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Subject: **CHEMISTRY, MATHEMATICS & PHYSICS**

Paper Code: **JEE_ Main_ Sample Paper - III**

Duration: 3 hrs

Maximum Marks: 360

General Instructions:

1. Immediately fill in the particulars on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
2. The test is of **3 hours duration.**
3. The Test Booklet consists of **90** questions. The maximum marks are **360.**
4. There are **three** parts in the question paper A, B, C consisting of **Chemistry, Mathematics** and **Physics** having 30 questions in each part of equal weight age. Each question is allotted **4 (four)** marks for correct response.
5. Candidates will be awarded marks as stated above in instruction No. 4 for correct response of each question. (1/4) (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
6. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 5 above.

Part – A – Chemistry

1) In the unit cell of an fcc system the number of octahedral and tetrahedral holes are

a) 4,4
b) 4,8
c) 1,8
d) 4,1

2) What volume of H_2 of NTP is needed to reduce 125 gm of MoO_3 to metal?

A 28.33lit

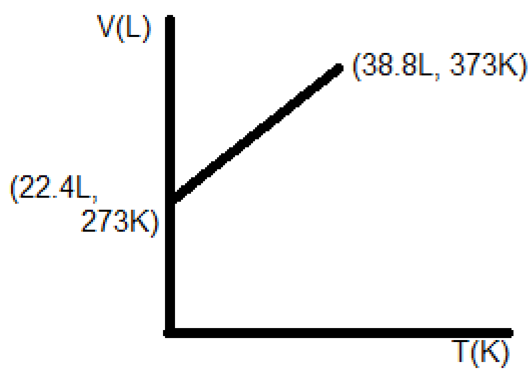
B 58.33lit

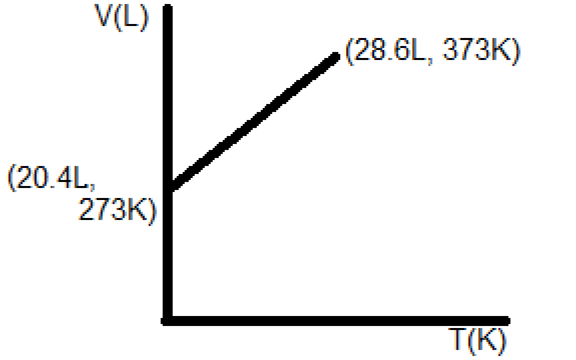
C 68.675lit

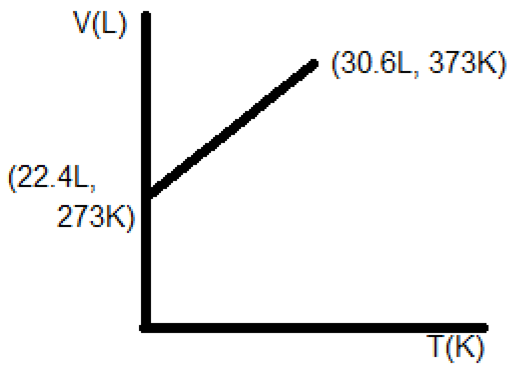
D 68.95lit

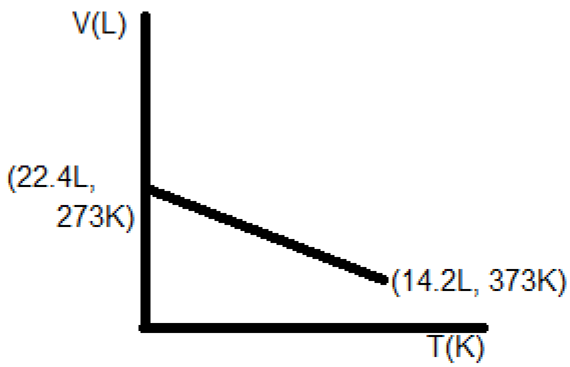
3) Which of the following volume (V) temperature (T) plots represents the behavior of one mole of an ideal gas at the atmospheric pressure?

A



B 

C 

D 

4) According to Graham's law, at a given temperature the ratio of the rates of diffusion r_A/r_B of gases A and B is given by (where, p and M are pressure and molecular weights of gases A and B respectively).

A $(p_A/p_B)\,(M_A/M_B)^{1/2}$

B $(M_A/M_B)(p_A/P_B)^{1/2}$

C $(p_A/p_B)(M_B/M_A)^{1/2}$

D $(M_A/M_B)\ (p_B/p_A)^{1/2}$

5) 1 mole of NH_3 gas at 27^oC is expanded under adiabatic conditions to make volume 8 times (γ = 1.33). Final temperature and work done respectively are –

A 150K, 900cal

B 150K, 400cal

C 250K, 1000cal

D 200K, 800cal

6) $C_P - C_V = R$. This R is:

A change in K.E.

B change in rotational energy

C work done which system can do on expanding the gas per mol per degree increase in temperature

D all are correct

7) The energy of an electron in the first Bohr orbit of H-atoms is -13.6eV. The possible energy value (s) of the excited state(s) for electrons in Bohr orbits of hydrogen is (are)

A -3.4eV

B -4.2eV

C -6.8eV

D +6.8eV

8) Which of the following has the maximum number of unpaired electrons?

A Mg^{2+}

B Ti^{3+}

C V^{3+}

D Fe^{2+}

9) A solution has 0.05M Mg^{2+} and 0.05NH_3. Calculate the concentration of NH_4Cl required to prevent the formation of $Mg(OH)_2$ in solution. $K_{sp[Mg(OH)_2]}$= 9.0 x 10^{-12} and ionization constant of NH_3 is 1.8 x 10^{-5}.

A 4.123M

B 0.67M

C 5.267M

D 0.067M

10) When equal volumes of the following solutions are mixed, precipitation of AgCl (K_{sp} = 1.8 x 10^{-10}) will occur only with –

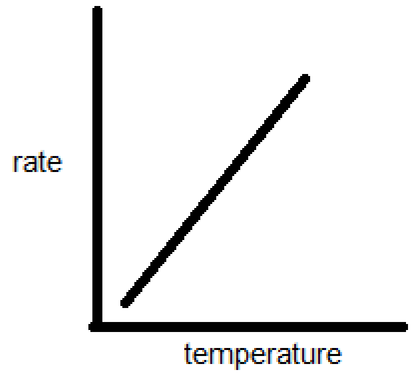
A 10^{-4}M(Ag^+) and 10^{-4}M (Cl^-)

B 10^{-5}M(Ag^+) and 10^{-5}M(Cl^-)

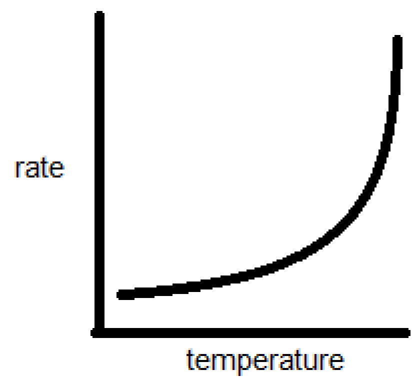
C 10^{-6}M (Ag^+) and 10^{-6}M(Cl^-)

D $10^{-10}M(Ag^{+})$ and $10^{-10}M(Cl^{-})$

11) Which of the following correctly represents the variation of the rate of the reaction with temperature?



A



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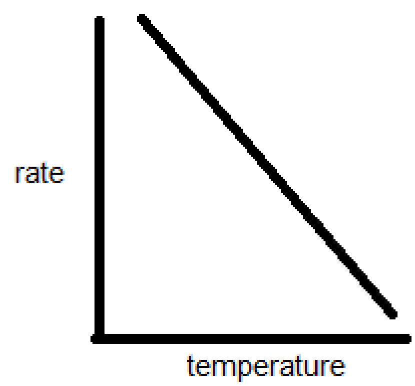

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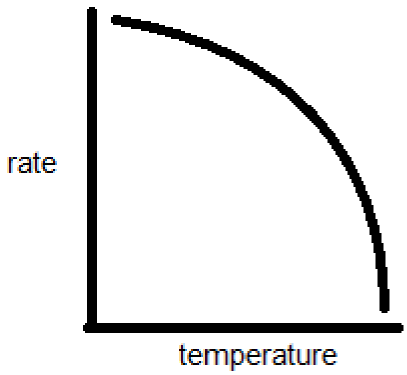
D 

12) For the reaction $R - X + OH^- \rightarrow ROH + X^-$ The Rate is given as

Rate = $5.0 \times 10^{-5}[R\text{-}X][OH^-] + 0.20 \times 10^{-5}[R\text{-}X]$ what percentage of R – X reacted by S_N2 mechanism when $[OH^-] = 1.0 \times 10^{-2}$M

A 96.1%

B 3.9%

C 80%

D 20%

13) When mercuric iodide is added to the aqueous solutions potassium iodide

A freezing point is raised

B freezing point is lowered

C freezing point does not change

D boiling point does not change

14) The number of neutrons accompanying the formation of $^{139}_{54}Xe$ and $^{94}_{38}Sr$ from the absorption of a slow neutron by $^{235}_{92}U$, followed by nuclear fission is

A 0

B 2

C 1

D 3

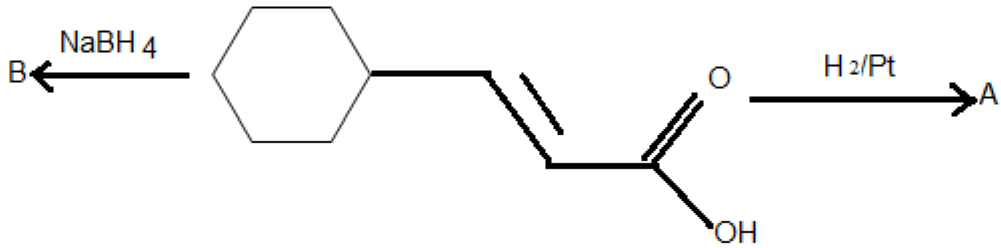
15) pH of a 0.1 M mono basic acid is found to be 2. Hence osmotic pressure at given temperature T is-

a) 0.1RT
b) 0.11RT
c) 1.1RT
d) 0.01RT

16) A hydrogen electrode X was placed in a buffer solution of sodium acetate and acetic acid in the ratio a:b and another hydrogen electrode Y was placed in a buffer solution of sodium acetate and acetic acid in the ratio b:a. If reduction potential values for two cells are found to be E_1 and E_2 respectively w.r.t. standard hydrogen electrode, the pK_avalues of the acid can be given as

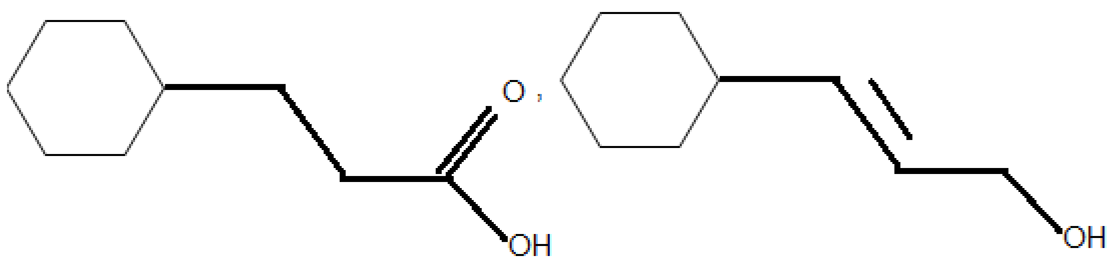
a) $\frac{E_1 - E_2}{0.118}$
b) $-\frac{E_1 + E_2}{0.118}$
c) $\frac{E_1}{E_2} X 0.118$
d) $\frac{E_2 - E_1}{0.118}$

17)



A and B are:

A



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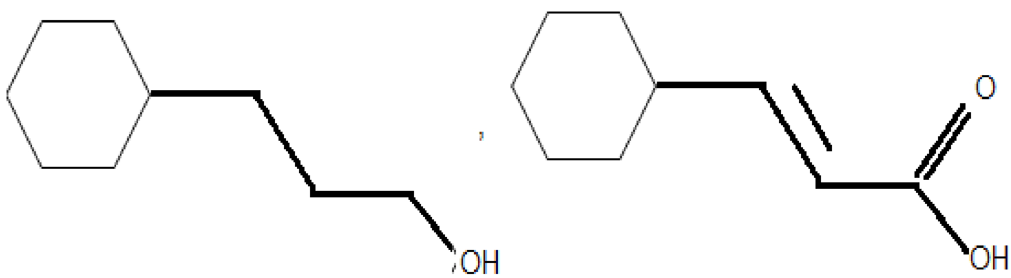
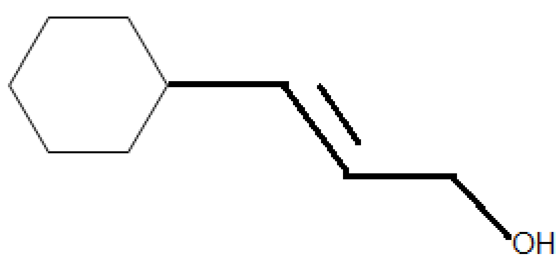
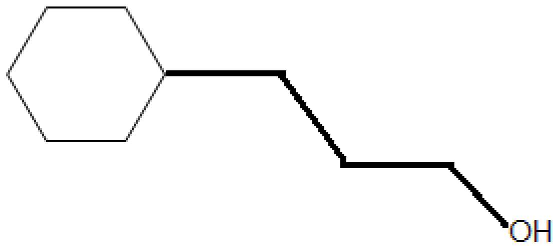


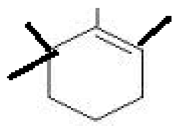
C Both are

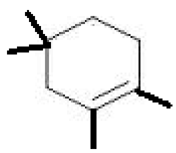


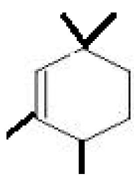


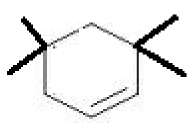
D Both are

18) 2,2,6,6-Tetramethylcyclohexanol is treated with an acid. An alkene is formed after rearrangement. The structure of the alkene is

A 

B 

C 

D 

19) Compound A has molecular formula C_2Cl_3OH. It reduces Fehling's solution and on oxidation it gives mono carboxylic acid, B. If A is obtained by the action of chlorine on ethyl alcohol, the compound A is:

A Chloral

B Chloroform

C CH_3Cl

D $ClCH_2COOH$

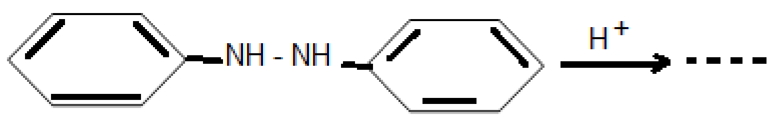
20) Ketones $\left[\begin{array}{c} R-C-R \\ \| \\ O \end{array}\right]$, where R = alkyl group can be obtained in one step by:

A Hydrolysis of esters

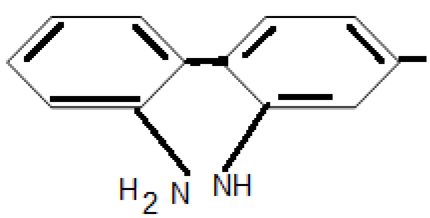
B Oxidation of primary alcohol

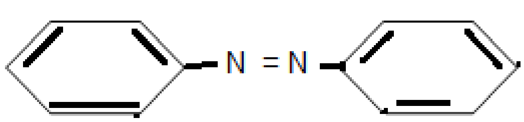
C Oxidation of tertiary alcohol

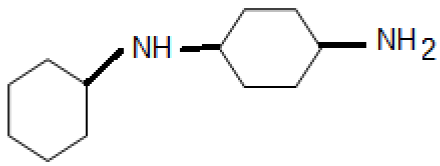
D Reaction of acid halide with alcohols

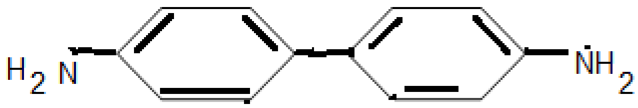
21) 

The mojor product obtained in the reaction is

A 

B 

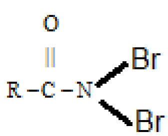
C 

D 

22) Reaction of $RCONH_2$ with a mixture of $Br_2$and KOH gives RNH_2 as the main product. The intermediates involved in the reaction are:

A $\overset{\overset{\displaystyle O}{\|}}{R-C-NHBr}$, $R-N=C=O$

B $R-NHBr$, $R-N=C=O$

C 

D None of the above

23) Composition of azurite mineral is

A $CuCO_3CuO$

B $Cu(HCO_3)_2.Cu(OH)_2$

C $2CuCO_3.Cu(OH)_2$

D $CuCO_3.2Cu(OH)_2$

24) Out of TiF_6^{2-}, CoF_6^{2-}, Cu_2Cl_2 and $NiCl_4^{2-}$ (Z of Ti = 22, Co = 27, Cu = 29, Ni = 28), the colourless species are:

A Cu_2Cl_2 and $NiCl_4^{2-}$

B TiF_6^{2-} and Cu_2Cl_2

C CoF_6^{3-} and $NiCl_4^{2-}$

D TiF_6^{2-} and CoF_6^{3-}

25) $K_2Cr_2O_7$ on heating with aqueous NaOH gives

A CrO_4^{2-}

B $Cr(OH)_3$

C $Cr_2O_7^{2-}$

D $Cr(OH)_2$

26) Acidified $K_2Cr_2O_7$ solution turns green when Na_2SO_3 is added to it. This is due to the formation of:

A $Cr_2(SO_4)_3$

B CrO_4^{2-}

C $Cr_2(SO_3)_3$

D $CrSO_4$

27) Amides can be converted to amines by

a) Kolbe's reaction
b) Reimer-Tiemann reaction
c) Stephen's reduction
d) Hofman'sbromamide reaction

28) The mechanism for the reaction is given below.

$$2P + Q \rightarrow S + T$$
$$P + Q \rightarrow R + S \ \ (slow)$$
$$A + R \rightarrow U \ \ (fast)$$

The rate law expression for the reaction is

a) R = k $[P]^2[Q]$
b) R = k [P] [Q]
c) R = k [A] [R]
d) R = k $[P]^2$

29) Enthalpy of neutralization of NaOH and CH_3COOH is

a) 57.1 kJ mol^{-1}
b) < 57.1 kJ mol^{-1}
c) > 57.1 kJ mol^{-1}
d) Zero

30) Which of the following alkane cannot be prepared by Wurtz reaction?

a) CH_4
b) C_2H_6
c) C_4H_{10}
d) All can be prepared

Part – B – Physics

31) A wire has a mass (0.3 ± 0.003)g, radius (0.5 ± 0.005)mm and length (6 ± 0.06)cm. The maximum percentage error in the measurement of its density is

A 1

B 2

C 3

D 4

32) A ball is projected upwards from the foot of a tower. The ball crosses the top of the tower twice after an interval of 6s and the ball reaches the ground after 12s. The height of the tower is ($g = 10m/s^2$)

A 120m

B 135m

C 175m

D 80m

33) A very broad elevator is going up vertically with a constant acceleration of $2m/s^2$. At the instant when its velocity is 4m/s a ball is projected from the floor of the lift with a speed of 4m/s relative to the floor at an elevation of 30^o. The time taken by the ball to return the floor is ($g = 10m/s^2$)

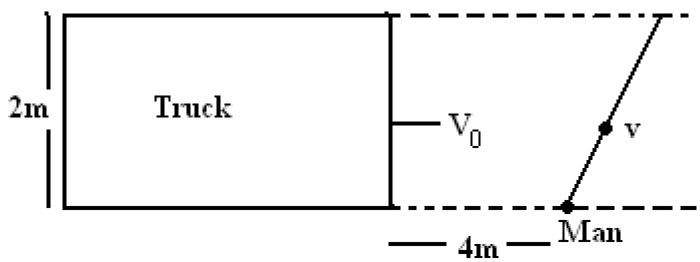
A ½ s

B 1/3 s

C ¼ s

D 1s

34) A 2m wide truck is moving with a uniform speed v_0 = 8m/s along a straight horizontal road. A pedestrian starts to cross the road with a uniform speed v when the truck is 4m away from him. The minimum value of v so that he can cross the road safely is



A 2.62m/s

B 4.6m/s

C 3.57m/s

D 1.414m/s

35) A lift of total mass M is raised by cables from rest to rest through a height h. The greatest tension which the cables can safely bear is n Mg. The maximum speed of lift during its journey if the ascent is to make in shortest time is

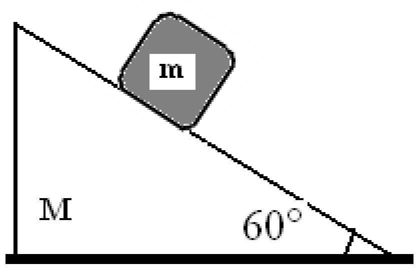
A $\sqrt{2gh\left(\frac{n+1}{n}\right)}$

B $\sqrt{2ghn}$

C $\sqrt{2gh\left(\frac{n}{n+1}\right)}$

D $\sqrt{2gh\left(\frac{n-1}{n}\right)}$

36) In the arrangement shown in figure wedge of mass M moves towards left with an acceleration a. All surfaces are smooth. The acceleration of mass m relative to wedge is



A a/2

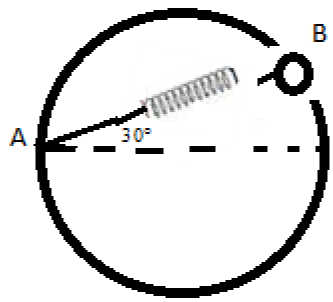
B 2ma/m

C 2(M+m)a/m

D (M+m)a/m

37) A bead of mass m is attached to one end of a spring of natural length R and spring constant k = (√3+1)mg/R. The other end of the spring is fixed at point A on

a smooth vertical ring of radius R as shown in figure. The normal reaction at B just after it is released to move is



A mg/2

B √3mg

C 3√3mg

D 3√3mg/2

38) A simple pendulum has a string of length l and bob of mass m. When the bob is at its lowest position, it is given the minimum horizontal speed necessary for it to move in a circular path about the point of suspension. The tension in the string at the lowest position of the bob is

A 3mg

B 4mg

C 5mg

D 6mg

39) A uniform rod of mass m and length l makes a constant angle θ with an axis of rotation which passes through one end of the rod. Its moment of inertia about this axis is

A $ml^2/3$

B $ml^2/3 \sin\theta$

C $ml^2/3 \sin^2\theta$

D $ml^2/3 \cos^2\theta$

40) The displacement y of a particle executing a certain periodic motion is given by $y = 4\cos^2(1/2\ t) \sin(1000t)$. This expression may be considered to be the superposition of n independent harmonic motions. Then, n is equal to

A 2

B 3

C 4

D 5

41) A point P lies on the axis of a ring of mass M and radius a, at a distance a from its centre C. A small particle starts from P and reaches C under gravitational attraction only. Its speed at C will be

A $\sqrt{(2GM/a)}$

B $\sqrt{(2GM/a(1- 1/\sqrt{2}))}$

C $\sqrt{(2GM/a (\sqrt{2} – 1))}$

D 0

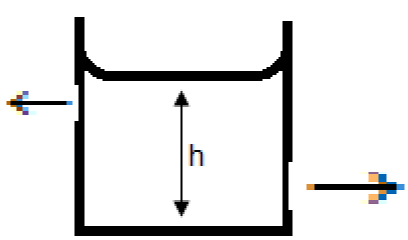
42) A uniform rod of mass m, length L, area of cross-section A and Young modulus Y hangs from the ceiling. Its elongation under its own weight will be

A 0

B mgL/2AY

C mgL/AY

D 2mgL/AY

43) 

There are two identical small holes on the opposite sides of a tank containing a liquid. The tank is open at the top. The difference in height between the two holes is h. As the liquid comes out of the two holes, the tank will experience a net horizontal force proportional to

A $\sqrt{h}$

B h

C $h^{3/2}$

D h^2

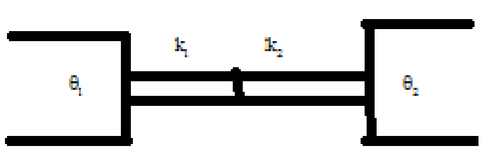
44) A mixture of n_1 moles of mono atomic gas and n_2 moles of diatomic gas has $C_P/C_V = \gamma = 1.5$, then

A $n_1 = n_2$

B $2n_1 = n_2$

C $n_1 = 2n_2$

D $2n_1 = 3n_2$

45) 

Two identical rods are made of different materials whose thermal conductivities are k_1 and k_2. They are placed end to end between two heat reservoirs at temperature Q_1 and Q_2. The temperature of the junction of the rods is

A $(\theta_1 + \theta_2)/2$

B $(k_1 \theta_1+k_2 \theta_2)/(k_1+k_2)$

C $(k_1\theta_2+k_2\theta_1)/(k_1+k_2)$

D $(|k_1\theta_1+k_2\theta_2|)/(|k_1-k_2|)$

46) A string fixed at both ends is vibrating in the lowest mode of vibration for which a point at quarter of its length from one end is a point of maximum displacement. The frequency of vibration in this mode is 100Hz. What will be the frequency emitted when it vibrates in the next mode such that this point in again a point of maximum displacement?

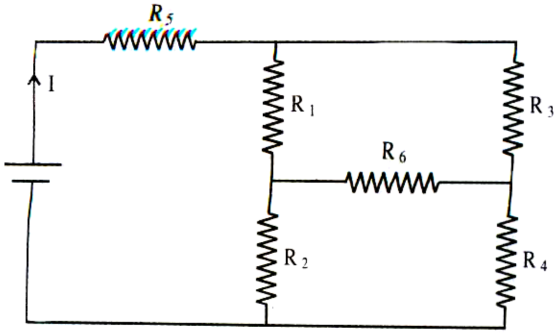
A 400Hz

B 200Hz

C 600Hz

D 300Hz

47) In the given circuit, it is observed that the current I is independent of the value of the residence R_6. Then the resistance vales must satisfy –



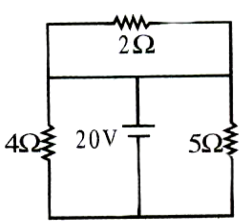
a) $\frac{9}{N^2 X 2} = \frac{1}{2} \Rightarrow N^2 = 9 \Rightarrow N = 3\ R_1R_2R_5 = R_3R_4R_5$

b) $\frac{1}{R_5} + \frac{1}{R_6} = \frac{1}{R_1 + R_2} + \frac{1}{R_3 + R_4}$

c) $R_1R_4 = R_2R_3$

d) $R_1R_3 = R_2R_4 = R_5R_6$

48) In the circuit shown in figure



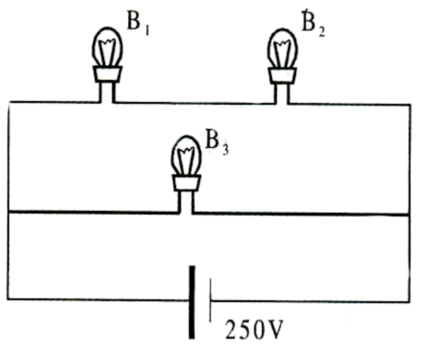
a) Current passing through 2Ω resistance is zero

b) Current 4Ω resistance is 5A

c) Current passing through 5Ω resistance is 4 A

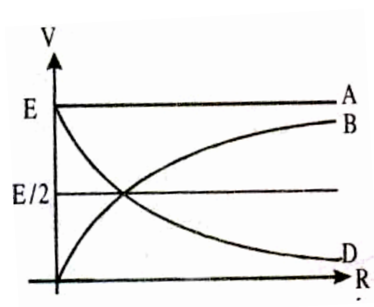
d) All of the above

49) A 100 W bulb B_1 and two 60 W bulbs $B_2$and B_3, are connected to a 250V source, as shown in the figure. Now W_1, W_2 and W_3 are the output powers of the bulbs B_1, B_2, and B_3 respectively. Then



a) $W_1 > W_2 = W_3$
b) $W_1 > W_2 > W_3$
c) $W_1 < W_2 = W_3$
d) $W_1 < W_2 < W_3$

50) A cell of emf E having an internal resistance 'r' is connected to an external resistance R.



The potential difference 'v' across the resistance R varies with R as shown by the curve:

a) A
b) B
c) C

d) D

51) The charge on a capacitor decreases η times in time t, when it discharges through a circuit with a time constant τ ,

a) $t = \eta\,\tau$

b) $t = \tau\ \ln \eta$

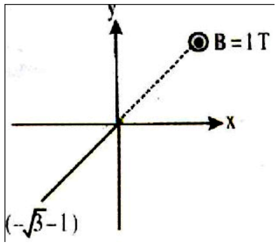
c) $t = \tau\,(\ln \eta - 1)$

d) $t = \tau \ln\left(1-\frac{1}{\eta}\right)$

52) A particle of charge q and mass m moves in circular orbit of radius r with angular speed ω. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

a) ω and q
b) ω,q and m
c) q and m
d) ω and m

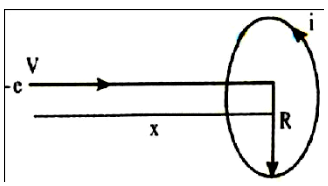
53) A uniform magnetic field of magnitude 1 T exists in region y≥0 is along $\hat{k}$ direction as shown.



A particle of charge 1 C is projected from point $(-\sqrt{3},-1)$ towards origin with speed 1m/sec. if mass of particle is 1 kg, then co-ordinates of centre of circle in which particle moves are-

a) $(1,\sqrt{3})$
b) $(1,-\sqrt{3})$
c) $\left(\frac{1}{2},-\frac{\sqrt{3}}{2}\right)$
d) $\left(\frac{\sqrt{3}}{2},\frac{1}{2}\right)$

54) An electron with velocity V along the axis approaches a circular current carrying loop as shown in the figure.



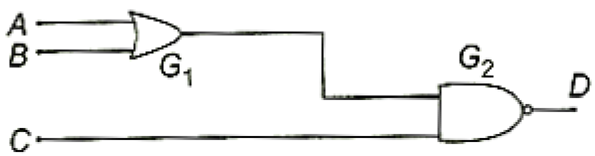
The magnitude of magnetic force on electron at this instant is –

a) $\frac{\mu_0}{2}\frac{eviR^2}{(x^2+R^2)^{3/2}}$
b) $\mu_0\frac{eviR^2x}{(x^2+R^2)^{3/2}}$

c) $\frac{\mu_0}{4\pi}\frac{eviR^2x}{(x^2+R^2)^{3/2}}$

d) Zero

55) For the given combination of gates, if the logic states of inputs A, B, C are as follows A = B = C = 0 and A = B = 1, C = 0, then the logic states of output D are



a) 0, 0
b) 0, 1
c) 1, 0
d) 1, 1

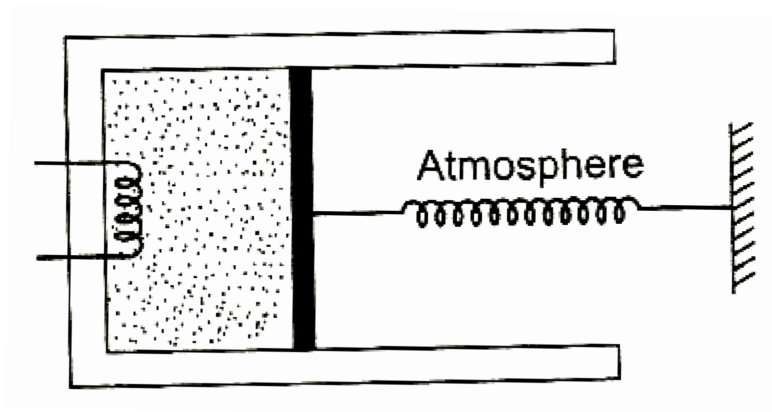
56) A rain drop of radius 0.2 cm is falling through air with a terminal velocity of 8.7 m/s. The viscosity of air in SI units is

[Take ρ_{water} = 1000 kg/m^3 and ρ_{air} = 1 kg/m^3]

a) 10^{-4} poise
b) 1×10^{-3} poise
c) 8.6×10^{-3} poise
d) 1.02×10^{-3} poise

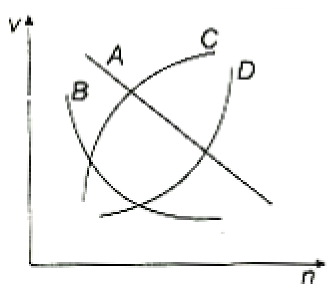
57) An ideal monoatomic gas is confined in a cylinder, fitted with piston, which is connected

to spring as shown in figure. The gas is heated by a small electric heater until the piston moves out slowly by 0.1 m. Find the work done by the gas. Spring constant = 8000 N/m, piston area = 8×10^{-3} m^2, atmospheric pressure = 10^5 Pa.



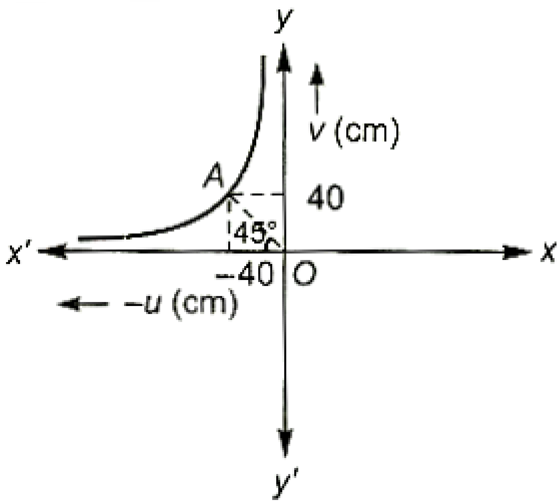
a) 40 J
b) 80 J
c) 120 J
d) 60 J

58) Which of the following curves may represent the speed of the electron in a hydrogen atom as a function of the principal quantum number n?



a) A
b) B
c) C
d) D

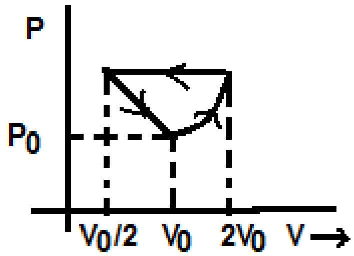
59) Consider the following u-v diagram regarding the experiment to determine the focal length of a convex lens.



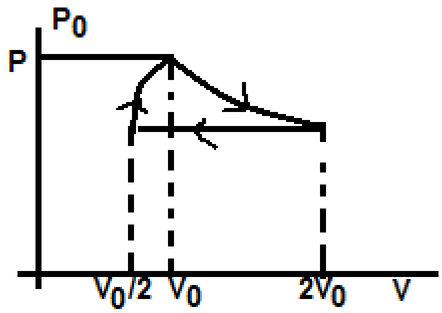
At the point A, the values u and v are equal. The focal length of the lens is

a) 40 cm
b) 20 cm
c) 10 cm
d) 15 cm

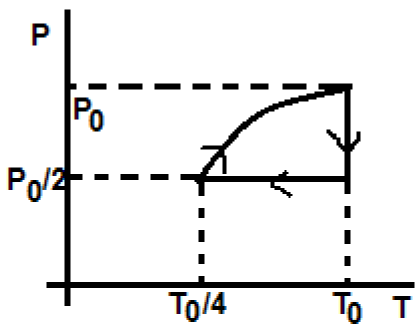
60) One mole of an ideal gas at pressure P_0 and temperature T_0 is expanded isothermally to twice its volume and then compressed at constant pressure to $(V_0/2)$ and the gas is brought back to original state by a process in which $P \propto V$ (Pressure is directly proportional to volume). The correct representation of process is



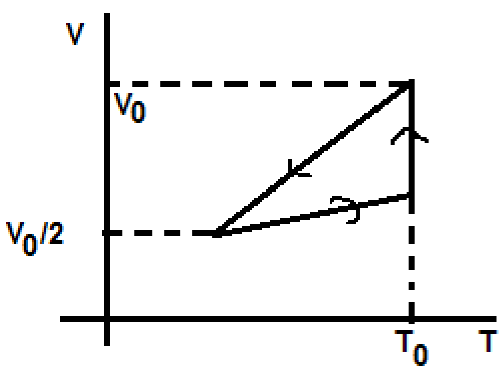
A



B



C



D

Part – C – Math

61) find the value of x : $\tan^{-1}((x-1)/(x+1)) + \tan^{-1}((2x-1)/(2x+1)) = \tan^{-1} 23/36$

a) 2/3
b) 4/3
c) 8/3
d) none of these

62) If a ≠ p; b ≠ q; c ≠ r and $\begin{vmatrix} p & b & c \\ a & q & c \\ a & b & r \end{vmatrix} = 0$, then the value of

p/p-a + q/q-b + r/r-c=

a) 0
b) 2
c) 3
d) none of these

63) If $\alpha = e^{2\pi i/7}$ and $f(x) = A_0 + \sum_{k=1}^{20} A_k x^k$ then find the value of $f(x) + f(\alpha x)$ + …….+ $f(\alpha^6 x)$ independent of α:

A A_0

B $7A_0$

C 1

D None of these

64) the terms independent of x in the expansion of

$(1+x+2x^3)(3x^2/2 - 1/3x)^9$

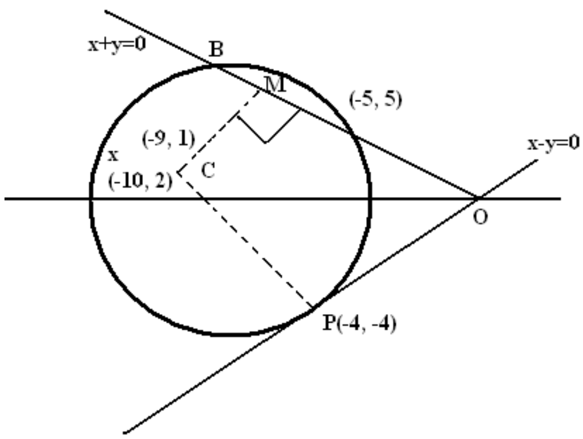
A 11/54

B 17/54

C 11/34

D 17/34

65) A circle touches the line y = x at a point P such that OP = $4\sqrt{2}$ where O is the origin. The circle contains (-10, 2) as an interior point. The length of its chord on the line x + y = 0 is $6\sqrt{2}$. Determine the equation of the circle.



A $x^2+y^2-18x-2y+32=0$

B $x^2+y^2+18x-2y-32=0$

C $x^2+y^2+18x+2y+32=0$

D $x^2+y^2+18x-2y+32=0$

66) The tangents dawn from a point P to the ellipse $x^2/a^2 + y^2/b^2 = 1$ make angles θ_1 and θ_2 with the major axis: find the locus of P when $\tan^2\theta_1 + \tan^2\theta_2 = \lambda$ (a constant).

A $2(x^2y^2+a^2y^2+x^2b^2-a^2b^2) = \lambda(x^2+a^2)^2$

B $2(x^2y^2+a^2y^2+x^2b^2+a^2b^2) = \lambda(x^2-a^2)^2$

C $2(x^2y^2-a^2y^2+x^2b^2-a^2b^2) = \lambda(x^2-a^2)^2$

D $2(x^2y^2+a^2y^2-x^2b^2-a^2b^2) = \lambda(x^2-a^2)^2$

67) The equation of a line through the point of intersection of the lines x – 3y + 1 = 0 and 2x + 5y – 9 = 0 and whose distance from the straight is $\sqrt{5}$ is –

a) 2x + y – 5 = 0
b) 2x – y + 5 = 0
c) 2x + y – 10 = 0
d) 2x – y – 10 = 0

68) Consider $f(x) = \left(\frac{2\sin x + \sin 2x}{2\cos x + \sin 2x} \cdot \frac{1-\cos x}{1-\sin x}\right)^{2/3}; x \in R$

Which of the following statements is /are correct?

(a) Domain of f is R

(b) Range of f is R

(c) Domain of f is R- (4n ± 1)$\frac{\pi}{2}$, n∈ I

(d) Domain of f is R + $(4n-1)\frac{\pi}{2}\ n \in l$

69) If the tangents are drawn from any point on the line x + y = 3 to the circle $x^2 + y^2 = 9$, then the chord of contact passes through the point –

a) (3,5)
b) (3,3)

c) (5,3)

d) None of these

70) Tangents are drawn to the ellipse $x^2 + 2y^2 = 2$, then the locus of the mid-point of the intercept made by the tangents between the coordinate axes is

a) $\frac{1}{2x^2}+\frac{1}{4y^2}=1$

b) $\frac{1}{4x^2}+\frac{1}{2y^2}=1$

c) $\frac{x^2}{2}+\frac{y^2}{4}=1$

d) $\frac{x^2}{4}+\frac{y^2}{2}=1$

71) Let g(x) = $\int_0^x \mathrm{f}(\mathrm{t})\,$dt, where f is such that $\frac{1}{2}\le f(t)\le 1\, for\, t\in[0,1]\, and\, 0\le f(t)\le\frac{1}{2}$ for t $\in$ [1, 2]. Then, g(2) satisfies the inequality

a) $-\frac{3}{2}g(2)<\frac{1}{2}$

b) $0\le g(2)\le\frac{3}{2}$

c) $\frac{3}{2}<g(2)\le\frac{5}{2}$

d) 2 < g(2) < 4

72) If $\begin{vmatrix} 1+\sin^2\theta & \cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & 1+\cos^2\theta & 4\sin 4\theta \\ \sin^2\theta & \cos^2\theta & 1+4\sin 4\theta \end{vmatrix}=0$

Such that $0\le\theta\le\frac{\pi}{2}, then\,\theta\, is$

a) $\frac{7\pi}{12}$

b) $\frac{7\pi}{24}, \frac{11\pi}{24}$

c) $\frac{7\pi}{12}, \frac{11\pi}{12}$

d) None of these

73) If in a triangle ABC,

cos A cos B + sin A sin B sin C = 1,

then a : b : c is equal to

a) $1: 1: \sqrt{2}$

b) $1: 1: \sqrt{3}$

c) $1: \sqrt{2} : 1$

d) $1: \sqrt{3} : 1$

74) If P be one of the point of intersection of E and C and S_1 and S_2 be the foci of the ellipse E, then maximum area of $\Delta PS_1 S_2$ is

a) $\frac{a^2}{\sqrt{2}}$

b) $\frac{ae}{\sqrt{2}}$

c) $\frac{a^2}{2}$

d) $2a^2$

75) The value of a for which the lines represented by $ax^2 + 5xy + 2y^2 = 0$ are mutually perpendicular is

a) 2
b) – 2
c) 25/8
d) None of these

76) The locus of the midpoints of a chord of the circle $x^2 + y^2 = 4$ which subtends a right angle at the origin is

a) $X + y = 2$
b) $X^2 + y^2 = 1$
c) $X^2 + y^2 = 2$
d) $X + y = 1$

77) If the vertex of a parabola is the point (- 3, 0) and the directrix is the line x + 5 = 0, then its equation is

a) $y^2 = 8(x+3)$
b) $x^2 = 8(y+3)$
c) $y^2 = -8(x+3)$
d) $y^2 = 8(x+5)$

78) If D = diag. $(d_1, d_2, d_3, ..., d_n^{-1})$. Where $d_i \neq 0$ for all i = 1 , 2, ……., n, then D^{-1} is equal to

a) D
b) Diag ($(d_1^{-1} d_2^{-1}, ..., d_n^{-1})$
c) I_n
d) None of these

79) If the system of equations x + ay + az = 0; bx + y + bz = 0 and cx + cy + z = 0 where a, b, and c are non-zero non unity, has a non-trivial solution, then the value of

$\frac{a}{1-a}+\frac{b}{1-b}+\frac{c}{1-c}$ is

a) 0
b) 1
c) – 1
d) $\frac{abc}{a^2+b^2+c^2}$

80) Area of the quadrilateral formed by the lines |x|+|y|=1 is

a) 4
b) 2
c) 8
d) None of these

81) The nth term of the corresponding series of $\int_0^1 tan^{-1}x dx$ is

a) $\frac{\pi}{4n}$
b) $\frac{1}{n}$ $\tan^{-1}$ (n–1)
c) $\frac{\pi}{2n}$
d) $\tan^{-1}$ n

82) $Lt_{n\to\infty}\Sigma_{r=0}^{2n-1}\frac{1}{n}\sec^2\left(\frac{r}{n}\right)$ = ?

a) sec 2
b) tan 2
c) $\sec^2$ 2

d) not defined

83) The equation of the plane containing the line

$$\frac{x-x_1}{\ell}=\frac{y-y_1}{m}=\frac{z-z_1}{n} \text{ is a } (x-x_1)+b(y-y_1)+c(z-z_1)=0, where$$

a) $ax_1+by_1+cz_1=0$
b) $a\ell+bm+cn=0$
c) $\frac{a}{\ell}=\frac{b}{m}=\frac{c}{n}$
d) $\ell x_1+my_1+nz_1=0$

84) Find the minimum of tosses of a pair of dice, so that the probability of getting the sum of the numbers on the dice equal to 7 on atleast one toss. Is greater than 0.95. (Given $\log_{10}2=0.3010$, $\log_{10}3=0.4771$).

a) 17
b) 18
c) 19
d) 20

85) The curve given by x + y = e^{xy} has a tangent parallel to the y-axis at the point

a) (0, 1)
b) (1, 0)
c) (1, 1)
d) None of these

86) If the sum of the coefficients in the expansion of $(1 + 2x)^n$ is 6561, then the greatest coefficient in the expansion is

a) 896
b) 3594

c) 1792
d) None of these

87) If E_1 and E_2 are two events that $P(E_1) = ¼$, $P(E_2/E_1) = ½$ and $p(E_1/E_2) = 1/4$, then choose the incorrect statement

a) E_1 and E_2 are independents
b) E_1 and E_2 are independents
c) E_2 is twice as likely to occur as E_1
d) Probability of the events $E_1 \cap E_2, E_1 and E_2$ are in GP.

88) If a plane meets in co-ordinate axes in A, B, C such that the centroid of the triangle is point$(1, r, r^2)$, then equation of the plane is

a) $\begin{matrix} 0 \\ 1-k \\ 1+k \end{matrix} \Bigg| \; x+ry+r^2z=3r^2$
b) $r^2x+ry+z=3r^2$
c) $x+ry+r^2z=3$
d) $r^2x+ry+z=3$

89) The value of $\int e^x \frac{1+nx^{n-1}-x^{2n}}{(1-x^n)\sqrt{1-x^{2n}}}dx$

(When n is a non-zero constant) is

a) $\frac{e^x\sqrt{1-x^n}}{1-x^n}+C$
b) $e^x\frac{\sqrt{1+x^{2n}}}{1-x^{2n}}+C$
c) $e^x\frac{\sqrt{1-x^{2n}}}{1-x^n}+C$
d) None of these

90) The streets of a city are arranged like the lines of a chess board. There are 'm' streets running north to south and 'n' streets running east to west. The number of ways in which a man can travel from NW to SE corner going the shortest possible distance is

a) $\sqrt{m^2+n^2}$

b) $\sqrt{(m-1)^2.(n-1)^2}$

c) $\frac{(m+n)!}{m!.n!}$

d) $\frac{(m+n-2)!}{(m-1)!.(n-1)!}$