PART – I (PHYSICS)

1. Two particles in same vertical plane are thrown to strike at same time. One from ground and other from height h vertically above it. Ground particle is thrown obliquely and it achieves a maximum height H. The second particle is thrown horizontally with same speed. What can be maximum so that two particles strike in air

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

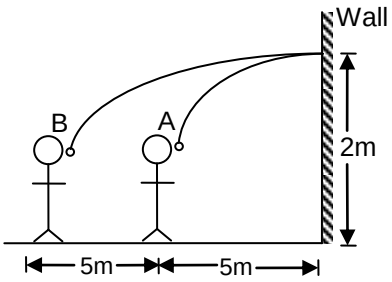
Ans. D

2. A cuboiclal block has dimension $(1.5 \times 1.5 \times 10)$ cm what is the surface area of cuboid (m, cm^2)

(A) 5.2 (B) 10.4 (C) 5.25 (D) 10.5

Ans. B

3. Two persons A & B are throwing ball of 200 g on wall as shown in figure. Balls strike wall perpendicularly at same point height 2m from ground. Ball strike wall elastically at same time and returns back to A & B, at same time. They aga m repeat the same. What is the average force on wall (take g = 10 m/s^2)

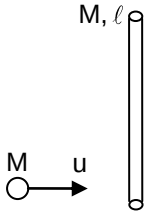


(A) 3.25 N (B) 6N

(C) 7.5 N (D) 10 N

Ans. C

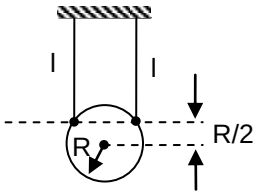
4. A rod of mass M and length ℓ is at rest on plane horizontal smooth surface. A particle of same mass M strike one end with velocity u perpendicular to rod, elastically. Now just after collision what is the kinetic energy of upper half part of rod.



(A) $\frac{Mu^2}{25}$ (B) $\frac{Mu^2}{16}$ (C) $\frac{Mu^2}{9}$ (D) $\frac{Mu^2}{4}$

Ans. A

5. A disc of mass m and radius R is attached to celling with the help of ropes of length l. Find the time period of small oscillation of disc m the plane of disc.



(A) $2\pi\sqrt{\frac{l+R/2}{g}}$ (B) $2\pi\sqrt{\frac{l^2+(R/2)^2}{g(R/2+1)}}$

(C) $2\pi\sqrt{\frac{l}{g}}$ (D) none of these

Ans. C

6. A bungee Jumper is Jumping with help of elastic ideal rope (Farce constant K). Jamper steps off the bridge and falls from the rest towards the river below. He does not hit the water. The mass of jumper is m, natural length of rope is l. Gravity is g, assume everything ideal, then, choose the incorrect option:

(A) Jumper comes to rest first time after falling a distance $S = \frac{(k\ell + mg) + \sqrt{2mgk\ell + m^2g^2}}{k}$

(B) Maximum speed attained $\upsilon = \sqrt{2gl - \frac{mg^2}{k}}$

(C) time of free fall from rest $-\sqrt{2l/g}$

(D) time to come to rest for the first time $= \left(\frac{\pi}{2}\sqrt{\frac{m}{k}} + \sqrt{\frac{2l}{g}}\right)$

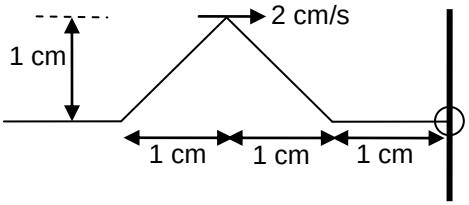
Ans. D

7. A screwgauage has pitch 1.5 mm and there is no zero error. Linear scale has marking at MSD – 1mm and there are 100 equal division of circular scale. When diameter of a sphere is measured with instrument, main scale is having 2mm mark visible on linear scale, but 3mm mark is not visible, 76^{th} division of circular scale is in line with linear scale. What is the diameter of sphere.

(A) 2.64 mm (B) 3.14 mm (C) 1.14 mm (D) 2.76 mm

Ans. D

8. A triangular purse moving at 2 cm's on a rope approaches an end at which it is free to slide on vertical pole. What is the particle speed at the free end at $\frac{3}{4}$sec from the instant shown.



(A) 2cm/s (B) 1cm/s

(C) 3cm/s (D) 4cm/s

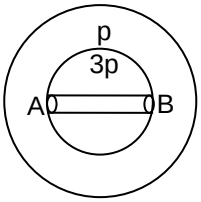
Ans. D

9. One mole of an ideal gas $\left(\frac{C_\alpha}{C_r}-\gamma\right)$ heated by law P = αV where P is pressure of gas, V is volume α is a constant what is the heat capacity of gas in the process

(A) $C=\frac{R}{\gamma-1}$ (B) $C=\frac{\gamma R}{\gamma-1}$ (C) $C=\frac{R}{2}\frac{(\gamma-1)}{(\gamma+1)}$ (D) $C=\frac{R}{2}\frac{(\gamma+1)}{(\gamma-1)}$

Ans. D

10. A plane of core density 3p and outer crust of density p has small tunnel in core A small particle of mass m is released from end A then time required reach end B.



(A) $\sqrt{\frac{\pi}{\rho G}}$ (B) $\frac{1}{2}\sqrt{\frac{\pi}{\rho G}}$

(C) $\pi\sqrt{\frac{1}{\rho G}}$ (D) $2\pi\sqrt{\frac{1}{\rho G}}$

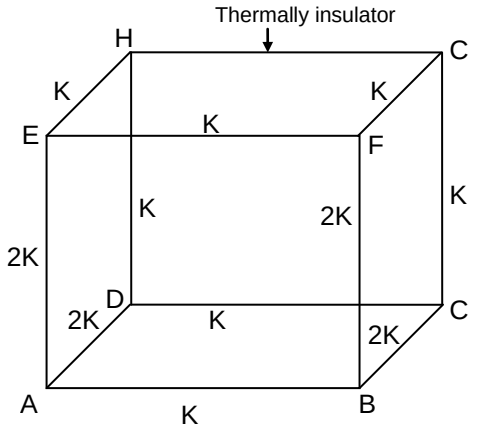
Ans. B

11. On a hypothetical planet satellite can only revolve in quantized energy level i.e. magnitude of energy of a satellite is integer multiple of a fixed energy. If two successive orbit have radius R and $\frac{3R}{2}$ what could be maximum radius of satellite

(A) 9R (C) 6R (C) 4R (D) 3R

Ans. D

12. Find effective thermal resistance between A & B of cube made up of 12 rods of same dimensions and shown given thermal conductivity. [ℓ = length of rod, a = cross section area of rod]

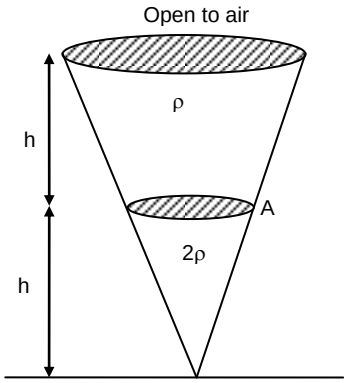


(A) $\frac{\ell}{kn}$ (B) $\frac{2\ell}{kn}$

(C) $\frac{4\ell}{7kn}$ (D) $\frac{\ell}{2kn}$

Ans. B

13. Two immiscible liquid are filled in conical flask as shown in figure. The area of cross section is shown a small hole of area a is made in lower end of cone. Find speed of liquid flow from hole

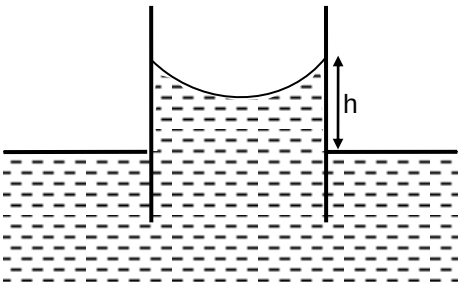


(A) $\sqrt{\frac{2gh}{1-\frac{17a^2}{A^2}}}$ (B) $\sqrt{\frac{gh}{1-\frac{17a^2}{A^2}}}$

(C) $\sqrt{\frac{2gh}{1-\frac{17a^2}{32A^2}}}$ (D) $\sqrt{\frac{3gh}{1-\frac{17a^2}{32A^2}}}$

Ans. D

14. Two vertical parallel plates are partially submerged in water. The distance between plate is equal to d. Water rises due to surface tension T, the width of plate is l, and contact angle of water with glass is 0. Find the force of attraction between the plates.



(A) $\frac{T^2\ell}{pgd^2}$ (B) $\frac{2T^2\ell}{pgd^2}$

(C) $\frac{T^2\ell}{2pgd^2}$ (D) $\frac{T^2\ell}{4pgd^2}$

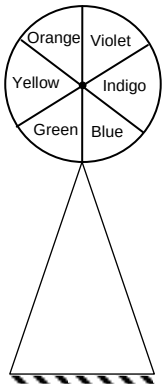
Ans. B

15. For a system with Newton's law of cooling applicable the initial rate of cooling is R^0C/ sec find the time when temperature difference ΔT_0 = initial temperature difference, is reduced to half

(A) $\frac{\Delta T_0}{2R}$ (B) $2\Delta T_0$ (C) $\frac{\ell n(2)\Delta T_0}{R}$ (D) $\frac{\Delta T_0}{\ell n(2)R}$

Ans. C

16. Figure shows, 2 identical bulbs, B_1 and B_2 and a game of spring wheel divide into 6 equal parts of different colour as shown At t = 0, switch S is closed and simultaneously the wheel is set to rotation about its centre O in clockwise direction with initial angular velocity of 2.5π rad/sec. Find the colour on which student should place be if the colour appearing on pointer at an instant when both bulbs give same illumination is selected for wining given $\rightarrow$ angular retardation of wheel due to friction and other effects is 2 rad/s^2 & take (ln 2 – 0.7)



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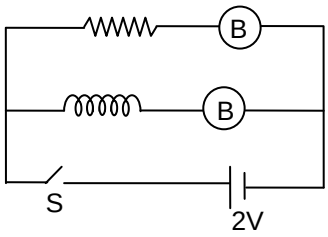
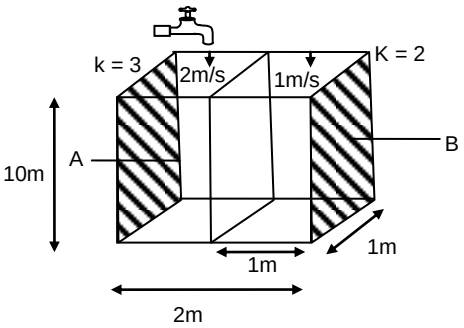


(A) Yellow (B) Blue (C) Green (D) Indigo

Ans. C

17. A thin metallic partition of negligible thickness is inserted between two shaded metallic plates as shown. The remaining ends are then packed with insulating plates to form a container like structure.
2 taps shown are opened at t = 0 and finally closed at t = 5s. Find capacitance of system between A and B after closing taps. (Assume liquid to be non conducting) Volumetric flow rates and dielectric constant of liquid are given.

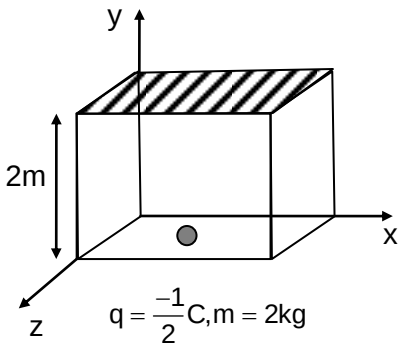


(A) 8.85×10^{-11}F (B) 8.85×10^{-10}F

(C) 4.42×10^{-10}F (D) 4.42×10^{-11}F

Ans. A

18. Consider a gravity free container as shown System in initially at rest and electric potential in the regions is V = (y^3 + 2) J/C. A ball of charge q and mass m is released from rest from base starts to move up due to electric field and collides with shaded face as shown
If its speed just after collision is 1.5 m/s and time for which ball is in contact with shaded face is 0.1 sec, find external force required to hold the container fixed in its position during collision assuming ball exerts constant force on wall during entire span of collision.

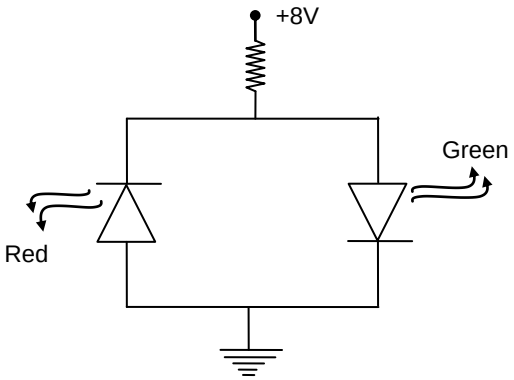


(A) 70N (B) 72N

(C) 74 N (D) 76 N

Ans. D

19. If the figure shown are 2LED's that can be used as a polarity detector. Apply a positive source voltage and a green light results. Negative supplies results in a red light. Packages of such combination are commercially available. Find resistor R to ensure a current of 20 mA through the ON diode for the configuration . Both diodes have reverse breakdown voltage of 3V and average turn on voltage of 2V.

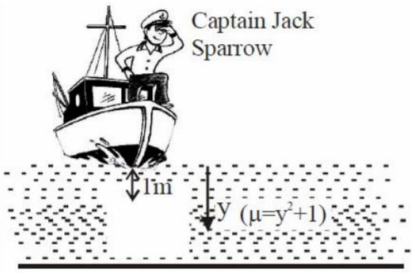


(A) 250 Ω (B) 300 Ω

(C) 325 Ω (D) 400 Ω

Ans. B

20. Captain Jack sparrow tires to observer a fish almost vertically below him in a magical sea of variable $\mu = y^2 + 1$ where y is depth below water surface. Find the apparent depth of fish below water level as seen by captain jack sparrow.

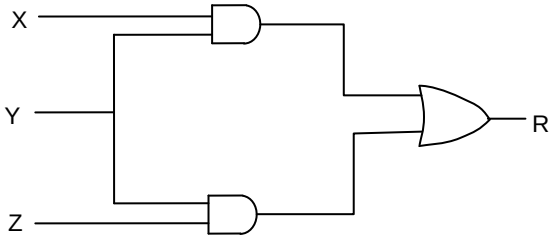


(A) $\frac{\pi}{4}$m (B) $\frac{\pi}{2}$m

(C) $\frac{\pi}{3}$m (D) π m

Ans. A

21. Figure shows 2 NAND gates followed by a NOR gate. The systems is equivalent to one gate G with input X, Y, Z and output R. What is G?



(A) OR (B) NAND

(C) XOR (D) AND

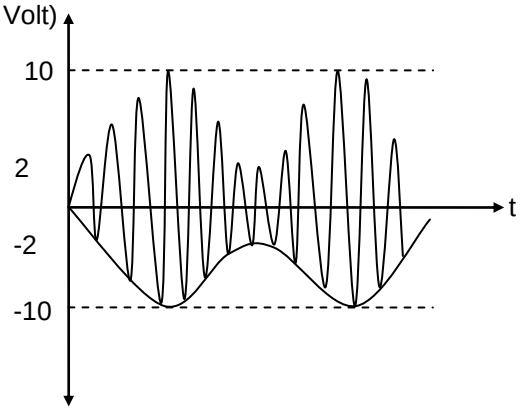
Ans. D

22. A radiowave has maximum electric filed intensity of 10^{-5}V/m on arrival at a receiving antenna. The maximum magnetic flux density of such a wave is

(A) 2×10^{3}T (B) 3×10^{4}T (C) 5.2×10^{3}T (D) 3.3×10^{-3}T

Ans. D

23. Figure shows the waveform of an amplitude modulated wave. Its modulation factor is

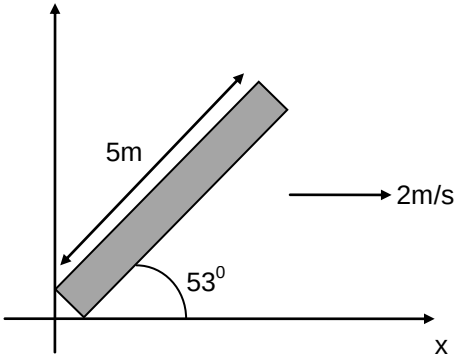


(A) $\frac{1}{5}$ (B) $\frac{3}{4}$

(C) $\frac{2}{3}$ (D) $\frac{2}{5}$

Ans. C

24. A conducting rod PQ of l = 5cm oriented as thrown is moving with $V = (2m/s)j$ without any rotation in a uniform magnetic field $(3\hat{j} - 4\hat{k})$ Tesla. Emf induced in the rod is

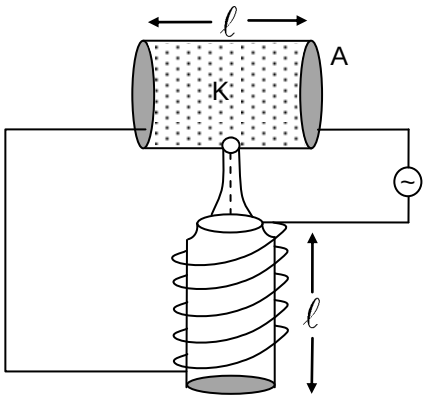


(A) 32V (B) 40 V

(C) 50 V (D) None

Ans. A

25. Figure shows a system of inductor and parallel plate capacitor made of 2 parallel circular plates of area A and filled with dielectric liquid of dielectric constant K as shown



A small leak develops in capacitor and liquid starts to fill the inductor of same dimensions having n turns / unit length. Find the ratio of magnitude if initial to final reactance of circuit after liquid fills the inductor completely .

Given : $\omega^2A^2n^2 = c^2$

$\omega \rightarrow$ angular frequency of AC

$c \rightarrow$ speed of light

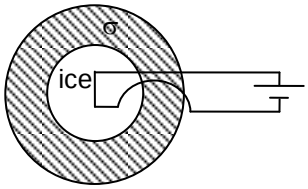
and $\mu \rightarrow$ relative permeability of liquid

(A) $K\dfrac{(K-1)}{(\mu_r+1)}$ (B) $\dfrac{1}{K}\dfrac{(1-K)}{(1-\mu_r)}$

(C) $\dfrac{(1+\mu_r)}{(1+K)}$ (D) $\dfrac{1}{K}\dfrac{(K+1)}{(1-\mu_1)}$

Ans. B

26. Figure shows a thick shell made of electrical conductivity σ and has inner & outer radii of 10 cm & 20 cm respectively and is filled with ice inside it. Its inside and outside surface are kept at different potentials by a battery of internal resistance $\dfrac{2}{\pi}\Omega$ & $\varepsilon = 5V$. Find value of σ for which ice melts at maximum possible rate if 25% of heat generated by shell due to joule heating is used to melt ice.

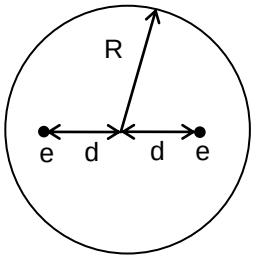


(A) $\dfrac{5}{3}$siemen/m (B) 2siemen/m

(C) $\dfrac{1}{2}$siemen/m (D) $\dfrac{5}{8}$siemen/m

Ans. D

27. Using thomson's model of the atom consider an atom consisting of two electrons, each of charge –e, embedded in a sphere of charge +2e and radius R. In equilibrium each electron is at a distance d from the centre of the atom. What is the equilibrium separation between electrons.

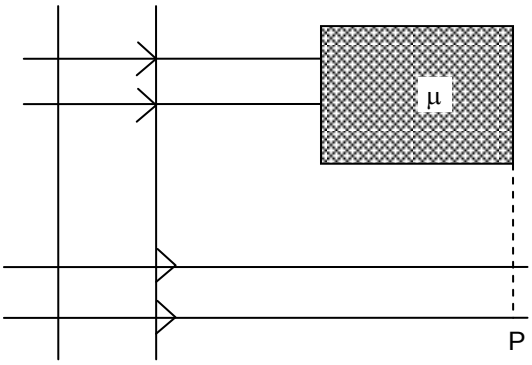


(A) R (B) R/2

(C) R/3 (D) R/4

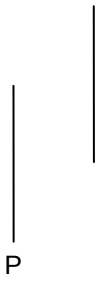
Ans. B

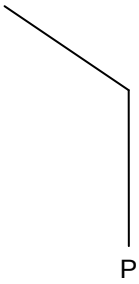
28. A plane wave front travelling in a straight line in vacuum encounters medium of refractive index μ. At P, the shape of the wave front is:



(A) 

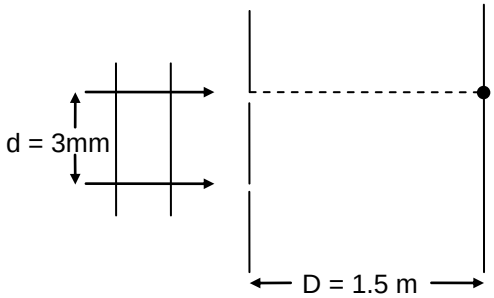
(B) 

(C) 

(D) 

Ans. C

29. In a YDSE light of two different wavelengths (λ_1 & λ_2) are incident normal to the plane of slits. The nth maxima of λ_1 coincides with the m^{th} maxima of λ_2 exactly in front of one of the slits.



Given D = 1.5 m

d = 3 mm

4500 Å < λ_1 λ_2 < 7000 Å

Then n, m and λ_1 are

(A) 3, 4 , 4000 Å (B) 5, 6 , 6000Å

(C) 2, 3, 5000 Å (D) 4, 5, 3000 Å

Ans. C

30. The K, L and M energy levels of platinum lie roughly at 78, 12 and 3 keV respectively. The ratio of wavelength of K_a line to that of K_a line in X-ray spectrum is:

(A) $\frac{22}{3}$ (B) $\frac{3}{22}$ (C) $\frac{22}{25}$ (D) $\frac{25}{22}$

Ans. D

PART – II (CHEMISTRY)

1.

Isotope	Relative abundance (%)	Atomic mass (u)
12	98.8	12
13	1.18	13.1
14	0.02	14.1

From above data what is the molecular mass of CH_4 containing all isotopes of carbon but hydrogen as ${}_1^1H$ (Given that atomic mass of hydrogen = 1.008)

(A) 16.004 u (B) 16.21 u (C) 16.125 u (D) 16.42 u

Ans. A

2. Select the correct statement for quantum numbers.

(i) Magnetic quantum no (m_ℓ) gives information about the sparial orientation of orbitals with respect to standard set of co-ordinate axis.

(ii) Electron spin quantum no. is represented by 's' and have value '$\frac{1}{2}$'

(iii) Principal quantum no. (n) determine the size of the orbitals and also to a large extent of the energy of the orbitals.

(A) Only (i) , (iii) (B) Only (iii) (C) Only (i) (D) (i), (ii), (iii)

Ans. A

3. Select the correct statement about water.

(i) Critical temperature of H_2O is less than NH_3

(ii) Standard boiling point of water is 100^0C.

(iii) Critical volume of H_2O is less than NH_3.

(A) Only (ii) (B) Only (ii), (iii) (C) Only (iii) (D) (i), (ii), (iii)

Ans. B

4. For 1st law of thermodynamics select the correct option

(A) The energy of a closed system is constant.

(B) 1st law is commonly stated as the law of conservation of energy i.e., energy can neither be created nor be destroyed.

(C) It is applicable only for reversible process.

(D) Both (A) & (B)

Ans. B

5. At 1 bar and 298 K, standard molar enthalpy of formation of which substance is zero.

(A) $CH_4(g)$ (B) C(diamond) (C) $Br_2(\ell)$ (D) All correct

Ans. C

6. Order of solubility of solid AgCl(s)in given cases.

(i) In pure water

(ii) In presence of 0.1 M $AgNO_3$

(iii) In presence of 2 M aq. Solution of KCN

(iv) In presence of 2M aq. Solution of NH_3

(Assuming 100% dissociation of $AgNO_3$, KCN and $Ca(CN)_2$) and complex formation with NH_3 and CN^- will take place.

(A) (ii) < (i) < (iii) < (iv) (B) (ii) < (i) < (iii) < (iv)

(C) (ii) < (i) < (iv) < (iii) (D) (i) < (ii) < (iii) < (iv)

Ans. C

7. Select the incorrect option:
(A) Each species appearing in balanced chemical equation must appear in kinetic rate law.
(B) Bimolecular elementary reaction is always second order.
(C) Hydrolysis of ester in alkaline medium is bimolecular second order reaction.
(D) Order and molecularity may be same for a chemical reaction.

Ans. A

8. In CsCl type structure if radius of cation and anion are 80 pm and 100 pm respectively then closet distance between two cations is:

(A) 180 pm (B) $60\sqrt{3}$ pm (C) 90pm (D) $120\sqrt{3}$pm

Ans. D

9. Select the correct option:
(A) Gold sol is negatively charged
(B) Peptization is method of purification of sols.
(C) Persistent dialysis is method of coagulation.
(D) Both (A) and (C)

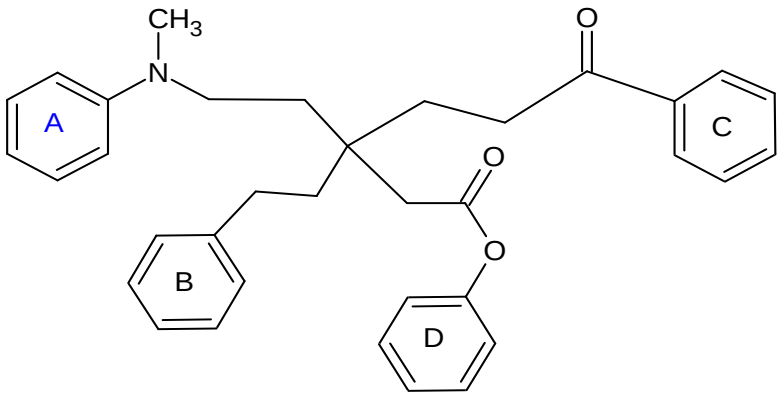
Ans. D

10. Conductivity of 0.01 M aq. Solution of Na_2SO_4 is found to be $2.6\times10^{-3}Scm^{-1}$ at 25^0C. If limiting molar conductance of Na is 50 S cm^2 mol^{-1}, then limiting molar conductance of SO_4^{2-} will be (neglect conductivity of water).

(A) 80 S cm^2 mol^{-1} (B) 160 S cm^2 mol^{-1}
(C) 40 S cm^2 mol^{-1} (D) 120 S cm^2 mol^{-1}

Ans. B

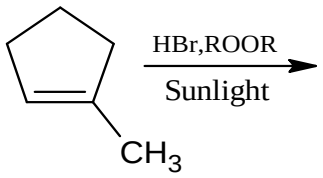
11. The following compound has four aromatic rings marked as A, B, C and D. Rank them in terms of increasing reactivity towards electrophilic aromatic substitution?

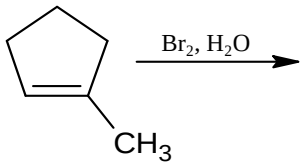


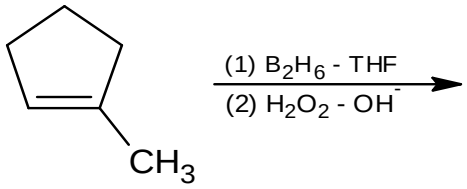
(A) C < D < A< B (B) C < B < D < A (C) C < B < A < D (D) B < C < D < A

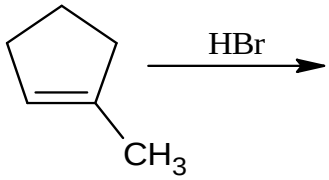
Ans. B

12. Some addition reaction of alkene are given below identify the one which fits on all the given criteria.
Reaction must have
(A) Stereochemistry of addition – SYN ONLY
(B) Regiochemistry of addition – ANTI – MARKOVNIKOV
OR
ANTI – MARKOVNIKO LIKE

(A) 

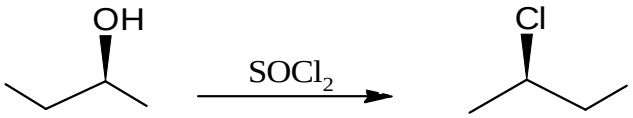
(B) 

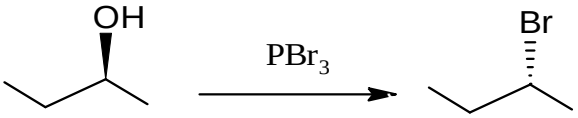
(C) 

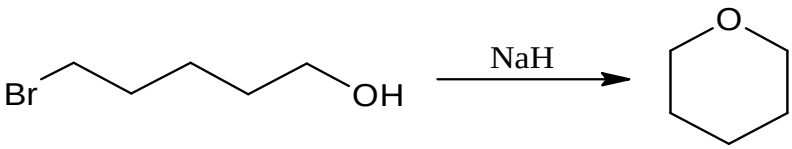
(D) 

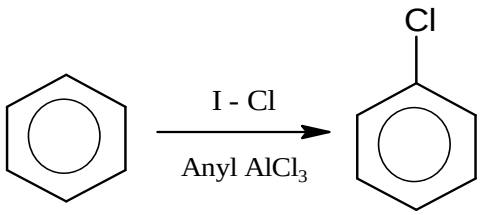
Ans. C

13. Select the reaction NOT representing correct major product?

(A) 

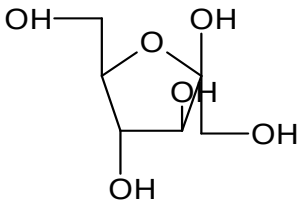
(B) 

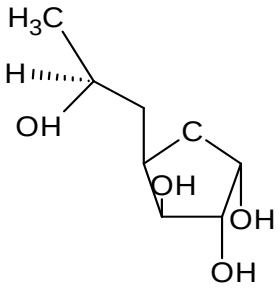
(C) 

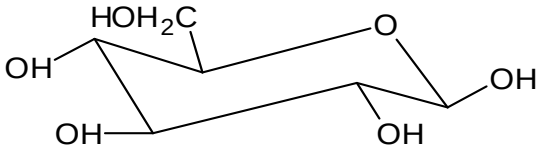
(D) 

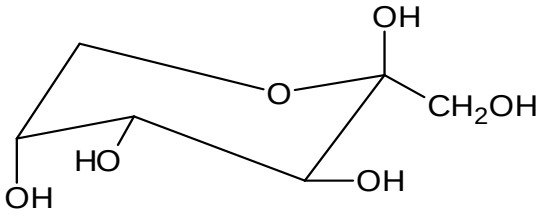
Ans. D

14. Which among the following compound , is a β - ketohexafuranose?

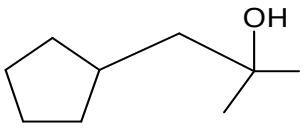
(A) 

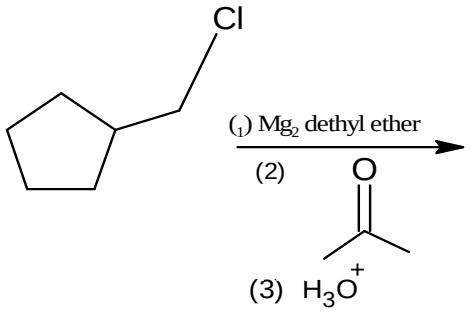
(B) 

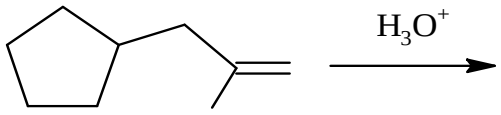
(C) 

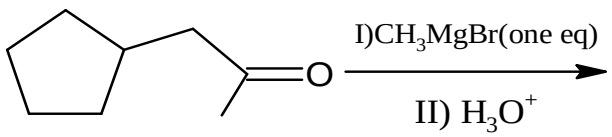
(D) 

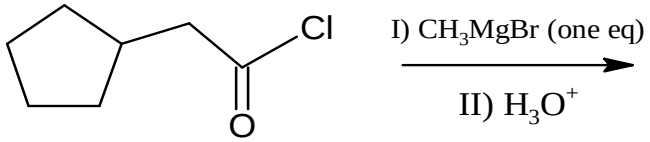
Ans. A

15. Identify the one which will NOT produce  as a major product?

(A) 

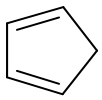
(B) 

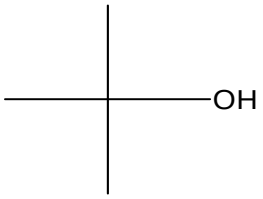
(C) 

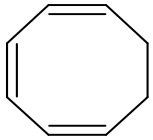
(D) 

Ans. D

16. Which does NOT liberate H_2 gas on reaction with Na – metal?

(A) 

(B) 

(C) 

(D) CH_3COOH

Ans. C

17. Match the processes in Column I with the characteristics (they have) in Column II and select the answer from the codes given.

Column – I		Column – II	
(I.)	$S + e^- \rightarrow S^-$	(P)	Exothermic process
(II)	$O^- + e^- \rightarrow O^{2-}$	(Q)	Endothermic process
(III)	$Mg \rightarrow Mg^{2+} + 2e^-$	(R)	Inert gas configuration is attained.
(IV)	$N \rightarrow N^+ + e^-$	(S)	Half-filled configuration is attained
(V)	$O \rightarrow O^+ + e^-$	(T)	Half-filled configuration is lost

Codes:

I II III IV V

(A) I - P, II - Q,R, III - Q,R, IV - Q,T, V - Q,S

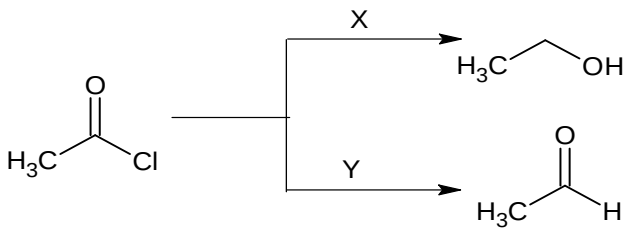
(B) I - P,R, II - Q,R, III - Q,R, IV – S, V - Q,S

(C) I - P,R, II - Q,R, III - Q,R, IV - Q,T, V - Q,S

(D) I - P, II - Q, III - R, IV - Q,T, V - Q,S

Ans. A

18.



X & Y respectively:

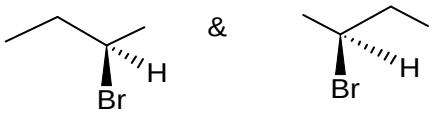
	X	Y
(A)	(a) $Li(t - BuO)_3$ AlH (b) H_2O	(a) LiAlH (b) H_2O
(B)	(a) $NaBH_4$ (b) H_2O	H_2 – Raney Ni
(C)	(a) DIBAL – H (b) H_2O	(a) $LiAlH_4$ (b) H_2O
(D)	(a) $NaBH_4$ (b) H_2O	(a) DIBAL - H (b) H_2O

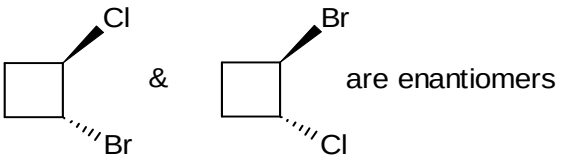
(DIBAL – H Diisobutylaluminum hydride)

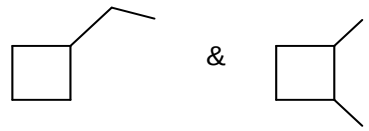
Ans. D

19. Which is correctly method?

(A)  are Positional isomers

(B)  are enantiomers

(C)  are enantiomers

(D)  are Positional isomers

Ans. B

20. You have two $C_6H_{10}O$ ketones, I and II. Both are optically active , but I is racemized by treatment with acid and II is not . Wolf kishner reduction of both ketones gives the same achiral hydrocarbon, formula C_6H_{12}. What reasonable structure may be assigned to I and II respectively?

(A) I is 3 – Methyl-4-Penten-2-one
II is 4-Methyl-1-Pentane-3-one
(B) I is 2 –Methyl cyclopentanone
II is 3 – Methyl cyclopentanone
(C) I is 3 – Methyl cyclopentanone
II is 2 – Methyl cyclopentanone
(D) I is 2 – Methyl cyclobutanone
II is 3 – Ethyl cyclobutanone

Ans. B

21. Which of the following does not have the correct order of given property?

(A) Ga < Al < In < Tl (Atomic size) (B) $I_3 < F_2 < Cl_2 < Br_2$ (Bond energy)
(C) $PH_3 < NH_3 < HF < H_2O$ (Boiling point) (D) $BF_3 < NF_3 < NH_3$ (Dipole moment)

Ans. B

22. The distance between two adjacent carbon atoms is maximum in:

(A) Diamond (B) Graphite (C) Benzene (D) Ethene

Ans. A

23. Which of the following does not liberate a brown gas?

(A) Action of heat on $LiNO_3$ (B) Action of heat on KNO_3
(C) Reaction of zinc with conc. HNO_3 (D) Addition of conc. H_2SO_4 on $NaNO_3$

Ans. B

24. Self reduction process is used in the extraction of

(A) Iron (B) Zinc (C) Aluminium (D) Lead

Ans. D

25. The ammine complex of metal ions Cu^{2+}, Ni^{2-} and Zn^{2+} have shapes respectively –

(A) Tetrahedral, Square planar, Tetrahedral (B) Square planar, Octahedral, Tetrahedral
(C) Square planar, Tetrahedral, Octahedral (D) Tetrahedral, Square planar, Octahedral

Ans. B

26. Geometrical as well as optical isomerism is shows by:

(A) $\left[Cr(C_2O_4)_3\right]^{3-}$ (B) $\left[Co(NH_3)_2Cl_3\right]$

(C) $\left[Cr(H_2O)_2(C_2O_4)_2\right]^-$ (D) $\left[Co(en)Cl_4\right]^-$

Ans. C

27. The reaction of white phosphorus with sodium hydroxide solution gives:

(A) Phosphine and sodium salt of a dibasic acid
(B) Phosphine and sodium salt of a monobasic acid
(C) Phosphine and sodium salt of a tribasic acid
(D) None of these

Ans. B

28. The qualitative distinction of $ZnSO_4$ and $Al_2(SO_4)_3$ can be done by using the reagent:

(A) NH_4OH (B) NaOH (C) Any of these (D) None of these

Ans. D

29. KI is oxidized into I_2 by using the reagent:

(A) $KMnO_4$ (neutral or slightly alkaline solution)
(B) Ozone (alkaline solution)
(C) $CuSO_4$ Solution
(D) All of these

Ans. C

30. Ammonia is liberated in the reaction of:

(A) $Mg_3N_2 + H_2O$ (B) $NaNO_3 + Zn + NaOH$
(C) $CaNCN + H_2O$ (D) All of these

Ans. D

PART – III (MATHEMATICS)

1. The solution of D.E. $(x\cot y + \ln\cos x)dy + (\ln\sin y - \tan x)dx = 0$

(A) $(\sin x)^y(\cos y)^x = c$ (B) $(\sin y)^x(\cos x)^y = c$

(C) $(\sin x)^y(\sin y)^x = c$ (D) $(\cot x)^y(\cot y)^x = c$

Ans. B

2. If f(x) be such that $f(x) = \max(|2-x|, 2-x^3), x \in R$

(A) f(x) is discontinuous at one point
(B) f(x) is differentiable $\forall x \in R$
(C) f(x) is non differentiable at one point only
(D) f(x) is non differentiable at 4 points only

Ans. D

3. If the range of $f(x) = \dfrac{2x^4 - 14x^2 - 8x + 49}{x^4 - 7x^2 - 4x + 23}$ is (a, b] , then (a + b) is:

(A) 3 (B) 4 (C) 5 (D) 6

Ans. C

4. Let $f(x) = x^3 - 3x^2 + 3x + 1$ and g be inverse of f(x), then area bounded by the curve y = g(x) with x axis between x = 1, x = 2 is (in square units.)

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

Ans. B

5. If f(x) satisfy the relation $f\left(\dfrac{5x-3y}{2}\right) = \dfrac{5f(x)-3f(y)}{2} \forall x, y \in R \quad f(0) = 1, f'(0) = 2$ then period of sin (f(x)) is

(A) 2π (B) π (C) 3π (D) 4π

Ans. B

6. If $\sum_{K-1}^{12} 12K \ {}^{12}C_k \ .{}^{11}C_{k-1}$ is equal to $\dfrac{12\times21\times19\times17\times.....\times3}{11!}\times 2^{12}\times p$ then p is

(A) 2 (B) 4 (C) 8 (D) 6

Ans. D

7. The line $\dfrac{x-2}{3} = \dfrac{y+1}{2} = \dfrac{z-1}{-1}$ intersects the curve $xy = c^2$, z = 0 if c is equal to

(A) ± 1 (B) $\pm\frac{1}{3}$ (C) $\pm\sqrt{5}$ (D) ± 2

Ans. C

8. If $\int_{-\infty}^{\infty} f(x)dx = 1$ then $\int_{-\infty}^{\infty} f\left(x - \dfrac{1}{x}\right)dx$ is equal to

(A) 0 (B) 1 (C) – 1 (D) 2

Ans. B

9. ABCD is a rhombus. The circumradii of ΔABD and ΔACD are $\frac{25}{2}$ and 25. Then the area of rhombus is

(A) 400 sq. unit (B) 600 sq. unit (C) 200 sq. unit (D) 800 sq. unit

Ans. A

10. If z is a complex number satisfying $|z|^2 - |z| - 2 < 0$, then the value of $|z^2 + z\sin\theta|$, for all value of θ is

(A)equal to 4 (B) equal to 6 (C) more than 6 (D) less than 6

Ans. D

11. If the graph of $y = ax^3 + bx^2 + cx + d$ is symmetric about the line x = k then

(A) k = c (B) $k = -\frac{c}{6}$ (C) $a + \frac{c}{2b} + k = 0$ (D) None of these

Ans. C

12. The value of $\lim_{x\to\infty} \dfrac{1}{3.7} + \dfrac{1}{7.11} + \dfrac{1}{11.15} + ... + \dfrac{1}{(4n-1)(4n+3)}$ is

(A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) $\frac{1}{12}$ (D) 0

Ans. C

13. Let $f(x)=\int_0^x (t^2+2t+2)dt$, where x is set of real numbers satisfying the inequation $\log_{\sqrt{2}}\left(1+\sqrt{6x-x^2-8}\right)\geq 0$. If range of f(x) is [a, b] then (a+b) is

(A) 50 (B) 56 (C) 72 (D) 32

Ans. B

14. The equation of the plane through the intersection of the planes x + 2y + z – 1 = 0 and 2x + y + 3z – 2 = 0 and perpendicular to the plane x + y + z – 1 = 0 and x + ky + 3z – 1 = 0. Then the value of k is

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

Ans. C

15. Let $f(x)=\begin{cases} x^p \sin\left(\frac{1}{x}\right)+x|x^3|, & x\neq 0 \\ 0, & x=0 \end{cases}$ then complete set of values for which f′(x) is continuous at x = 0 is

(A) [2, ∞) (B) [3, ∞) (C) (4, ∞) (D) [-2, ∞)

Ans. C

16. If $\lim_{x\to\frac{1}{2}} \frac{ax^2+bx+c}{(2x-1)^2}=\frac{1}{2}$ then $\lim_{x\to 2}\frac{(x-a)(x-b)(x-c)}{x-2}$ is

(A) 0 (B) $\frac{1}{2}$ (C) 2 (D) 6

Ans. D

17. If $\frac{d}{dx}\left[\frac{2x^3+3x^2+x-3}{x^2+x-2}\right]=A+\frac{B}{(x-1)^2}+\frac{C}{(x+2)^2}$ then (A – B + C) is

(A) 4 (B) 7 (C) – 2 (D) 0

Ans. D

18. Lines are drawn from a point P(-1, 3) to a circle $x^2 + y^2 – 2x + 4y – 8 = 0$. Which meets the circle at 2 points A & B, then the minimum value of PA + PB is

(A) 6 (B) 8 (C) 10 (D) 12

Ans. B

19. If $T_n=\left(n^2+1\right)n!$ & $S_n=T_1+T_2+T_3+.....T_n$. Let $\frac{T_{10}}{S_{10}}=\frac{a}{b}$ where a & b are relatively prime natural numbers , then the value of (b- a) is

(A) 8 (B) 9 (C) 10 (D) 11

Ans. B

20. If $g(x)=2f(2x^3-3x^2)+f(6x^2-4x^3-3), \forall x\in R$ and $f''(x)>0, \forall x\in R$, then $g'(x)>0$ for x belonging to

(A) $\left(-\infty,-\frac{1}{2}\right)\cup(0,1)$ (B) $\left(-\frac{1}{2},0\right)\cup(1,\infty)$ (C) (0, ∞) (D) (-∞, 1)

Ans. B

21. Let $I=\int_0^{\pi/6}\frac{\cos x}{x}dx, J=\int_{\pi/3}^{\pi/2}\frac{\cos x}{x}dx$. Which of the following is CORRECT?

(A) $I<\frac{\pi}{6}, J<\frac{\pi}{6}$ (B) $I>\frac{\pi}{6}, J<\frac{\pi}{6}$ (C) $I<\frac{\pi}{6}, J>\frac{\pi}{6}$ (D) $I>\frac{\pi}{6}, J>\frac{\pi}{6}$

Ans. B

22. A variable line ax + by + c = 0, where a, b, c are in A.P.., is normal to a circle.

$(x-\alpha)^2+(y-\beta)^2=\gamma$ which orthogonal to circle $x^2+y^2-4x-4y-1=0$. The value of $\alpha+\beta+\gamma$ is equal to

(A) 3 (B) 5 (C) 10 (D) 7

Ans. D

23. If $A=\begin{bmatrix}1 & 1 & 2\\ 0 & 2 & 1\\ 1 & 0 & 2\end{bmatrix}$ and $A^3=(aA-I)(bA-I)$, where a, b are integers and I is a 3×3 unit, then value of (a + b) is equal to

(A) 4 (B) 5 (C) 6 (D)7

Ans. C

24. The statement $\left[(p\wedge q)\to p\right]\to(p\wedge\sim q)$ is

(A) tautology (B) contradiction
(C) open statement (D) neither tautology nor contradiction

Ans. B

25. The average marks of 10 students in a class was 60 with a standard deviation 4, while the average marks of other students was 40 with a standard deviation 6. If all the students are taken together, their standard deviation will be

(A) 5 (B) 7.5 (C) 9.8 (D) 11.2

Ans. D

26. The number of ways in which 3 children can distribute 10 tickets out of 15 consecutively numbered tickets themselves such that they get consecutive blocks of 5, 3 and 2 tickets is

(A) ${}^5C_5$ (B) ${}^5C_5\ 3!$ (C) ${}^8C_3\ (3!)^2$ (D) None of these

Ans. C

27. Let $\vec{b}=-\hat{i}+4\hat{j}+6\hat{k}$ and $\vec{c}=2\hat{i}-7\hat{k}-10\hat{k}$. If $\vec{a}$ be a unit vector and the scalar triple product $\left[\vec{a}\vec{b}\vec{c}\right]$ has the greater value, then $\vec{a}$ is equal to

(A) $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$ (B) $\frac{1}{\sqrt{5}}\left(\sqrt{2}\hat{i}-\hat{j}-\sqrt{2}\hat{k}\right)$ (C) $\frac{1}{3}\left(2\hat{i}+\hat{j}-\hat{k}\right)$ (D) $\frac{1}{\sqrt{59}}\left(3\hat{i}-7\hat{j}-\hat{k}\right)$

Ans. C

28. The locus of the orthocenter of the triangle formed by the focal chord of the parabola $y^2 = 4ax$ and the normal's drawn at its extremities is

(A) $y^2=a(x-3a)$ (B) $y^2=a(x+3a)$ (C) $y^2=a(x-4a)$ (D) $y^2=a(x-4a)$

Ans. A

29. In a tournament there are twelve players P_1, P_2, P_3,…….P_{12} and divided into six pairs at random . From each game a winner is decided on the basis of game played between the two players of the pair. Assuming each player is of equal strength then the probability that exactly one out of P_1 and P_2 is among the loser is :

(A) $\frac{5}{11}$ (B) $\frac{6}{11}$ (C) $\frac{1}{2}$ (D) $\frac{5}{22}$

Ans. B

30. Point from which two distinct tangents can be drawn on two different branches of the hyperbola $\frac{x^2}{25}-\frac{y^2}{16}=1$ but no two different tangent can be drawn to the circle $x^2+y^2=36$ is

(A) (1, 6) (B) (1, 3) (C) (7, 1) (D) $\left(1,\frac{1}{2}\right)$

Ans. B