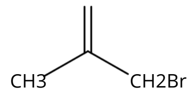
P.T.O.

44. 

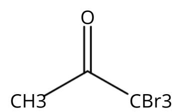
The correct option for the above reaction is

Efl¡š² ¢h¢œ²u¡u p¢WL ¢hLÒf¢V q'm

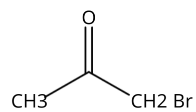
O

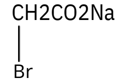
(A) X= 

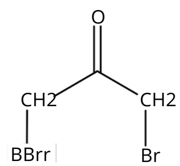
Y= CHBr3 Z= CH3CO2Na

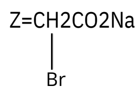
(B) X= 

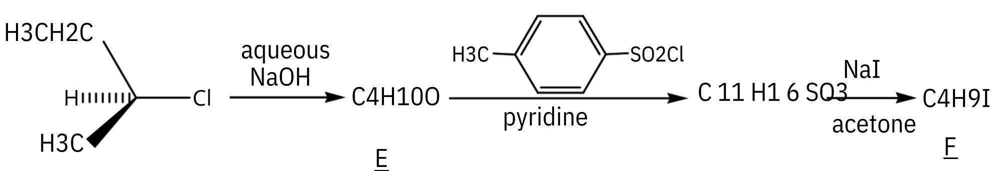
Y= CHBr3 Z= CH3CO2Na

(C) X= 

Y= CHBr3 Z= 

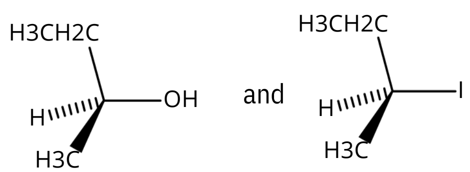
(D) X= 

Y= CHBr3 

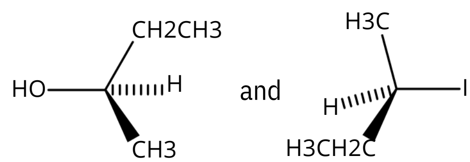
45. 

If all the nucleophilic substitution reactions at saturated carbon atoms in the above sequence of reactions follow SN2 mechanism, then E and F will be respectively,

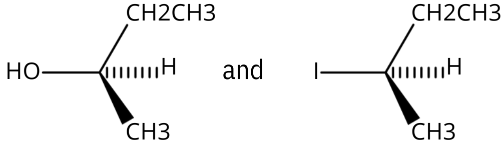
k¢c Efl h¢ZaÑ ¢h¢œ²u¡œ²j pÇfš«² L¡heÑ flj¡Z¤a O¢Va phL'¢V ¢eJ¢LJÓ¢g¢mL f¢ËaÙ¡Ûfe ¢h¢œ²u¡ SN2 ¢œ²u¡L±nm Aep¤lZ Ll, ah E H<u>h</u>w F q<u>h</u> kb¡œ²j



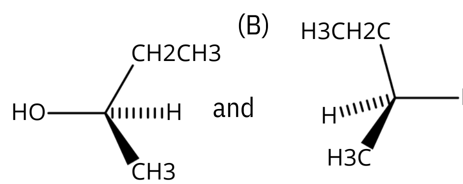
(A)



(B)



(C)



(D)

46. Two base balls (masses: $m_1 = 100$ g, and $m_2 = 50$ g) are thrown. Both of them move with uniform velocity, but the velocity of m_2 is 1.5 times that of m_1. The ratio of de Broglie wavelengths $\lambda m_1 : \lambda m_2$ is given by

cC¤¢V hphm (il $m_1 = 100$N¡Ëj, Hhw $m_2 = 50$N¡Ëj) R¡ys¡ qm z fËaÉL¢VC ¢ÙlÛ hN N¢an£m z ¢L¿¹¥ m_2-Hl N¢ahN m_1-Hl bL 1.5 …Z h¢n z hphm c¤C¢Vl p‰ kš¤² ¢X hNË¢m al‰°cOÉÑ-Hl Aef¤¡a $m_1 : m_2$ qm

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

47. What is the edge length of the unit cell of a body centred cubic crystal of an element whose atomic radius is 75 pm ?

HL¢V cqL¢¾cLÊ OeL¡L¡l Lm¡pl HL¢V j±ml flj¡Zl¤ hÉ¡p¡d Ñ 75 pm z I Lm¡pl HLL L¡ol f¡Ë¢¿L¹£l °cOÉÑ La ?

(A) 170 pm (B) 175 pm (C) 178 pm (D) 173.2 pm

48. The root mean square (rms) speed of X_2 gas is x m/s at a given temperature. When the temperature is doubled, the X_2 molecules dissociated completely into atoms. The root mean square speed of the sample of gas then becomes (in m/s)

HL¢V ¢e¢cøÑ Eo·a¡u X2 -Hl Ns hNÑâ¢¤al hNjÑm§ qm x m/s z Eo·a¡ ¢à…Z Llm X2 -Hl AZ…¤¢m flj¡Z¤a ¢hu¡¢Sa qu z HC AhÙ¡Ûu HC NÉ¡pl Ns hNÑâ¢¤al hNjÑm§ (m/s HLL) qh

(A) x/2 (B) x (C) 2x (D) 4x

49. Arrange the following in order of increasing mass

I. 1 mole of N_2

II. 0.5 mole of O_3

III. 3.011×10^{23} molecules of O_2

IV. 0.5 gram atom of O_2

ill EÜœÑ²j¡ep¤¡l p¡S¡J

I. 1 j¡m N_2

II. 0.5 j¡m O_3

III. O_2-Hl 3.011×10^{23} pwMÉL AZ¤

IV. 0.5 N¡Ëj flj¡Z ¤O_2

(A) IV < III < II < I (B) IV < I < III < II

(C) III < II < IV < I (D) I < III < II < IV

50. Which of the following would give a linear plot ?
¢eQl L¡e fVÔ¢V (lM¡¢Qœ¢V) plm°l¢ML qh ?
(A) k vs T (B) k vs 1/T (C) ln k vs T (D) ln k vs 1/T
(k is the rate constant of an elementary reaction and T is temp. in absolute scale)
(k HL d¡f ¢h¢œ^{2}u¡l N¢adËh¤L, T flj a¡fj¡œ¡)

51. The equivalent conductance of NaCl, HCl and CH3COONa at infinite dilution are 126.45, 426.16 and 91 ohm−1cm2eq−1 respectively at 25□C. The equivalent conductance of acetic acid (at infinite dilution) would be
(A) 461.61 ohm−1 cm2 eq−1 (B) 390.71 ohm−1 cm2 eq−1
(C) cannot be determined from the given data. (D) 208.71 ohm−1 cm2 eq−1
Ap£j mOa¤¡u NaCl, HCl Hhw CH3COONa -Hl am¥É¡wL f¢lh¡¢qa¡ kb¡œ^{2}j 126.45, 426.16 Hhw 91 ohm−1cm2eq−1 (25℃ -H) z HLC AhÙ¡Ûu AÉ¡p¢VL AÉ¡¢pXl am¥É¡wL f¢lh¡¢qa¡
(A) 461.61 ohm−1 cm2 eq−1 (B) 390.71 ohm−1 cm2 eq−1
(C) k¡ abÉ cJu¡ quR a¡ bL hl Ll¡ k¡h e¡ z (D) 208.71 ohm−1 cm2 eq−1

52. For the reaction A + B → C, we have the following data :

Initial concentration of A (in molarity)	Initial concentration of B (in molarity)	Rate (initial) (Relevant unit)
1	10	100
1	1	1
10	1	10

The order of the reaction with respect to A and B are
(A) Not possible to tell with the given data.
(B) First order with respect to both A and B.
(C) First order with respect to A and second order with respect to B.
(D) Second order with respect to A and first order with respect to B.

A J B Hl jdÉ A + B → C ¢h¢œ^{2}u¡¢Vl N¢ahN pÇfL Ñ¢eQl abÉ…¢m S¡e¡ BR z

A -Hl f¡Ël¢ñL N¡taÄ (j¡m¡¢l¢Va)	B -Hl f¡Ël¢ñL N¡taÄ (j¡m¡¢l¢Va)	¢h¢œ^{2}u¡l f¡ËI¢ñL N¢ahN (Efkš¤^{2} HLL)
1	10	100
1	1	1
10	1	10

prœ A J B -Hl p¡fr ¢h¢œ^{2}u¡¢Vl œ^{2}j
(A) hm¡l ja kbø abÉ cJu¡ eC z
(B) A J B cC¤ul p¡frC œ^{2}j HL z
(C) A-Hl p¡fr HL Hhw B-Hl p¡fr cC¤ z
(D) A-Hl p¡fr cC¤ Hhw B-Hl p¡fr HL z

53. The equivalent weight of KIO_3 in the given reaction is (M = molecular mass):

$2Cr(OH)_3 + 4OH^- + KIO_3 \rightarrow 2CrO_4^{2-} + 5H_2O + KI$

fcËš ¢h¢œ²u¡u $2Cr(OH)_3 + 4OH^- + KIO_3 \rightarrow 2CrO_4^{2-} + 5H_2O + KI$,

KIO_3-Hl am¥É¡ˆ il (M = Be¢hL il)

(A) M (B) M/2 (C) M/6 (D) M/8

54. At STP, the dissociation reaction of water is $H_2O \rightleftharpoons H^+(aq.) + OH^-(aq.)$, and the pH of water is 7.0. The change of standard free energy (ΔG°) for the above dissociation process is given by

STP na,Ñ Sml ¢hu¡Se ¢h¢œ²u¡¢V qm $H_2O \rightleftharpoons H^+(aq.) + OH^-(aq.)$, Hhw Sml pH qm 7.0 z Ef¢lš² ¢hu¡Se ¢h¢œ²u¡u Bcn Ñjš¤²n¢š²l f¢lhaeÑ (ΔG°) qm

(A) 20301 cal/mol (B) 19091cal/mol (C) 20096 cal/mol (D) 21301 cal/mol

55. Na_2CO_3 is prepared by Solvay process but K_2CO_3 cannot be prepared by the same because

(A) K_2CO_3 is highly soluble in H_2O (B) $KHCO_3$ is sparingly soluble

(C) $KHCO_3$ is appreciably soluble (D) $KHCO_3$ decomposes

Na_2CO_3 fÙË¢¹¥aa pmÚi fÜ¢a hýmhÉhq©a qmJ K_2CO_3 fÙË¢¹¥aa hÉhq¡l Ll¡ k¡u e¡ L¡lZ

(A) K_2CO_3 Sm A¢a j¡œ¡u â¡hÉ (B) $KHCO_3$ üÒfâ¡hÉ

(C) $KHCO_3$ kbø j¡œ¡u â¡hÉ (D) $KHCO_3$ ¢hu¡¢Sa qu k¡u

56. If in case of a radio isotope the value of half-life ($T_{1/2}$) and decay constant (λ) are identical in magnitude, then their value should be

k¢c HL¢V aS¢ûu BCp¡V¡fl Ad¡Ñu×¤L¡m ($T_{1/2}$) Hhw ru¡ˆ (λ)-Hl j¡e f¢lj¡ZNai¡h pj¡e qu, a¡qm pC j¡e¢V qJu¡ E¢Qv

(A) 0.693/2 (B) $(0.693)^{1/2}$ (C) $(0.693)^2$ (D) 0.693

57. Suppose a gaseous mixture of He, Ne, Ar and Kr is treated with photons of the frequency appropriate to ionize Ar. What ion(s) will be present in the mixture ?

HL¢V h¡uh£u ¢jnËZl jdÉ He, Ne, Ar Hhw Kr hajÑ¡e z HC ¢jnËZl jdÉ Ar-L Bu¢ea Lla f¡l HlLj LÇf¡ˆl g¡Ve f¡W¡e¡ qm z HMe ¢jnËZl jdÉ k Bue…¢m b¡Lh a¡l¡ qm

(A) Ar^+ (B) $Ar^+ + Kr^+$

(C) $Ar^+ + He^+ + Ne^+$ (D) $He^+ + Ar^+ + Kr^+$

58. A solution containing 4g of polymer in 4.0 litre solution at 27°C shows an osmotic pressure of 3.0×10^{-4} atm. The molar mass of the polymer in g/mol is

27°C Eo·a¡u 4.0 L âhZ HL¢V f¢mj¡ll 4.0 g âh£i¨ä b¡Lm 3.0×10^{-4} atm A¢iphËe Q¡fl p¢ªø qu z f¢mj¡l¢Vl Be¢hL il (N¡Ëj/j¡m HLL) qh

(A) 820000 (B) 82000 (C) 8200 (D) 820

59. The molecular shapes of SF4, CF4 and XeF4 are

(A) the same with 2, 0 and 1 lone pairs of electrons on the central atoms, respectively.

(B) the same with 1, 1 and 1 lone pairs of electrons on the central atoms, respectively.

(C) different with 0, 1 and 2 lone pairs of electrons on the central atoms, respectively.

(D) different with 1, 0 and 2 lone pairs of electrons on the central atoms, respectively.

SF4, CF4 Hhw XeF4 Hl Be¢hL BL¢«a qm

(A) HLC Hhw L¾c£Êu flj¡Zl¤ ¢exp‰ CmLVÊe S¡s kb¡œ²j 2, 0 Hhw 1 z

(B) HLC Hhw L¾c£Êu flj¡Zl¤ ¢exp‰ CmLVeÊ S¡s kb¡œ²j 1, 1 Hhw 1 z

(C) Bm¡c¡ Hhw L¾c£Êu flj¡Zl¤ ¢exp‰ CmLVeÊ S¡s kb¡œ²j 0, 1 Hhw 2 z

(D) Bm¡c¡ Hhw L¾c£Êu flj¡Zl¤ ¢exp‰ CmLVeÊ S¡s kb¡œ²j 1, 0 Hhw 2 z

60. The species in which nitrogen atom is in a state of sp hybridisation is

e£Ql L¡e Úk±N e¡CV¡ÊSe flj¡Z¢¤V sp pwLl¡¢ua (hybridised)

(A) NO_3^- (B) NO_2 (C) NO_2^+ (D) NO_2^-

61. The correct statement about the magnetic properties of $[Fe(CN)_6]^{3-}$ and $[FeF_6]^{3-}$ is

(A) Both are paramagnetic

(B) Both are diamagnetic

(C) $[Fe(CN)_6]^{3-}$ is diamagnetic, $[FeF_6]^{3-}$ is paramagnetic

(D) $[Fe(CN)_6]^{3-}$ is paramagnetic, $[FeF_6]^{3-}$ is diamagnetic

$[Fe(CN)_6]^{3-}$ Hhw $[FeF_6]^{3-}$ Hl Q±ðL dj Ñpÿf¢LaÑ p¢WL hš²hÉ¢V qm

(A) c¢¤V k±NC EfQð¥L£u

(B) c¢¤V k±NC AfQð¥L£u

(C) $[Fe(CN)_6]^{3-}$ AfQ ð¥L£u, $[FeF_6]^{3-}$ EfQð¥L£u

(D) $[Fe(CN)_6]^{3-}$ EfQ ð¥L£u, $[FeF_6]^{3-}$ AfQð¥ L£u

62. The calculated spin-only magnetic moment values in BM for $[FeCl_4]^-$ and $[Fe(CN)_6]^{3-}$ are

$[FeCl_4]^-$ Hhw $[Fe(CN)_6]^{3-}$ HI Nz¡La« ¢Øfe Qð¥L£u ïj¡L (spin magnetic moment) (BM) qm

(A) 5.9 BM, 1.732 BM

(B) 4.89 BM, 1.732 BM

(C) 3.87 BM, 1.732 BM

(D) 1.732 BM, 2.82 BM

63. BrF_3 self ionises as following

BrF_3 ¢ej¡As¨ïi¡h uaxBu¢ea qu

(A) $2BrF_3 \rightleftharpoons BrF^+ + BrF_5^-$

(B) $2BrF_3 \rightleftharpoons BrF_2^+ + BrF_4^-$

(C) $2BrF_3 \rightleftharpoons BrF_4^+ + BrF_2^-$

(D) $2BrF \rightleftharpoons BrF_3^+ + BrF_3^-$

64. $4f^2$ electronic configuration is found in

L¡e¢ÚVl rœ $4f^2$ CmLVeÊ ¢heÉ¡p cM¡ k¡u ?

(A) Pr (B) Pr^{3+} (C) Nd^{3+} (D) Pm^{3+}

65. Which of the following statements is incorrect ?

(A) $[VF_6]^{3-}$ is paramagnetic with 2 unpaired electrons.

(B) $[CuCl_4]^{2-}$ is paramagnetic with 1 unpaired electron.

(C) $[Co(NH_3)_6]^{3+}$ is diamagnetic

(D) $[CoF_6]^{3-}$ is paramagnetic with 2 unpaired electrons.

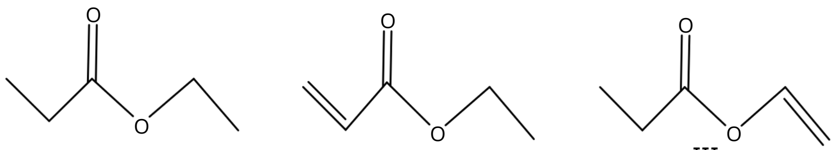
¢ej¢Àm¢Ma L¡e ¢hh¢ªa¢V p¢WL eu ?

(A) $[VF_6]^{3-}$ EfQð¥L£u, 2¢V S¡sq£e CmLVeÊ pja

(B) $[CuCl_4]^{2-}$ EfQð¥L£u, 1¢V S¡sq£e CmLVeÊ pja

(C) $[Co(NH_3)_6]^{3+}$ AfQð¥L£u

(D) $[CoF_6]^{3-}$ EfQð¥L£u, 2¢V S¡sq£e CmLVeÊ pja

66. 

I II III

The correct order of C□Obond length in ethyl propanoate (I), ethyl propenoate (II) and ethenyl propanoate (III) is

Cb¡Cm f¡Ëf¡e¡uV (), Cb¡Cm f¡Ë¢fe¡uV (II) Hhw C¢be¡Cm f¡Ëf¡e¡uV (III) -H C Ohåe °cOÉÑl p¢WL œ^{2}j qm

(A) I > II > III (B) III > II > I (C) I > III > II (D) II > I > III

67. Select the molecule in which all the atoms may lie on a single plane is

(A) 4-Nitrobenzaldehyde (B) 4-Methoxybenzaldehyde

(C) 4-Methylnitrobenzene (D) 4-Nitroacetophenone

¢ej¡Àš^2 k AZ¤a pLm flj¡Z…¤¢m HL¢V j¡œ am AhÙ¡Ûe Ll p¢V qm

(A) 4-e¡CV¡Êh”É¡m¢Xq¡CX (B) 4-¢jb¢„h”É¡m¢Xq¡CX

(C) 4-¢jb¡Cme¡CV¡Êh¢”e (D) 4-e¡CV¡ÊAÉ¡¢pV¡ge¡e

68. The IUPAC name of CH 3CH= C–CH2–CH3 is :

CHO (on C)

(A) 3-Formyl-2-pentene (B) 2-Ethylbut-2-enal

(C) 3-Ethylbut-3-enal (D) 2-Ethylcrotonaldehyde

CH 3CH= C–CH2–CH3 k±N¢Vl e¡j q'm:

CHO (on C)

(A) 3-glj¡Cm--f¢¾Ve (B) 2-Cb¡Cm¢hEV-2-CeÉ¡m

(C) 3-Cb¡Cm¢hEV-3-CeÉ¡m (D) 2-Cb¡Cmœ^2¡V¡eÉ¡m¢Xq¡CX

69. The correct stability order of the following carbocations is

¢ej¢Àm¢Ma L¡hÑ¡LÉ¡V¡ue…¢ml Ù¡Ûu£alÄ p¢WL œ²j qm

$H_2\overset{\square}{C} - CH = CH - CH_3$ (I)

$\overset{\square}{C}H_2 - CH = CH - BMe_2$ (II)

$H_2\overset{\square}{C} - CH = CH - NMe_2$ (III)

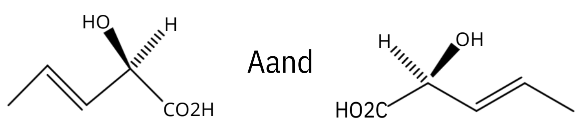
$H_2\overset{\square}{C} - CH = CH - OMe$ (IV)

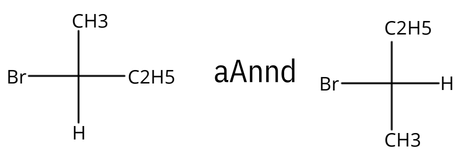
(A) II > I > III > IV

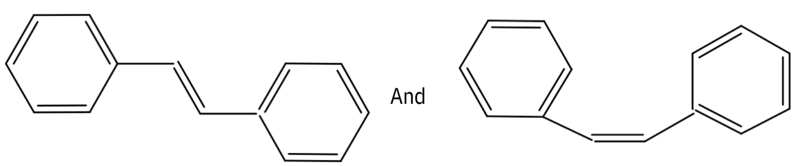
(B) III > I > II > IV

(C) III > IV > I > II

(D) IV > III > II > I

70. 1 

2 

3 

The relationship between the pair of compounds shown above are respectively,

(A) enantiomer, diastereomer, diastereomer

(B) enantiomer, enantiomer, diastereomer

(C) enantiomer, homomer (identical), diastereomer

(D) homomer (identical), diastereomer, geometrical isomer

Efl¡š² k±NS¡s…¢ml jdÉ pÇfL Ñqm kb¡œ²j

(A) He¡e¢nJj¡l (f¢Ëa¢hð pj¡huh), X¡u¡¢ØV¢lJj¡l, X¡u¡¢ØV¢lJj¡l

(B) He¡e¢nJj¡l (f¢Ëa¢hð pj¡huh), He¡e¢nJj¡l (f¢Ëa¢hð pj¡huh), X¡u¡¢ØV¢lJj¡l

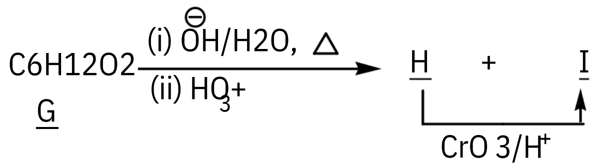
(C) He¡e¢nJj¡l (f¢Ëa¢hð pj¡huh), q¡j¡j¡l, X¡u¡¢ØV¢lJj¡l

(D) q¡j¡j¡l, X¡u¡¢ØV¢lJj¡l, SÉ¡¢j¢aL pj¡huh

Category-2 (Q 71 to 75)

(Carry 2 marks each. Only one option is correct. Negative marks : – ½)

71.



‘G’ in the above sequence of reactions is

Efl¡š² ¢h¢œ²u¡œ²j ‘G’ g'm

(A) $(CH_3)_2CHCOOCH_2CH_3$

(B) $CH_3CH_2CH_2COOCH_2CH_3$

(C) $CH_3CH_2COOCH_2CH_2CH_3$

(D) $CH_3CH_2COOCH(CH_3)_2$

72. Case – 1: An ideal gas of molecular weight M at temperature T.
Case – 2: Another ideal gas of molecular weight 2M at temperature T/2.

Identify the correct statement in context of above two cases.

(A) Average kinetic energy and average speed will be the same in the two cases.

(B) Both the averages are halved.

(C) Both the averages are doubled.

(D) Only average speed is halved in the second case.

fbËj rœ : Eo·a¡u M Be¢hL ill HL¢V Bcn ÑNÉ¡p T

¢àa£u rœ : 2M Be¢hL ill HL¢V Bcn ÑNÉ¡p T/2 Eo·a¡u z

Hl©f f¢l¢Ù¢Ûaa p¢WL hš²hÉ¢V ¢el©fZ Ll:

(A) Ns N¢an¢š² J Ns â¢¤a Eiurœ HLC b¡Lh z

(B) Eiu l¡¢nl f¢lj¡f AdLÑ qh z

(C) Eiu l¡¢nl f¢lj¡f ¢à...Z qh z

(D) Lhm Ns â¢¤al f¢lj¡e ¢àa£u rœ AdLÑ qh z

73. 63 g of a compound (Mol. Wt. = 126) was dissolved in 500 g distilled water. The density of the resultant solution as 1.126 g/ml. The molarity of the solution is

HL¢V k±Nl (Be¢hL il = 126) 63 N¡Ëj ¢eu 500 N¡Ëj f¡¢aa Sm âh£i¨ä Ll¡ qm

âhZl Oea Äqm 1.126 N¡Ëj/¢j¢m z I âhZl j¡m¡¢l¢V qm

(A) 1.25 M (B) 1.0 M (C) 0.75 M (D) 1.1 M

74. Nickel combines with a uninegative monodentate ligand (X^-) to form a paramagnetic complex $[NiX_4]^{2-}$. The hybridisation involved and number of unpaired electrons present in the complex are respectively

(A) sp3, two (B) dsp2, zero (C) dsp2, one (D) sp3, one

¢eLm HL¢V HLL GZ¡aÈL Bd¡ekš¤² HLk¡S£ ¢mNÉ¡äl (X) p‰ kš¤² qu HL¢V EfQð¥L£u k±N $[NiX_4]^{2-}$ We Ll z k±N¢Va ¢eLml pwLl¡uZ (hybridisation) Hhw AkN¤È CmLVÊel pwMÉ¡ qm

(A) sp3, c¢¤V (B) dsp2, HL¢VJ eu (C) dsp2, HL¢V (D) sp3, HL¢V

75. $L \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) PhMgBr}} \xrightarrow{CrO_3/H^+} N \xrightarrow{Ph_3P = CH_2} PhC = CH_2$

'L' in the above sequence of reaction is/are (where L ≠ M ≠ N)

(A) Benzaldehyde (B) Methyl benzoate

(C) Benzoyl chloride (D) Benzonitrile

Efl¡š² ¢h¢œ²u¡œ²j 'L' q'm (HM¡e L ≠ M ≠ N)

(A) h"É¡m¢Xq¡CX (B) ¢jb¡Cm h"¡uV

(C) h"¡¢um L¡Ól¡CX (D) h"¡e¡CV¡ÊCm

Category-3 (Q 76 to 80)

(Carry 2 marks each. One or more options are correct. No negative marks)

76. The correct set(s) of reactions to synthesize benzoic acid starting from benzene is/are

(A) (i) Br_2/Fe (ii) Mg/dry ether (iii) CO_2 (iv) H_3O^+

(B) (i) Br_2/Fe (ii) NH_3, 25°C (iii) $NaNO_2$, dil. HCl, 0 to 5°C (iv) CuCN/KCN (v) dil.HCl, Δ

(C) (i) CH_3Cl, Anhydrous $AlCl_3$ (ii) $KMnO_4$ $\overset{\ominus}{O}H$, (iii) $H_3\overset{\oplus}{O}$

(D) (i) CH_3COCl, Anhydrous $AlCl_3$ (ii) Br_2, NaOH (iii) H_3O^+

h¢"e bL öl¦ Ll h"¢uL AÉ¡¢pX pwnoÔZl SeÉ p¢WL ¢h¢œ²u¡ œ²j¢V/œ²j...¢m q'm

(A) (i) Br_2 / Fe (ii) Mg / ö×L Cb¡l (iii) CO_2 (iv) H_3O^+

(B) (i) Br_2 / Fe (ii) NH_3, 25°C (iii) $NaNO_2$, mO¤ HCl, 0° to 5°C (iv) CuCN / KCN (v) mO¤ HCl, Δ

(C) (i) CH_3Cl, Ae¡â Ñ $AlCl_3$ (ii) $KMnO_4$ | $\overset{\ominus}{O}H$, Δ (iii) $H_3\overset{\oplus}{O}$

(D) (i) CH_3COCl, Ae¡â Ñ $AlCl_3$ (ii) Br_2, NaOH (iii) H_3O^+

P.T.O.

77. Which statement(s) is/are applicable above critical temperature ?
   (A) A gas cannot be liquified.
   (B) Surface tension of a liquid is very high.
   (C) A liq. phase cannot be distinguished from a gas phase.
   (D) Density changes continuously with P or V.

pwLV a¡fj¡œ¡l Jfl L¡e Ú¢hhª¢a¢V/¢hhª¢a…¢m fËk¡SÉ ?
   (A) L¡e¡ NÉ¡pL alm Ll¡ k¡u e¡ z
   (B) alml fùªV¡e Mh¤ h¢n qu z
   (C) NÉ¡p h¡ almL Bm¡c¡ i¡h Qe¡ k¡u e¡ z
   (D) Oea,Ä P Abh¡ V-Hl p‰ d¡l¡h¡¢qLi¡h f¢lhaeÑ qu z

78. Which of the following mixtures act(s) as buffer solution ?

¢ej¢Àm¢Ma ¢jnËZ…¢ml jdÉ L¡e¢V/L¡e…¢m h¡g¡l âhZ ¢qp¡h L¡S Llh ?
   (A) NaOH + CH 3COOH (1 : 1 mole ratio)
   (B) NH4OH + HCl (2 : 1 mole ratio) 3COOH
   (C) + NaOH (2 : 1 mole ratio) 3COOH +
   NaOH (1 : 2 mole ratio)
   (D) CH CH

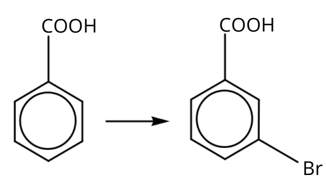
79. An electron in the 5d orbital can be represented by the following (n, l, mℓ,) values

5d EfLrl (orbital) HL¢V CmLVeÊL ¢ej¢Àm¢Ma (n, l, mℓ,) Hl j¡e…¢m à¡l¡ hm¡ k¡u

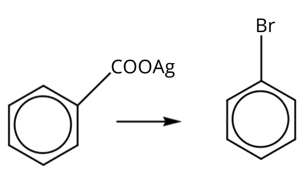
(A) (5, 2, 1)	(B) (5, 1, −1)	(C) (5, 0, 1)	(D) (5, 2, −1)

80. The conversion(s) that can be carried out by bromine in carbon tetrachloride solvent is/are

L¡heÑ VV¡ÊL¡Ól¡CX â¡hL h¡Ë¢je k l©f¡¿l¹¢VL/l©f¡¿¹l…¢mL pÇfæ Lla f¡l p…¢m q'm
   (A) PhCH = CHCH 3 □ PhCHBrCHBrCH 3

   (B) 

   (C) CH 3CH2COOH □ CH 3CHBrCOOH

   (D) 

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