JEE MAIN

COURSE
NUCLEUS

TEST CODE				
1	1	3	0	4

MOCK TEST-11

Class: **XII** ***Time:*** **3 Hours.** ***Max. Marks:*** **360**

IMPORTANT INSTRUCTIONS

1. The question paper consists of **'90'** objective type questions. There are **'30'** questions each in **Physics** , **Chemistry** and **Mathematics** respectively. **Please fill the OMR answer Sheet accordingly and carefully.**

2. Each question has four choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

3. You will be **awarded 4 marks** for each question, if you have darkened only the bubble corresponding to the correct answer and zero mark if no bubble are darkened. In all other cases, **minus one (–1) mark** will be awarded.

4. There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 3 above.

5. Use **Black or Blue Ball Point Pen** only for filling particulars.

6. Use of **Calculator, Log Table, Slide Rule and Mobile** is not allowed.

7. Rough work is to be done on the space provided at the bottom and in end of the booklet for this purpose in the Test Booklet only.

8. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator. However, the candidates are allowed to take away this Test Booklet with them.

9. Do not fold or make any stray marks on the Answer Sheet.

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USEFUL DATA

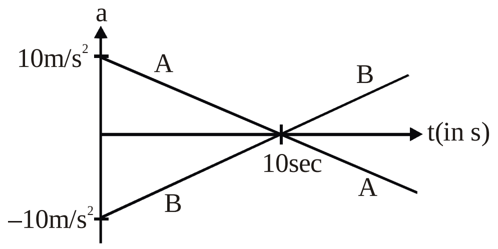
Atomic weights: Al = 27, Mg = 24, Cu = 63.5, Mn = 55, Cl = 35.5, O = 16, H = 1, P = 31, Ag = 108, N = 14, Li = 7, I = 127, Cr = 52, K=39, S = 32, Na = 23, C = 12, Br = 80, Fe = 56, Ca = 40, Zn = 65.5, Ti = 48, Ba = 137, U = 238, Co= 59, B =11, F = 19, He = 4, Ne = 20, Ar = 40 , Mo = 96

[Take : ln 2 = 0.693, ln 1.1 = 0.095, ln 3 = 1.09, e = 1.6×10^{-19}, $m_e = 9.1 \times 10^{-31}$ kg]

Take: $\epsilon_0 = 8.85 \times 10^{-12}$ C^2/Nm^2, g = 10 m/s^2, S_{water} = 1 cal/gm °C, L_{ice} = 80 cal/gm. , g = 10 m/s^2 unless otherwise stated

PHYSICS

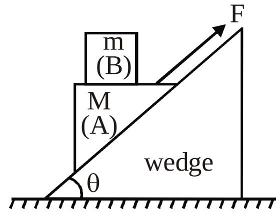
Q.1 Two particles A and B start moving from rest from x = 0 at t = 0 along x-axis with variable acceleration as shown in graph.



Then relative velocity of A with respect to B is 21 m/sec along negetive x-axis after

(1) 11 sec (2) 21 sec (3) 31 sec (4) None

Q.2 Wedge if fixed on horizontzal surface block A is pulled upwards by applying a force F as shown in the figure and there is no friction between wedge and the block A while coefficient of friction between A and B is µ. If there is no relative motion between block A and block B then frictional force developed between A and B is.

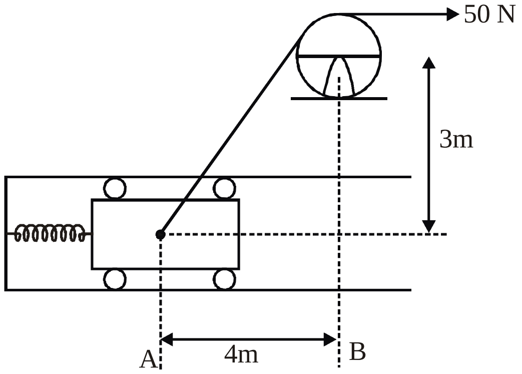


(1) $\left[\frac{F+(M+m)g\sin\theta}{m+m}\right]$ (2) μ mg

(3) $\frac{\mu mg}{2}$ (4) $\left[\frac{F-(M+m)g\sin\theta}{m+M}\right] m \cdot \cos\theta$

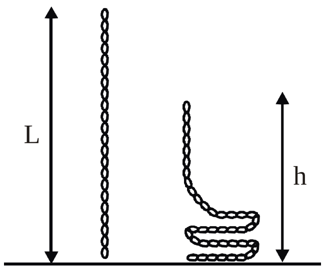
SPACE FOR ROUGH WORK

Q.3 A 20 kg block attached to a spring of force constant k = 5 N/m. is released from rest at A. The spring at this instant is having an elongation of 1m. The block is allowed to move in smooth horizontal slot with the help of a constant force of 50N as shown. The speed of block as it reaches B is :- [Assume the rope to be light].



(1) 4 m/s (2) 2 m/s (3) 1 m/s (4) 3 m/s

Q.4 A flexible chain of mass m and length L is suspended vertically as shown in figure. If upper end of the chain is released so that the chain starts falling and forms a small heep on the table. When h length of chain is still in air, what is the force exerted on the table by the chain ?



(1) $\frac{3mgh}{L}$

(2) $3mg\left(1-\frac{h}{L}\right)$

(3) $mg\left(1-\frac{h}{L}\right)$

(4) $\frac{mgh}{L}$

SPACE FOR ROUGH WORK

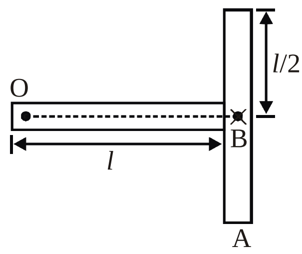
Q.5 Two identical rods are joined as shown. The system is pivoted at point O and is released from rest from the horizontal position. The speed of point A when OB becomes vertical is

(1) $6\sqrt{\frac{gl}{17}}$

(2) $3\sqrt{\frac{5gl}{17}}$

(3) $4\sqrt{\frac{3gl}{17}}$

(4) $2\sqrt{\frac{15gl}{17}}$



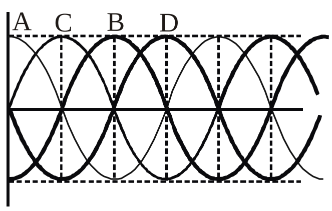
Q.6 At what speed, the velocity head of water is equal to pressure head of 40 cm of Hg ?

(1) 10.3 m/s (2) 2.8 m/s (3) 5.6 m/s (4) 8.4 m/s

Q.7 Three very large plates of same area are kept parallel and close to each other. They are considered as ideal black surfaces and have very high thermal conductivity. The first and third plates are maintained at temperatures 2T and 3T respectively. The temperature of the middle (i.e., second) plate under steady state condition is :

(1) $\left(\frac{65}{2}\right)^{\frac{1}{4}}T$ (2) $\left(\frac{97}{4}\right)^{\frac{1}{4}}T$ (3) $\left(\frac{97}{2}\right)^{\frac{1}{4}}T$ (4) $(97)^{\frac{1}{4}}T$

Q.8 The electric dipole is situated along an electric field. The dipole is rotated about an axis perpendicular to the plane of the paper in clockwise direction with respect to the field. The graph between torque and θ will be represented by :



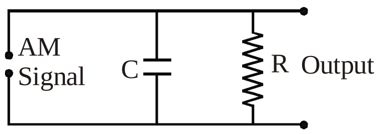
(1) A (2) B (3) C (4) D

SPACE FOR ROUGH WORK

Q.9 A bar magnet has a magnetic moment equal to 5×10^{-5} weber-m. It is suspended in a magnetic field, which has a magnetic induction B equal to $8\pi \times 10^{-4}$ tesla. The magnet vibrates with a period of vibration equal to 15 sec. The moment of inertia of the magnet is :

(1) 22.5×10^{-7} kg-m^2 (2) 11.25×10^{-7} kg-m^2
(3) 5.62×10^{-7} kg-m^2 (4) 7.16×10^{-7} kg-m^2

Q.10 Given is a circuit diagram of an AM demodulator. For good demodulation of AM signal of carrier frequency f, the value of RC should be :

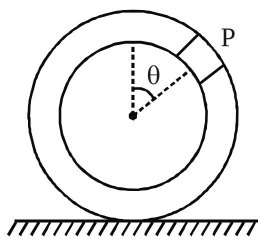


(1) RC = 1/f (2) RC < 1/f (3) RC ≥ 1/f (4) RC > > 1/f

Q.11 Two moles of helium, four moles of hydrogen and one mole of water vapour forms an ideal gas mixture. The molar specific heat at constant pressure of the mixture is (neglecting vibrational degrees of freedom):

(1) $\frac{7}{3}R$ (2) $\frac{16}{7}R$ (3) $\frac{10}{3}R$ (4) $\frac{23}{7}R$

Q.12 A small block of mass m is rigidly attached to P to a ring of mass 3m and radius R. The system is released from rest at θ = 90° and rolls without sliding. The angular acceleration of hoop after release is :



(1) $\frac{g}{4R}$

(2) $\frac{g}{8R}$

(3) $\frac{g}{3R}$

(4) $\frac{g}{2R}$

SPACE FOR ROUGH WORK

Q.13 Two vibrating tuning forks producing progressive waves given by :

$y_1 = 4 \sin (500\pi t)$ $y_2 = 2 \sin (506\pi t)$

are held near the ear of a person. The person will hear :

(1) 3 beats/s with intensity ratio between maxima and minima equal to 2

(2) 3 beats/s with intensity ratio between maxima and minima equal to 9

(3) 6 beats/s with intensity ratio between maxima and minima equal to 2

(4) 6 beats/s with intensity ratio between maxima and minima equal to 9

Q.14 A particle free to move along the x-axis has potential energy given by :

$U(x) = k[1 - \exp(-x^2)]$ for $-\infty \le x \le +\infty$

Where k is positive constant of appropriate dimensions. Then :

(1) at points away from the origin, the particle is in stable equilibrium

(2) for any finite non-zero value of x, there is a force directed away from the origin

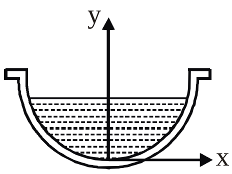
(3) if its total mechanical energy is k/2, it has its minimum kinetic energy at the origin

(4) for small displacements from x = 0, the motion is simple harmonic

Q.15 A planet revolves around the sun in an elliptical orbit. If v_p and v_a are the velocities of the planet at the perigee and apogee respectively, then the eccentricity of elliptical orbit is given by :

(1) $\frac{v_p}{v_a}$ (2) $\frac{v_a - v_p}{v_a + v_p}$ (3) $\frac{v_p + v_a}{v_p - v_a}$ (4) $\frac{v_p - v_a}{v_p + v_a}$

Q.16 A small hole is made at the bottom of a symmetrical jar as shown in figure. A liquid is filled into the jar upto a certain height. The rate of fall of liquid is independent of the level of liquid in the jar. Then the surface of jar is a surface of revolution of the curve $y = kx^n$, the value of n is :



(1) 1 (2) 2 (3) 3 (4) 4

Q.17 An ideal gas is expanding such that PT^2 = constant. The coefficient of volume expansion of the gas is A/T where T is temperature is kelvin. Find the value of A.

(1) 1 (2) 2 (3) 3 (4) 4

SPACE FOR ROUGH WORK

Q.18 The intensity absorbed in a material of depth d with absorption coefficient μ, when I_0 is the incident intensity of X-rays, is :

(1) $(1 - e^{-\mu d})$ (2) $I_0 (1 - e^{-\mu d})$ (3) $\mu I_0 (1 - e^{-\mu d})$ (4) μd

Q.19 Boron has two isotopes ${}^{10}_{5}B$ and ${}^{11}_{5}B$. If the atmomic weight of bororn is 10.81, the ratio of ${}^{10}_{5}B$ and ${}^{11}_{5}B$ in nature is :

(1) 19/81 (2) 20/53 (3) 15/16 (4) 10/11

Q.20 A parallel plate capacitor consists of two circular plates each of radius 2 cm, separated by a distance of 0.1 mm. If voltage across the plates is varying at the rate of 5×10^{13} V/s, then the value of displacement current is :

(1) 5.50 A (2) 5.56×10^2 A (3) 5.56×10^3 A (4) 2.28×10^4 A

Q.21 A beam of light is incident on a glass plate at an angle of incidence 60º. The reflected ray is completely polarised. What is the angle of refraction when angle of incidence is 45º ?

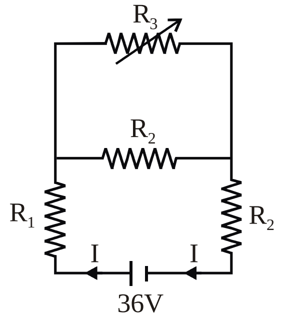
(1) $\sin^{-1} (\sqrt{3/2})$ (2) $\cos^{-1} (\sqrt{3/2})$ (3) $\sin^{-1} (\sqrt{1/6})$ (4) $\sin^{-1} (\sqrt{1/3})$

Q.22 In Young's experiment, find the distance between two slits that results in the third minimum for 420 nm violet light at an angle 30º. It may be assumed that separation between the slits (d) is much smaller than the separation between slits and the screen (D).

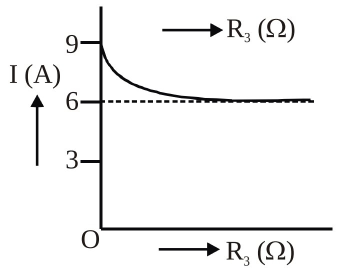
(1) 2.5×10^{-6} m (2) 2.1×10^{-6} m (3) 4.2×10^{-6} m (4) None of these

SPACE FOR ROUGH WORK

Q.23 In the circuit shown in figure R_3 is a variable resistance. As the value R_3 is changed, current I through the cell varies as shown. ;Obviously, the variation is asymptotic, i.e., $I \to 6A$ as $R_3 \to \infty$. Resistance R_1 and R_2 are, respectively :



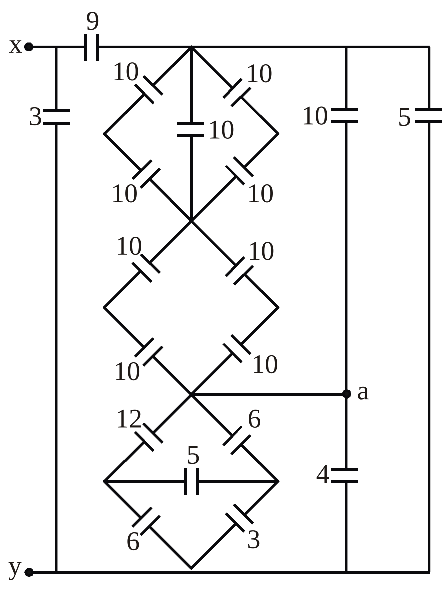
(a)



(b)

(1) 4 Ω, 2 Ω (2) 2 Ω, 4 Ω (3) 2 Ω, 2 Ω (4) 1 Ω, 4 Ω

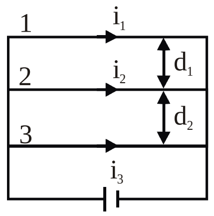
Q.24 Equivalent capacitance of network in figure between x any y is (all capacitances are in μF) :



(1) 8 μ F (2) 6 μ F (3) 4 μ F (4) 2 μ F

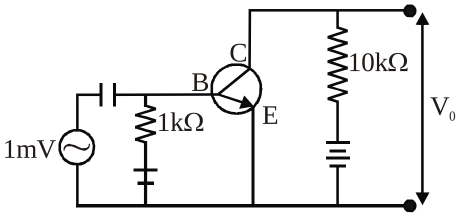
SPACE FOR ROUGH WORK

Q.25 Three long wires (1, 2 and 3) of resistances in the ratio 3 : 4 : 5 are connected in parallel to each other as shown in the diagram. If net force on middle wire is zero. Then d_1/d_2 will be :



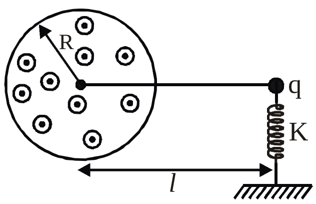
(1) 9 : 25 (2) 5 : 3 (3) $\sqrt{5}:\sqrt{3}$ (4) 1 : 1

Q.26 In the CE amplifier circuit shown in the figure an n-p-n transistor of β = 100 is used. The output voltage of the amplifier is :



(1) 1 volt (2) 2 volt (3) 3 volt (4) 4 volt

Q.27 There is horizontal cylindrical uniform but time varying magnetic field increasing at a constant rate $\frac{dB}{dt}$ as shown. A charged particle having charge q and mass m is kept in equilibrium, at the top of a spring of spring constant K in such a way that it is on the horizontal line passing through the centre of the magnetic field as shown in figure. The compression in the spring will be :

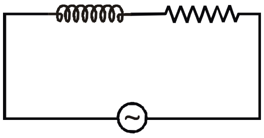


(1) $\frac{1}{K}\left[mg-\frac{qR^2}{2l}\frac{dB}{dt}\right]$ (2) $\frac{1}{K}\left[mg+\frac{qR^2}{2l}\frac{dB}{dt}\right]$

(3) $\frac{1}{K}\left[mg+\frac{2qR^2}{l}\frac{dB}{dt}\right]$ (4) $\frac{1}{K}\left[mg+\frac{qR^2}{l}\frac{dB}{dt}\right]$

SPACE FOR ROUGH WORK

Q.28 In the circuit shown in the below figure, current through source will be : [Given $\cos^{-1}(0.6) = 53^\circ$]



(1) $\frac{1}{3} + \frac{\sqrt{2}}{5}\sin(100\pi t - 8^\circ)$ (2) $\frac{1}{5} + \frac{\sqrt{2}}{5}\sin(100\pi t - 8^\circ)$

(3) $\frac{1}{3} + \frac{\sqrt{2}}{5}\sin(100\pi t - 98^\circ)$ (4) $\frac{1}{5} + \frac{\sqrt{2}}{5}\sin(100\pi t - 98^\circ)$

Q.29 A compound microscope is used to enlarge an object kept at a distance of 3 cm from its objective. The objective consists of several convex lenses in contact and has a focal length of 2cm. If a lens of focal length 10 cm is removed from the objective, the eyeplece has to be moved by x cm to refocus the image. The value of x is :

(1) 5 (2) 9 (3) 4 (4) 15

Q.30 Charge is distributed non-uniformly in the volume of a solid insulating sphere of radius 'a' such that volume charge density (ρ) varies with distance from the centre (r) as,

$$\rho(r) = Cr^2,\ r \le a$$

Here C is a constant.

Magnitude of electric field strength outside the sphere, i.e., for $r > a$, is :

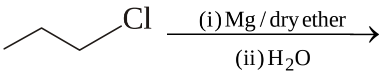
(1) $E = \frac{Ca^5}{5\varepsilon_0 r^2}$ (2) $\frac{Cr^3}{5\varepsilon_0}$ (3) $\frac{Cr^2}{2\varepsilon_0}$ (4) $\frac{Ca^3}{\varepsilon_0 r^2}$

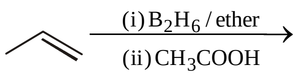
SPACE FOR ROUGH WORK

Q.31 Which of the following set of transition metal of 3d-series have maximum and minimum melting point respectively?

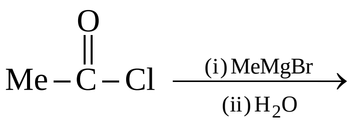
(1) Cr and Mn (2) Fe and Zn (3) Cr and Cu (4) Fe and Hg

Q.32 Which of the following reaction will not give propane ?

(1) 

(2) 

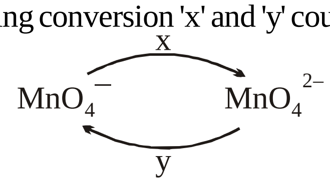
(3) 

(4) 

Q.33 At the given condition of CH_4–O_2 fuel cell the cell emf is 0.8 V and the enthalpy of combustion of CH_4 (g) is –772 kJ/mol. The maximum efficiency of the given fuel cell in the given condition is :

(1) 60 % (2) 75 % (3) 80 % (4) 90 %

Q.34 For the following conversion 'x' and 'y' could be respectively.

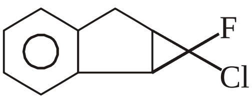


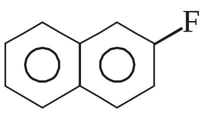
(1) H_2O_2/H^+ and H_2O_2/OH^- (2) Heat and O_3/Δ

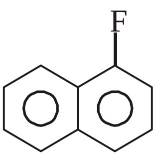
(3) H^+ and OH^- (4) Cooling and Heating

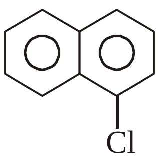
Q.35 

Product 'A' is

(1) 

(2) 

(3) 

(4) 

SPACE FOR ROUGH WORK

Q.36 Which of the following is NOT true ?

(1) The catalyst ZSM-5 converts alcohols directly into gasoline (petrol).

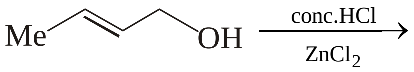
(2) Charge on Lyophilic colloids depends on pH of medium.

(3) The charged colloidal particles of the sol formed by addition of $FeCl_3$ in excess NaOH (aq.) move towards cathode during electrophoresis.

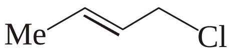
(4) Physisorption is reversible in nature

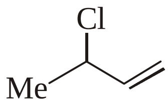
Q.37 Select the **incorrect** match for the extraction process involved for the given metal ore.

(1) Cu_2S : Self reduction
(2) $CuCO_3.Cu(OH)_2$: Carbon Reduction
(3) $CuFeS_2$: Froth floatation
(4) FeS_2 : Self Reduction

Q.38 

Which statement is correct ?

(1) Both 

(I) and 

(II) are formed

(2) Only (I) is formed

(3) Only (II) is formed

(4) Both are not formed

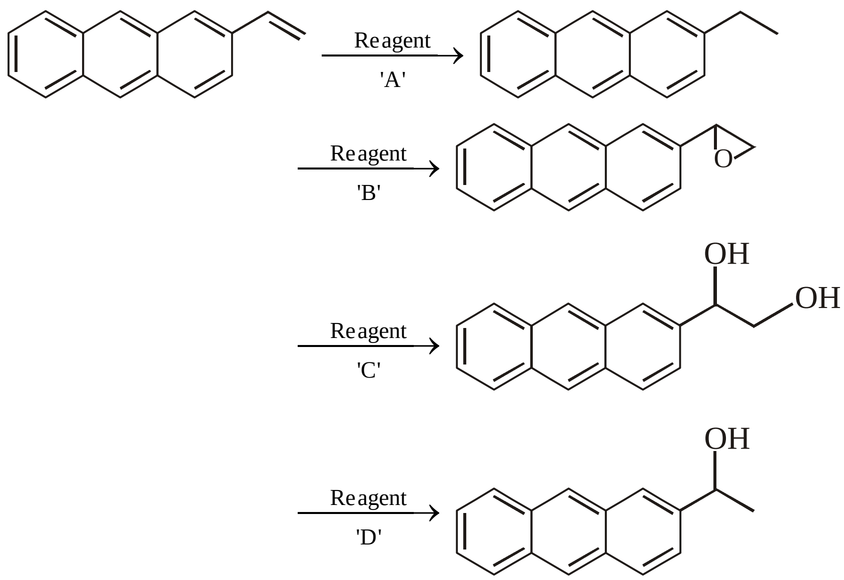
Q.39 What is the pH of the solution obtained by mixing equal volumes of two solutions having pH values 9 and 11? Assume no components of the two solutions reacts. **[Given : log 5 = 0.7]**

(1) 3.3
(2) 10.7
(3) 11.3
(4) 10.3

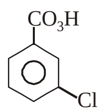
Q.40 A species 'X' can show reaction with both HCl and NaOH. 'X' cannot be :

(1) Al_2O_3
(2) Zn
(3) PbS
(4) $ZnCO_3$

SPACE FOR ROUGH WORK

Q.41 

Select correct option for reagent A, B, C, D ?

	(A)	(B)	(C)	(D)
(1)	H_2/Pt	HCO_2H	cold alk.$KMnO_4$	$HgSO_4$/dil.H_2SO_4
(2)	H_2/Pd-$BaSO_4$	mCPBA	hot alk.$KMnO_4$	$Hg(OAc)_2/H_2O$, $NaBH_4$
(3)	B_2H_6/THF,CH_3COOH	$PhCO_3H$	$OsO_4/NaHSO_3$	B_2H_6/THF,H_2O_2/OH^-
(4)	(Sia),BH/THF,CH_3COOH		Baeyer's Reagent	$Hg(OCOCH_3)_2/H_2O$,$NaBH_4$

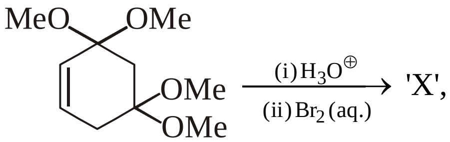
Q.42 The molar mass of a gas is 50 g / mol. The density of the gas at critical temperature and critical pressure of 30 atm is 125 g / L. What is the critical temperature of the gas?
[**Take :** R = 0.08 L atm mol^{-1} K^{-1}]
(1) 200 K (2) 500 K (3) 300 K (4) 400 K

SPACE FOR ROUGH WORK

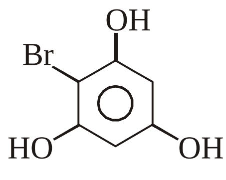
Q.43 The ionic radii (in Å) of N^{3-}, O^{2-}, F^{-} are respectively

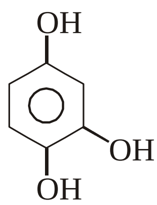
(1) 1.71, 1.40 and 1.36 (2) 1.71, 1.36 and 1.40

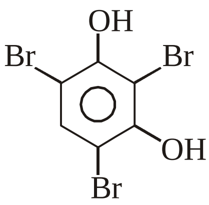
(3) 1.36, 1.40 and 1.71 (4) 1.36, 1.71 and 1.40

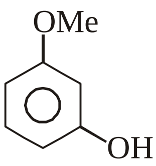
Q.44 

'X' would be

(1) 

(2) 

(3) 

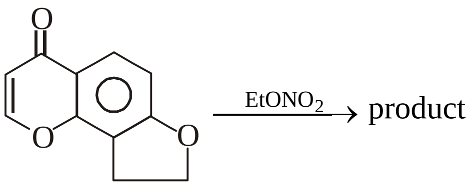
(4) 

Q.45 A photon of energy 9.4 eV strikes to the electron present in third excited state of He^{+}. What is the wavelength of the electron after absorption of the 9.4 eV energy of the photon ?

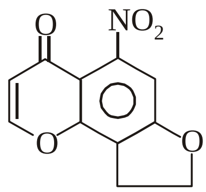
(1) 4 Å (2) 1.8 Å (3) 5 Å (4) 6.65 Å

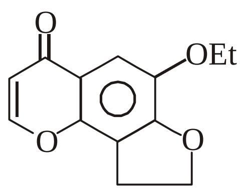
Q.46 In which of the following complex, ligands are considered as strong field ligands (SFL) ?

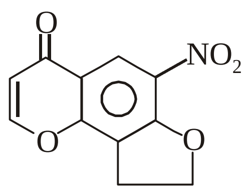
(1) $[NiCl_4]^{2-}$ (2) $[PtCl_4]^{2-}$ (3) $[Fe(NH_3)_6]^{2+}$ (4) $[FeF_6]^{3-}$

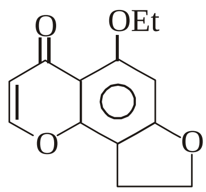
Q.47 

Product of reaction will be :

(1) 

(2) 

(3) 

(4) 

SPACE FOR ROUGH WORK

Q.48 A mixture of $NaHC_2O_4$ and $H_2C_2O_4$ requires 50 mL, 0.1 M $KMnO_4$ (aq.) solution during titration in acidic medium. The same mass of $NaHC_2O_4$ and $H_2C_2O_4$ requires 50 mL, 0.4 M NaOH (aq.) solution for the complete neutralisation. Calculate the mass of $H_2C_2O_4$ in the initial mixture.

(1) 1.250 g (2) 0.900 g (3) 0.450 g (4) 0.675 g

Q.49 Which of the following reactions is not feasible ?

(1) $[Fe(en)_3]^{+3} + 6CN^{-} \longrightarrow [Fe(CN)_6]^{3-} + 3\ en$

(2) $[Co(en)_3]^{+3} + EDTA^{4-} \longrightarrow [Co(EDTA)]^{-1} + 3\ en$

(3) $[Cr(CO)_6] + 4NO \longrightarrow [Cr(NO)_4] + 6CO$

(4) $[Fe(CO)_5] \xrightarrow{\text{Dimerisation}} [Fe_2(CO)_{10}]$

Q.50 In which reaction incorrect product is formed?

(1) $CH_3–COCH_3 \xrightarrow[\text{conc.HCl}]{\text{Zn–Hg}} CH_3–CH_2–CH_3$

(2) $CH_3–CHO \xrightarrow[\Delta]{\text{dil.NaOH}} CH_3–CH = CH – CHO$

(3) $Ph – I + C_2H_5ONa \longrightarrow Ph – OC_2H_5$

(4) $HCHO \xrightarrow{\text{conc.NaOH}} HCOONa + CH_3OH$

Q.51 Identify the **incorrect** statement :

(1) During an adiabatic expansion of an ideal gas temperature will always decrease.

(2) During an isothermal expansion of a real gas temperature will always remain constant throughout.

(3) $\Delta_{rxn}S$ must be zero for $A(g) + B(g) \rightarrow 2AB(g)$

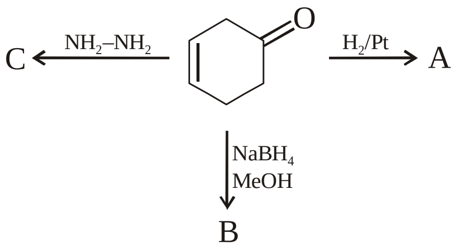
(4) During reversible adiabatic expansion of an ideal gas entropy of system will remain constant.

Q.52 Which of the following would not result in the formation of paramagnetic substance ?

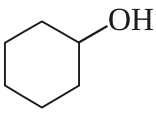
(1) $K_2O_{2(s)} + H_2O_{(l)} \xrightarrow{\text{R.T.}}$ (2) $K_{(s)} + NH_{3(l)} \xrightarrow{0°C}$

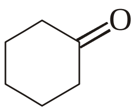
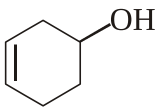
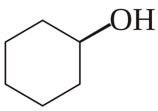
(3) $K_{(s)} + H_2O_{(l)} \xrightarrow{\text{R.T.}}$ (4) $K_{(s)} + \text{air} \xrightarrow{\text{R.T.}}$

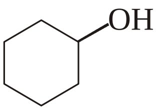
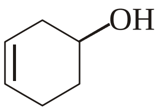
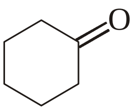
SPACE FOR ROUGH WORK

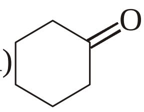
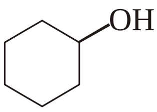
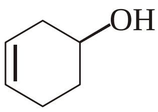
Q.53 

A,B, C are :

(1)  in all cases

(2) (A)  (B)  (C) 

(3) (A)  (B)  (C) 

(4) (A)  (B)  (C) 

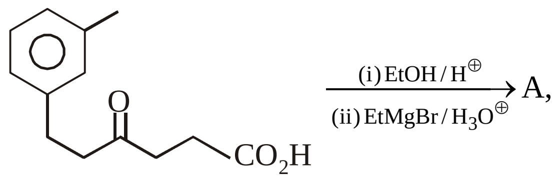
Q.54 In which of the following option the property of the given substance is **wrongly** matched?

(1) CrO_2 – Ferromagnetic
(2) MnO – Antiferromagnetic
(3) C_6H_6 – Ferrimagnetic
(4) Fe_3O_4 – Ferrimagnetic

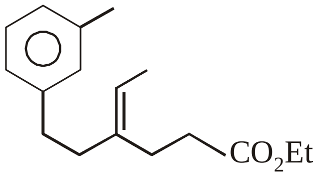
Q.55 Hybridisation of underlined atom would not change after the given reaction in :

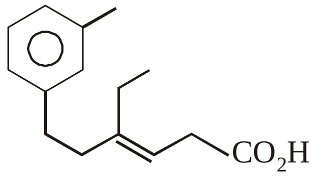
(1) $\underline{P}Cl_3 + Cl_2 \longrightarrow$
(2) $H_2\underline{S}O_4 \xrightarrow{\Delta}$
(3) $\underline{N}Cl_3 + H_2O \longrightarrow$
(4) $\underline{Xe}F_4 + F^- \longrightarrow$

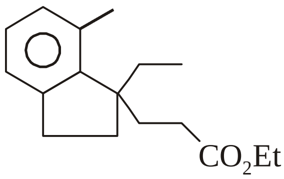
SPACE FOR ROUGH WORK

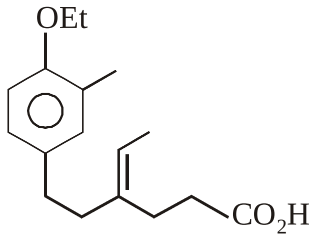
Q.56 

A will be :

(1) 

(2) 

(3) 

(4) 

Q.57 Calculate the weight of urea (NH_2CONH_2) which must be dissolved in 490 g water so that the solution obtained has vapour pressure 2% less than vapour pressure of pure water.

(1) 60 g (2) 30 g (3) 33.33 g (4) 40 g

Q.58 Which of the following option is incorrect about NO_2 and ClO_2 ?

(1) Both are paramagnetic species (2) Both have bent shape

(3) Both compounds dimerised readily. (4) Both have sp^2 hybridisation

Q.59 Which statement is incorrect ?

(1) Proline has 2° amine group

(2) D-Glucose and D-Fructose form same product on reduction by red P / HI

(3) D-Glucose and D-Mannose form different product on reaction with 3 eq. of phenyl hydrazine.

(4) Sucrose is non reducing carbohydrate

Q.60 For the reaction : A$\longrightarrow$ Product having order of the reaction 2.5. The half life period of the reaction is given as $t_{1/2} \propto \frac{1}{[A]_0^m}$.

[Here, $[A]_0$ is the initial concentration of A]. Then the value of "m" is :

(1) 0.5 (2) 3.5 (3) 2.5 (4) 1.5

SPACE FOR ROUGH WORK

Q.61 The value of $\left|(\vec{r}\cdot\vec{a})(\vec{b}\times\vec{c})+(\vec{r}\cdot\vec{b})(\vec{c}\times\vec{a})+(\vec{r}\cdot\vec{c})(\vec{a}\times\vec{b})\right|$, where $|\vec{r}| = 2$ and $\vec{a},\ \vec{b},\ \vec{c}$ are coterminous sides of a tetrahedron with volume 3, is equal to

(1) 6 (2) 12 (3) 18 (4) 36

Q.62 For a twice differentiable non-constant function f (x), if f '' (x) = f ' (x), then the value of $\lim_{x\to\infty}\frac{f(x)}{f'(x)}$ is

(1) 1 (2) – 1 (3) 0 (4) Does not exists

Q.63 If x, y, z satisfy the system of equations $\tan^2 x + \cot^2 x = 2\cos^2 y$ and $\cos^2 y + \sin^2 z = 1$, then the value of $\int_{\cos^2 y}^{\sec^2 x+\sec^2 z}\frac{t^2}{t^2-4t+8}\,dt$ is equal to

(1) 0 (2) 1 (3) 2 (4) 3

Q.64 The value of ${}^{50}C_0 \cdot {}^{50}C_{20} - {}^{50}C_1 \cdot {}^{50}C_{21} + {}^{50}C_2 \cdot {}^{50}C_{22} - {}^{50}C_3 \cdot {}^{50}C_{23} + ... + {}^{50}C_{30} \cdot {}^{50}C_{50}$ is equal to

(1) ${}^{100}C_{40}$ (2) ${}^{50}C_{15}$ (3) ${}^{50}C_{20}$ (4) ${}^{50}C_{10}$

Q.65 The total number of ways of selecting 5 balls out of 20 identical red balls, 10 identical blue balls and 6 identical green balls is

(1) ${}^{36}C_5$ (2) ${}^{20}C_5 + {}^{10}C_5 + {}^{6}C_5$
(3) 21 (4) 42

Q.66 A dice is thrown six times, it is being known that each time a different digit is shown. The probability that a sum of 11 will be obtained in the first three throws is

(1) $\frac{3}{20}$ (2) $\frac{5}{24}$ (3) $\frac{25}{216}$ (4) $\frac{1}{12}$

SPACE FOR ROUGH WORK

Q.67 The value of 'a' for which the straight line $4x - 3y + 4z - 2 = 0 = 3x - 2y + z - 5$ is parallel to the plane $2x - y + az - 7 = 0$, will be

(1) 8 (2) – 8 (3) 11 (4) – 2

Q.68 Mean of 50 observations is 20. If the sum of 40 observations is 300, then the mean of remaining 10 observation is

(1) 30 (2) 50 (3) 70 (4) 10

Q.69 If the equations $ax^2 + bx + c = 0$ and $x^3 + 6x^2 + 12x + 9 = 0$ have two common roots, $(a, b, c \in R)$, then

(1) $a = 3b = 3c$ (2) $a = b = c$ (3) $a = -3b = c$ (4) $3a = b = c$

Q.70 Let f (x) be a twice differentiable function such that $f''(x) > 0$ in $x \in [0, 1]$, then

(1) $f(0) + f(1) = 4f(c)$ for some $c \in (0, 1)$ (2) $f(0) + f(1) = 2f\left(\frac{1}{2}\right)$

(3) $f(0) + f(1) > 2f\left(\frac{1}{2}\right)$ (4) $f(0) + f(1) < 2f\left(\frac{1}{2}\right)$

Q.71 The area of the figure bounded by two branches of curve $(y - x)^2 = x^3$ and the line $x = 1$ is

(1) $\frac{1}{3}$ (2) $\frac{4}{5}$ (3) $\frac{5}{4}$ (4) 3

Q.72 Let $a > 0$ and $b = \lim\limits_{x\to 0} \frac{a\left(1 - 4\sqrt{a^2 - x^2}\right)}{x^2\sqrt{a^2 - x^2}}$ is finite, then the value of ab is

(1) 1 (2) 2 (3) 4 (4) 8

Q.73 The fundamental period of the function $\sin\left(\frac{\pi[x]}{12}\right) + \tan\left(\frac{\pi[x]}{3}\right) + \cos\left(\frac{\pi x}{4}\right)$ is

[**Note** : where [·] denotes greatest integer function.]

(1) 12 (2) 24 (3) 36 (4) function is non-periodic

SPACE FOR ROUGH WORK

Q.74 Let A and B are two sets then $(A \cup B)' \cup (A' \cap B)$ is equal to

(1) A' (2) A (3) B' (4) None of these

Q.75 If p , q, r are statements with truth values false, true and false respectively, then the truth value of $(\sim p \vee \sim q) \vee r$ is

(1) True (2) False (3) False if r is true (4) false if q is false

Q.76 Consider four 2×2 non singular matrices A, B, C, D such that ABC = BCD, then

(1) A = D (2) $A = BCDB^{-1}C^{-1}$ (3) $A = C^{-1}B^{-1}DCB$ (4) $A = BCDC^{-1}B^{-1}$

Q.77 If roots of the equation $z^6 = 1$ are 1, z_1, z_2, z_3, z_4 and z_5, then the value of $\sum_{k=1}^{5} z_k^5$ is

(1) 0 (2) – 1 (3) 6 (4) 5

Q.78 The equation of axis and directrix of parabola $x^2 + 4x + 4y + 16 = 0$ are given by respectively

(1) $x + 2 = 0, y - 2 = 0$ (2) $x = 2$ & $y = 2$

(3) $x + 2 = 0$ and $y + 2 = 0$ (4) None of these

Q.79 Product of length of perpendiculars drawn from foci upon a variable tangent to the hyperbola $\frac{(3x+4y-1)^2}{40} - \frac{(4x-3y+1)^2}{100} = 1$ is equal to

(1) 40 (2) 100 (3) 8 (4) 4

Q.80 If $\int \frac{\left(\sqrt{x}\right)^5}{\left(\sqrt{x}\right)^7 + x^6} dx = a\, ln\left(\frac{x^k}{x^k+1}\right) + c$, the value of a & k respectively are

(1) $\frac{5}{2}$ and $\frac{2}{5}$ (2) $\frac{2}{5}$ and $\frac{5}{2}$ (3) $\frac{5}{2}$ and 2 (4) None of these

SPACE FOR ROUGH WORK

Q.81 The ratio in which the plane $\vec{r}\cdot(\hat{i}-2\hat{j}+3\hat{k}) = 17$ divides the line joining the points $-2\hat{i}+4\hat{j}+7\hat{k}$ and $3\hat{i}-5\hat{j}+8\hat{k}$ is given by

(1) 1 : 5 (2) 1 : 10 (3) 3 : 5 (4) 3 : 10

Q.82 The number of pairs of integers (x, y) that satisfy the following two equations

$\begin{cases}\cos(xy) = x \\ \tan(xy) = y\end{cases}$, is(are)

(1) 1 (2) 2 (3) 4 (4) 6

Q.83 Let $f\left(x+\frac{1}{2}\right) = f\left(x-\frac{1}{2}\right)$ and $f\left(\frac{-1}{2}\right) = \frac{3}{2}$. If $g(x) = \int_0^x f(t+n)\,dt$ for all $n \in N$. Then $g'\left(\frac{5}{2}\right)$ is equal to

(1) $\frac{1}{2}$ (2) $\frac{3}{2}$ (3) $\frac{5}{2}$ (4) none of these

Q.84 The population P(t) at time t of a certain mouse species follows the differential equation $\frac{d(P(t))}{dt} = 0.5P(t) - 450$, if $P(0) = 850$. Then the time at which the population becomes zero is

(1) $\ln 9$ (2) $\frac{\ln 18}{2}$ (3) $\ln 18$ (4) $2\ln 18$

Q.85 If the point (2, 3) lies inside the circle $x^2 + y^2 - 6x - 10y + k = 0$ and the circle neither touches nor intersect the line y = 1. Then the set of all possible value of k lies in the interval

(1) no value of k (2) (9, 29) (3) (18, 29) (4) (25, 31)

Q.86 If $f(x) = \frac{1}{1-x}$ where $x \neq 0, 1$. Then the graph of the function $y = f(f(f(x)))$, $x > 1$ is

(1) circle (2) ellipse (3) straight line (4) hyperbola

SPACE FOR ROUGH WORK

Q.87 The co-ordinate of a point P on the line x + 2y + 5 = 0 such that | PA – PB | is minimum, where A (3, 4) & B (1, 2), is equal to

(1) $\left(-\frac{7}{3}, -\frac{4}{3}\right)$ (2) (– 5, 0) (3) $\left(-\frac{9}{13}, -\frac{28}{13}\right)$ (4) (15, – 10)

Q.88 The value of $\prod_{r=1}^{3} \sin\left(\frac{2r\pi}{7}\right)$ is equal to

(1) $\frac{1}{8}$ (2) $\frac{7}{64}$ (3) $\frac{3}{4}$ (4) $\frac{\sqrt{7}}{8}$

Q.89 Let $f(x) = \begin{cases} \text{sgn}\left(\cot^{-1} x - \cot^{-1}(x^2)\right) & ; x \neq 0 \\ 1 & ; x = 0 \end{cases}$

(where sgn denotes signum function), then

(1) f (x) is continuous at x= 0

(2) f (x) is continuous at x = 0 but not differentiable at x = 0

(3) f (x) is discontinuous at x = 0

(4) f (x) is differentiable at x = 0

Q.90 Consider a variable plane $lx + my + nz = k$ (k > 0) and l, m, n are direction cosines of normal of the plane. Let the given plane intersects the co-ordinate axes at A, B and C, then the minimum area of ΔABC is

(1) $\frac{3\sqrt{3}k^2}{2}$ (2) $\frac{3\sqrt{3}\,k^2}{4}$ (3) $3\sqrt{3}\,k^2$ (4) $12\sqrt{3}\,k^2$

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

ANSWER KEY

COURSE
NUCLEUS

JEE-MAIN MOCK TEST-11
XII

TEST CODE
1 1 3 0 4

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans	2	4	2	2	2	1	3	3	4	4	4	2	2	4	4
Q.No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans	4	3	2	1	3	3	2	3	1	2	1	2	1	2	1
	IOC	OC	PC	IOC	OC	PC	IOC	OC	PC	IOC	OC	PC	IOC	OC	PC
Q.No.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans	3	4	3	2	2	3	4	1	2	3	4	4	1	3	3
	IOC	OC	PC	IOC	OC	PC	IOC	OC	PC	IOC	OC	PC	IOC	OC	PC
Q.No.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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Q.No.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans	4	1	3	2	3	1	4	3	4	3	2	2	2	1	1
Q.No.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans	4	2	3	4	2	4	1	2	4	3	3	4	4	3	1

HINTS & SOLUTIONS

PHYSICS

Q.1 $a_A = -t + 10$

$a_B = t - 10$

$\therefore a_{AB} = -2t + 20$

$$\frac{dv_{AB}}{dt} = -2t + 20$$

$\Rightarrow V_{AB} = -t^2 + 20t$

$\Rightarrow -21 = t^2 + 20t$

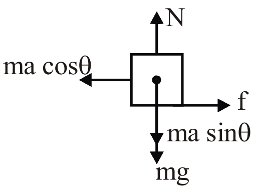
$\Rightarrow t^2 - 20t - 21 = 0$

$\Rightarrow t = 21$ sec

Q.2 As there is no relative motion between A and B hence static friction acts between

$$a = \left[\frac{F-(M+m)g\sin\theta}{m+M}\right]$$

FBD of B



$f = ma \cdot \cos\theta$

$$f = \left[\frac{F-(M+m)g\sin\theta}{(M+m)}\right]\cdot m\cdot\cos\theta$$

Q.3 $W_{net} = \Delta KE$

$W_{sp} + W_{ext} = K_F - K_T$

$$\left[\frac{1}{2}\times k\times(1)^2 - \frac{1}{2}\times k\times(5)^2\right] + 50\times 2$$

$$= \frac{1}{2}\times mv^2$$

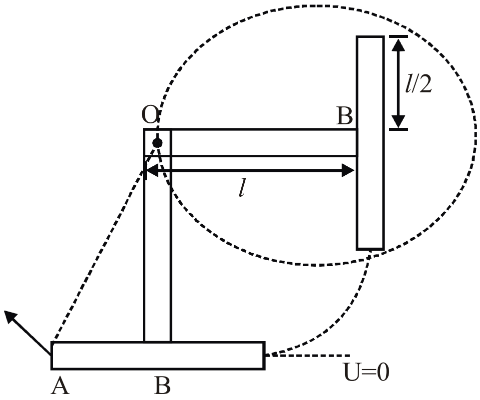
$v = 2$ m/s

Q.4 $\vec{F}_{Net} = \vec{F}_{Thrust} + \vec{F}_{gravity}$

$$F_{Net} = \frac{M}{L}\cdot(L-h)\,g + \left(\sqrt{2g(L-h)}\right)^2 \times \frac{m}{L}$$

$$F_{Net} = \frac{2mg}{L}\,(L-h)$$

Q.5 From conservation of mechanical energy at initial and final position. Considering horizontal line OB as the reference for PE.



$$\frac{I\omega^2}{2} - 0 = 3mg\,\frac{1}{2}$$

$$\Rightarrow \frac{17}{12}\, ml^2\,\omega^2 = 3mgl$$

$$\Rightarrow \frac{17}{12}\, l\omega^2 = 3g$$

$$\Rightarrow \omega = \sqrt{\frac{36g}{17l}}$$

$v_A = \omega \times OA$

$$\Rightarrow v_A = 3\sqrt{\frac{5gl}{17}}$$

Q.6 Velocity head = Pressure head

$$\frac{v^2}{2g} = \frac{\rho}{\rho_w g}$$

$$v = \sqrt{\frac{2\rho}{\rho_w}} = \sqrt{\frac{2(H\rho_{Hg}g)}{\rho_w}}$$

$$= \sqrt{\frac{2\times 40\times 13.6\times 1000}{1}}$$

$= 10.3 \times 10^2$ cm/s = 10.3 m/s

Q.7 Under steady state, $\sigma A[(2T)^4 - T_1^{\,4}]$
$= \sigma A[T_1^{\,4} - (3T)^4]$
$(2T)^4 - T_1^{\,4} = T_1^{\,4} - 3^4T^4$
$2T_1^{\,4} = (2^4 + 3^4)\,T^4$; $2T_1^{\,4} = (16 + 81)\,T^4$

$$T_1 = \left(\frac{97}{2}\right)^{1/4} T$$

Q.8 $\tau = pE\sin\theta$
$\tau \propto \sin\theta$
Hence, graph will be curve marked "C" in graph.

Q.9 $T = 2\pi\sqrt{\frac{I}{MB}}$

$$\therefore\ I = \frac{MBT^2}{4\pi^2} = \frac{5\times 10^{-5}\times 8\pi\times 10^{-4}\times (15)^2}{4\pi^2}$$

$= 7.16 \times 10^{-7}$ kgm^2

Q.10 For good demodulation of AM signal

$$RC >> \frac{1}{f}$$

Q.11 $(C_p)_{mix}$

$$= \frac{n_1(C_p)_{He} + n_2(C_p)_{H_2} + n_3(C_p)_{vapour}}{n_1 + n_2 + n_3}$$

$$= \frac{2\left(\frac{5}{2}R\right) + 4\left(\frac{7}{2}R\right) + 1(4R)}{2+4+1} = \frac{23}{7}R$$

Q.12 $mgR = [3mR^2 + 3mR^2 + m(\sqrt{2}\,R)^2]\,\alpha$
$mgR = 8mR^2 \cdot \alpha$

$$\alpha = \frac{g}{8R}$$

Q.13 y_1 4 sin $(500\pi t) \Rightarrow a_1 = 4$ and $n_1 = 250$ Hz
y_2 2 sin $(506\pi t) \Rightarrow a_2 = 2$ and $n_2 = 253$ Hz
$\therefore$ Beat frequency, $b = n_2 - n_1$
= 253 – 250 = 3

$$\frac{I_{max}}{I_{min}} = \left(\frac{a_1 + a_2}{a_1 - a_2}\right)^2 = \left(\frac{4+2}{4-2}\right)^2 = 9$$

Q.14 $U(x) = k\,[1 - \exp(-x^2)]$

$$F = -\frac{dU}{dx} = -2kx\,e^{-x^2} \qquad ...(i)$$

For small value of x,

$$F = -2kx\left[1 - \frac{x^4}{2} + ...\right] \simeq 2kx$$

$\Rightarrow F \propto -x$
$\therefore$ Motion is SHM and option (4) is correct.
From equation (i), F = 0 (equilibrium) when x = 0. Thus, the origin is the position of equilibrium (and not away from the origin).
$\therefore$ Option (1) is wrong.
At x = 0, U (x) = 0
$\therefore$ K.E. is maximum and option (3) is wrong

Q.15 $\frac{v_p}{v_a} = \frac{a(1+e)}{a(1-e)}$ $\quad \therefore\ e = \frac{v_p - v_a}{v_p + v_a}$

Q.16 Let height of liquid in the jar decreases at rate dy/dt and $A = \pi x^2$ be the cross-sectional area of liquid at time t. Then

$$A\left(\frac{-dy}{dt}\right) = av$$

$$\pi r^2\left(-\frac{dy}{dt}\right) = a\sqrt{2gy}$$

$$\pi r^2\left(-\frac{dy}{dt}\right) = a\ \sqrt{2gkx^n}$$

$(\because\ y = kx^n)$

(dy/dt) will be independent of x, if tern containing x gets concelled out. Thus,

$$2 = \frac{n}{2} \Rightarrow n = 4$$

Q.17 $PT^2 = k$

$$\left(\frac{RT}{V}\right) T^2 = k$$

$T^3 \propto V$ ...(i)

Differentiation,

$3T^2\ \Delta T \propto \Delta V$ ...(ii)

Dividing equation (ii) by equaiton (i).

$$\frac{3\Delta T}{T} = \frac{\Delta V}{V}$$

$$\frac{3}{T} = \frac{\Delta V}{V\Delta T} \quad \Rightarrow \quad \frac{3}{T} = \gamma$$

$\therefore$ A = 3

Q.18 Information based

Q.19 Let 'x' and (1 – x) be the amount of ${}^{10}_{5}B$ and ${}^{11}_{5}B$. Then

$10\,x + (1 - x) = 10.81$

$10x - 11x = 10.81 - 11.00$

$x = 19$

$\therefore$ $1 - x = 100 - 19 = 81$

$\therefore$ Ratio of ${}^{10}_{5}B : {}^{11}_{5}B = 19 : 81$

Q.20 Displacement current is equal to conduction current.

$$\therefore I = \frac{dq}{dt} = \frac{dq}{dt}(CV) = C\frac{dV}{dt} = \frac{\varepsilon_0 A}{d}\frac{dV}{dt}$$

$$= \frac{8.854\times10^{-12}\times\pi\times(2\times10^{-2})^2}{0.1\times10^{-3}}\ 5\times10^{13}$$

$= 5.56 \times 10^3$ A

Q.21 Using Brewster's law,

$$\mu = \tan\theta_p = \tan 60^\circ = \sqrt{3}$$

But, $\mu = \frac{\sin i}{\sin r}$

$$\sqrt{3} = \frac{\sin 45^\circ}{\sin r}$$

$$r = \sin^{-1}\left(\frac{1}{\sqrt{6}}\right)$$

Q.22 P is any point on the screen. For D >> d rays 1 and 2 are approximately parallel and path difference is ΔS_2L.

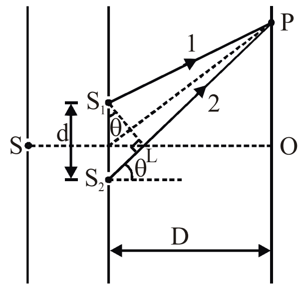
In ΔS_1S_2L,

$$\sin\theta = \frac{S_2L}{d}$$

$\therefore$ $S_2L = d\sin\theta$

or $\Delta = d\sin\theta$

Here θ is the angle that S_1 P or O'P or S_2P (these are almost parallel for D >>d) makes with the central axis or any line parallel to central axis.



For intensity to be minimum,

$\Delta = d\sin\theta = (2n - 1)\,\lambda/2$,

n = 1, 2, 3, ...

For third minimum, n = 3

$$\therefore \quad d\sin q = \frac{5\lambda}{2}$$

Given $\lambda = 420$ nm $= 420 \times 10^{-9}$ m

$\theta = 30^\circ$

$$\therefore \quad d\sin 30^\circ = \frac{5}{2} \times 420 \times 10^{-9}$$

or $d = 2.1 \times 10^{-6}$ m

Q.23 When $R_3 \to 0$

$$I_0 = \frac{36}{R_1 + R_2}$$

$$9 = \frac{36}{R_1 + R_2} = R_1 + R_2 = 4 \quad .....(1)$$

When $R_3 \to \infty$ $IR_3 = 0$

$$I' = \frac{36}{R_1 + 2R_2} = 6$$

$R_1 + 2R_2 = 6$ ....(2)

From (1) and (2)

$R_1 + R_2 = 4 \Rightarrow R_1 + 2R_2 = 6$

$-R_2 = -2 \Rightarrow R_2 = 2\Omega$

$R_1 = 2\Omega$

Q.24 Reduced the circuit using capacitors in parallel and series rules.

Q.25 Currents i_1, i_2 and i_3 will be in the ratio $\frac{1}{3} : \frac{1}{4} : \frac{1}{5}$

$= 20 : 15 : 12$

Given that, $F_{12} = F_{23}$

$$\frac{\mu_0 I_1 I_2}{2\pi d_1} = \frac{\mu_0 I_2 I_3}{2\pi d_2}$$

$$\frac{d_1}{d_2} = \frac{I_1}{I_3} = \frac{20}{12} = \frac{5}{3}$$

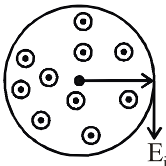
Q.26 $$A_v = \frac{\Delta V_0}{\Delta V_i} = \beta \frac{R_0}{R_i}$$

$$\therefore \quad \Delta V_0 = (\Delta V_i)\left(\beta \frac{R_0}{R_i}\right)$$

$$= 10^{-3} \times 100 \times \frac{10 \times 10^3}{1 \times 10^3}$$

$$= 1 \text{ volt}$$

Q.27



B↑ outward

$$\oint E \cdot dl = \frac{d\phi}{dt} = \frac{d(BA)}{dt}$$

$$\int E \cdot 2\pi l = A\frac{dB}{dt} = \pi R^2 \frac{dB}{dt}$$

$$E \cdot 2\pi l = \pi R^2 \frac{dB}{dt}$$

$$E = \frac{R^2}{2l}\frac{dB}{dt}$$

$$kx = mg + qE$$

$$x = \frac{1}{k}[mg + qE]$$

$$= \frac{1}{k}(mg + \frac{qR^2}{2l}\frac{dB}{dt})$$

Q.28 $I_{dc} = \frac{V_{dc}}{R} = \frac{10}{30} = \frac{1}{3}$ A (as average value of ac over complete cycle is zero)

$$Z = \sqrt{R^2 + X_L^2} = \sqrt{(30)^2 + (40)^2} = 50\ \Omega$$

From impendance triangle.

$$\therefore \quad \tan\phi = \frac{4}{3} = 1.333$$

$$\phi = 53^\circ$$

As current lags behind the applied voltage by phase ϕ, current at time t is given by

$$I = \frac{V}{Z} = \frac{10\sqrt{2}}{50} \sin(100\pi t + 45^\circ - \phi)$$

$$I = \frac{\sqrt{2}}{5} \sin(100\pi t - 45^\circ - 53^\circ)$$

$$I = \frac{\sqrt{2}}{5} \sin(100\pi t - 8^\circ)$$

$\therefore$ Current through the circuit is

$$I_{total} = \frac{1}{3} + \frac{\sqrt{2}}{5} \sin(100\pi t - 8^\circ)$$

Q.29 Ist case : $\frac{1}{v_1} - \frac{1}{-3} = \frac{1}{3} \Rightarrow v_1 = 6$ cm

When one lens is removed, the new focal length of the objective is

$$\frac{1}{F'} = \frac{1}{F} - \frac{1}{f_1} = \frac{1}{2} - \frac{1}{10}$$

$\Rightarrow$ F' = 2.5 cm

The new position of the image is

$$\frac{1}{v_2} - \frac{1}{-3} = \frac{1}{25}$$

$\Rightarrow$ $v_2 = 15$ cm

The position of the image changes by 15 – 6 = 9 cm. Here, eye piece must be moved by the same distance (= 9 cm) to refocus the image.

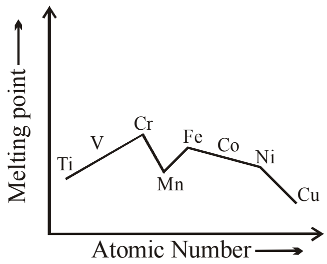
Q.30 $$\oint E \cdot ds = \frac{q_{in}}{\epsilon_0} = \frac{\int q_{in}}{\epsilon_0} = \frac{\int_0^q e(r) 4\pi r^2 dr}{\epsilon_0}$$

$$E \cdot 4\pi r^2 = \frac{\int_0^q cr^2 4\pi r^2 dr}{\epsilon_0}$$

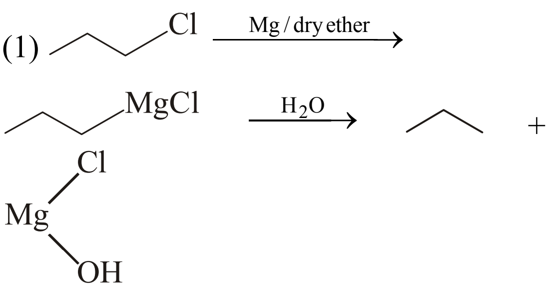
$$E = \frac{4\pi}{4\pi \epsilon_0} \frac{[r^s]_0^a}{5} = \frac{C}{5\epsilon_0} \frac{s}{r^2}$$

CHEMISTRY

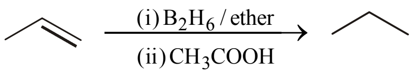
Q.31



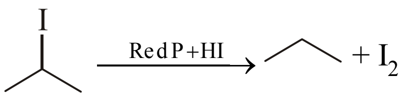
Q.32 (1)



(2)



(3)



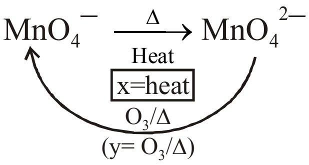
(4) $Me-\overset{O}{\overset{\|}{C}}-Cl \xrightarrow[(ii)\,H_2O]{(i)\,MeMgBr} Me-\overset{O}{\overset{\|}{C}}-Me$

Q.33 $\Delta G = -nFE_{cell} = (-8 \times 96500 \times 0.8)$ J/mol

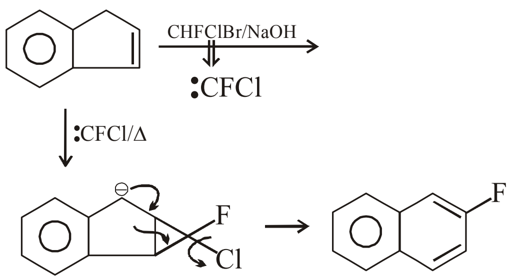
$\therefore$ % efficiency $= \dfrac{-8 \times 96500 \times 0.8}{-772 \times 1000} \times 100\%$

= 80 % Ans.

Q.34



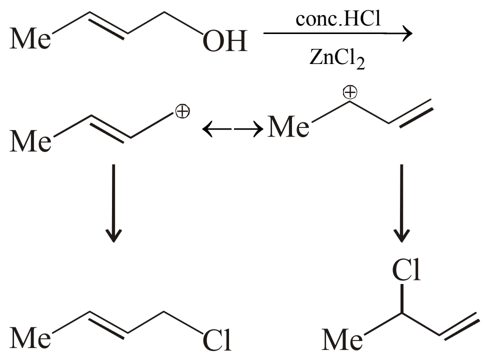
Q.35



Q.36 Theory based

Q.37 Self reduction is done for sulphide ores. FeS_2 is not suphide ore. so carbon reduction is done for FeS_2. Self reduction is done for Pb, Hg and Cu.

Q.38



Q.39 For the solution 1 : pH = 9

$\therefore$ pOH = 5 $\therefore [OH^-]_1 = 10^{-5}$ M

For the solution 2 : pH = 11

$\therefore$ pOH = 3 $\therefore [OH^-]_2 = 10^{-3}$ M

$\therefore$ Resultant $[OH^-] = \left(\dfrac{10^{-3} + 10^{-5}}{2}\right)$M

$= 5 \times 10^{-4}$ M

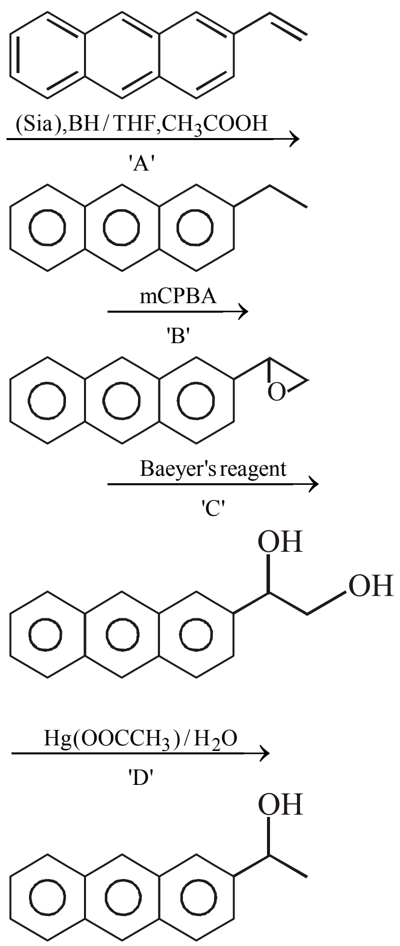
$\therefore$ pOH = – log (5×10^{-4}) = 4 – 0.7

$\therefore$ Resultant pH = 14 – (4 – 0.7) = 10.7

Q.40 PbS + HCl (aq.) $\longrightarrow$ no reaction

PbS + NaOH $\longrightarrow$ no reaction

Q.41

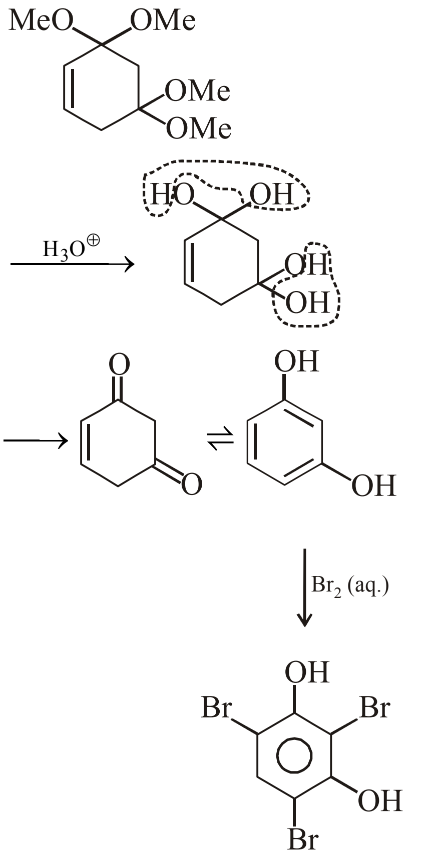


Q.42 $V_C = \dfrac{50}{125}$ L / mol = 0.4 L / mol

But, $Z_C = \frac{P_C V_C}{RT_C} = \frac{3}{8}$

$\Rightarrow T_C = \frac{8 P_C V_C}{3R} = \left(\frac{8 \times 30 \times 0.4}{3 \times 0.08}\right) K = 400\ K$

Q.43 Order of ionic radii : $N^{3-} > O^{2-} > F^{-}$
1.71, 1.40, 1.36

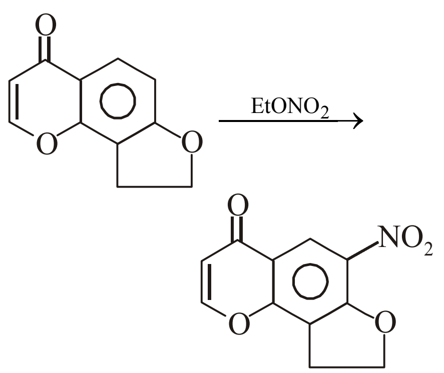
Q.44 

Q.45 KE of the ejected electron =

$$\left(9.4 - 13.6 \times \frac{2^2}{4^2}\right) eV = 6\ eV$$

$$\therefore \lambda = \left(\frac{150}{6}\right)^{\frac{1}{2}} Å = 5Å$$

Q.46 All ligands act as SFL for 4d & 5d series elements, so in $[PtCl_4]^{2-}$, ligand are considered as SFL.

Q.47 

Q.48 Let, $n_{NaHC_2O_4}$ be a- mmol

& $n_{H_2C_2O_4}$ be b-mmol

$\therefore$ In 1st titration : $\frac{2a}{5} + \frac{2b}{5} = 0.1 \times 50$

$\therefore$ a + b = 12.5 ....(i)

In 2nd titration : a + 2b = 20 .....(ii)

solving (i) and (ii) : b = 7.5

$\therefore m_{H_2C_2O_4} = \frac{7.5}{1000} \times 90\ g = 0.675\ g$

Q.49 $[Fe(CO)_5] \xrightarrow{\text{Dimerisation}} \times$

EAN = 26 – 0 + 5 × 2 = 36

Q.50 $Ph - I + C_2H_5\overset{\ominus\oplus}{O}Na \longrightarrow$ No S_N2, Partial double bond character.

Q.51 Theory based.

Q.52 (1) $K_2O_{2(s)} + H_2O_{(l)} \xrightarrow{R.T.} KOH + O_2$ (Paramagnetic)

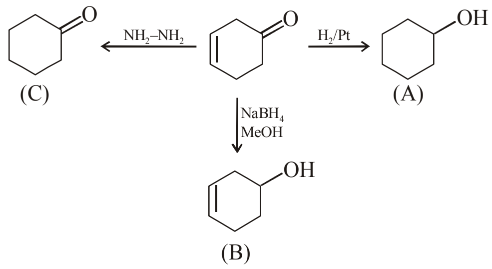
(2) $K_{(s)} + NH_{3(l)} \xrightarrow{0°C} K^+$ (ammoniated) + e^- (ammoniated)

Paramagnetic (due to ammoniated e^-)

(3) $K_{(s)} + H_2O_{(l)} \xrightarrow{R.T.} 2KOH\ (aq.) + H_2\ (g)$

(4) $K_{(s)} + \text{air} \xrightarrow{R.T.} KO_2$ (super oxides)

Paramagnetic

Q.53 

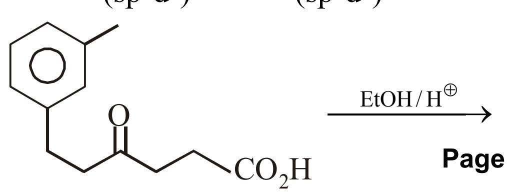
Q.54 Theory based

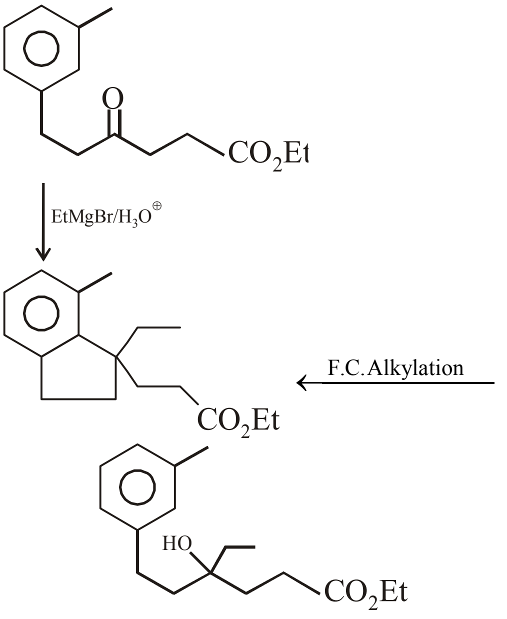
Q.55 (1) $\underline{P}Cl_3 + Cl_2 \longrightarrow \underline{P}Cl_5$
(sp^3) (sp^3d)

(2) $H_2\underline{S}O_4 \xrightarrow{\Delta} H_2O + \underline{S}O_3$
(sp^3) (sp^2)

(3) $\underline{N}Cl_3 + H_2O \longrightarrow \underline{N}H_3 + HOCl$
(sp^3) (sp^3)

(4) $\underline{Xe}F_4 + F^- \longrightarrow \underline{Xe}F_5^-$
(sp^3d^2) (sp^3d^3)

Q.56 



Q.57 $\because \dfrac{P^0 - P_s}{P_s} = \dfrac{n}{N}$

$\therefore \dfrac{2}{98} = \left(\dfrac{m_{urea}/60}{490/18}\right)$

$\therefore m_{urea} = 33.33$ g **Ans.**

Q.58 Dimerisation tendency of $NO_2 > ClO_2$
Reason : Odd e^- is localized in NO_2 and delocalized in ClO_2

Q.59 D-glucose and D-Mannose are C_2 epimers and form the same osazone.

Q.60 For n^{th} order reaction : $t_{1/2} \propto [A]_0^{1-n}$

$\therefore t_{1/2} \propto [A]_0^{1-2.5}$

$\Rightarrow t_{1/2} \propto \dfrac{1}{[A]_0^{1.5}}$

$\therefore m = 1.5$ **Ans.**

MATHEMATICS

Q.61 $\left|\vec{r}\,[\vec{a}\ \vec{b}\ \vec{c}]\right| = |\vec{r}|\,[\vec{a}\ \vec{b}\ \vec{c}] = 2 \times 3 \times 6 = 36.$

Q.62 $f''(x) = f'(x) \Rightarrow f'(x) = k_1e^x$

$\Rightarrow f(x) = k_1 e^x + k_2 \Rightarrow \lim\limits_{x\to\infty} \dfrac{k_1e^x + k_2}{ke^x} = 1$

Q.63 $\underbrace{\tan^2 x + \cot^2 x}_{\geq 2} = \underbrace{2\cos^2 y}_{\leq 2}$

$\Rightarrow \tan^2 x = 1$ and $\cos^2 y = 1$

$\underbrace{\cos^2 y}_{1} + \sin^2 z = 1 \Rightarrow \sin^2 z = 0$

$\displaystyle\int_1^3 \frac{t^2}{t^2 - 4t + 8}\,dt = 2\int_1^3 \frac{t^2}{2t^2 - 4t + 8}$

$\displaystyle = 2\int_1^3 \frac{t^2}{t^2 + (4-t)^2}\,dt = 2 \times \frac{1}{2}\,(3-1) = 2.$

Q.64 $(1-x)^{50}(x+1)^{50}$
$= ({}^{50}C_0 - {}^{50}C_1 \cdot x + \ldots.. + {}^{50}C_{50} \cdot x^{50})$
$\cdot ({}^{50}C_0 \cdot x^{50} + {}^{50}C_1 \cdot x^{49} + \ldots\ldots. + {}^{50}C_{50})$
compare the coefficient of x^{30} from both the sides
${}^{50}C_{15} = {}^{50}C_0 \cdot {}^{50}C_{20} - {}^{50}C_1 \cdot {}^{50}C_{21} + \ldots\ldots..$

Q.65 $B_1 + B_2 + B_3 = 5$
${}^{5+2}C_2 = 21$

Q.66 Possible cases are (1, 4, 6), (2, 4, 5) and (2, 3, 6)

$\dfrac{1}{6\cdot5\cdot4}\times 3! + \dfrac{1}{6\cdot5\cdot4}\times 3! + \dfrac{1}{6\cdot5\cdot4}\times 3! = \dfrac{3}{20}$

Q.67 $\vec{n}_1 = (4, -3, 4)$

$\vec{n}_2 = (3, -2, 1)$

$\vec{n}_1 \times \vec{n}_2 = (5, 8, 1)$

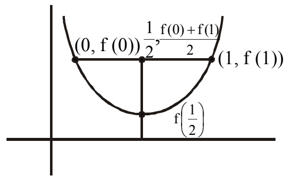
$(\vec{n}_1 \times \vec{n}_2) \cdot \vec{n} = 0$

$\Rightarrow 10 - 8 + a = 0 \Rightarrow a = -2$

Q.68 $\dfrac{50 \times 20 - 300}{10} = 70$

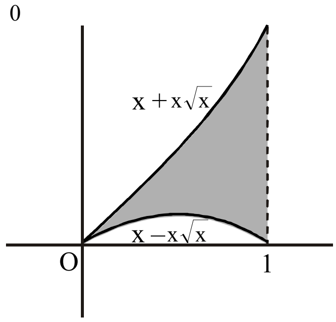
Q.69 $x^3 + 6x^2 + 12x + 9 = 0$
$\Rightarrow (x+2)^3 = -1 \Rightarrow x + 2 = -1, -\omega, -\omega^2$
$\Rightarrow x = -3, -2-\omega, -2-\omega^2$, then common roots are $-2-\omega$ and $-2-\omega^2$
sum of roots $= -4 - (\omega + \omega^2) = -3$;
Product of roots $= (2+\omega)(2+\omega^2)$
$= 4 + (-2) + 1 = 3$
$\therefore$ equation $x^2 + 3x + 3 = 0$
So, $\dfrac{a}{1} = \dfrac{b}{3} = \dfrac{c}{3}$

Q.70 $f\left(\dfrac{1}{2}\right) < \dfrac{f(0) + f(1)}{2}$



Q.71 $y = x \pm x\sqrt{x}$

$\displaystyle\int_0^1 2x^{\frac{3}{2}}\,dx = 2 \times \frac{2}{5} = \frac{4}{5}$



Q.72 Let $x = a\sin\theta$, $\lim\limits_{\theta\to 0} \frac{1}{a^2}\left(\frac{1-4a\cos\theta}{\sin^2\theta\cdot\cos\theta}\right)$ is finite

$\Rightarrow a = \frac{1}{4}$ and $b = 8 \Rightarrow ab = 2$

Q.73 $T_1 = 24, T_2 = 3, T_3 = 8$
L.C.M of $\{T_1, T_2, T_3\} \Rightarrow 24$.

Q.74 Using Venn-diagram it is equal to A'

Q.75 $(T \vee F) \vee F \Rightarrow (T \vee F) \Rightarrow T$

Q.76 $ABC = BCD$
$\Rightarrow ABCC^{-1} = BCDC^{-1}$
$\Rightarrow AB = BCDC^{-1}$
$\Rightarrow ABB^{-1} = BCDC^{-1}B^{-1}$
$\Rightarrow A = BCDC^{-1}B^{-1}$

Q.77 $1^5 + z_1^5 + z_2^5 + z_3^5 + z_4^5 + z_5^5 = 0$

Q.78 $(x + 2)^2 = -4(y + 3)$
equation of axis is $x + 2 = 0$ and directrix is
$y + 3 = 1 \Rightarrow y + 2 = 0$

Q.79 $p_1p_2 = b^2$

Q.80 $\int \frac{1}{(\sqrt{x})^7\left(1+\frac{1}{(\sqrt{x})^5}\right)}dx$ let $\frac{1}{(\sqrt{x})^5} = t$

$$\Rightarrow \int \frac{-2dt}{5(1+t)} = -\frac{2}{5}\, ln(1 + t) + c$$

$$\Rightarrow \frac{2}{5}\, ln\left(\frac{(\sqrt{x})^5}{(\sqrt{x})^5+1}\right) + c \Rightarrow a = \frac{2}{5}, k = \frac{5}{2}$$

Q.81 Let the ratio t : 1

$$\Rightarrow \text{point } P \equiv \left(\frac{3t-2}{t+1}, \frac{-5t+4}{t+1}, \frac{8t+7}{t+1}\right) \text{ lies on plane}$$

$$\Rightarrow \left(\frac{3t-2}{t+1}\right)1 - 2\left(\frac{-5t+4}{t+1}\right) + 3\left(\frac{8t+7}{t+1}\right) = 17$$

$$\Rightarrow t = \frac{3}{10}$$

Q.82 $\sin(xy) = xy$
$xy = 0 \Rightarrow x = 0$ or $y = 0$
$\Rightarrow x = 0$ not possible
So, $y = 0 \Rightarrow x = 1 \Rightarrow x = 1$ and $y = 0 \Rightarrow (1, 0)$

Q.83 $f(x + 1) = f(x)$ and $f\left(\frac{1}{2}\right) = f\left(\frac{-1}{2}\right)$

$g'(x) = f(x + n) = f(x)$

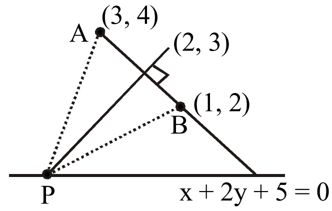
$$g'\left(\frac{5}{2}\right) = f\left(\frac{5}{2}\right) = f\left(2+\frac{1}{2}\right) = f\left(\frac{1}{2}\right) = \frac{3}{2}.$$

Q.84 $e^{-t/2} P(t) = 900e^{-t/2} + C;\ t = 0, P = 850$
$\Rightarrow 850 = 900 + C \Rightarrow C = -50$
$\Rightarrow P(t) = 900 - 50e^{t/2} = 0$
$\Rightarrow e^{t/2} = 18 \Rightarrow t = 2ln\ 18$.

Q.85 $S_1 < 0$
$4 + 9 - 12 - 30 + k < 0 \Rightarrow k < 29$
$r < 4$
$\sqrt{9+25-k} < 4 \Rightarrow k > 18$.

Q.86 $(f(f(x))) = x$.

Q.87 $y - 3 = -1\ (x - 2)$



$x + y = +5$, $x + 2y = -5$ $\Big\{$ $x = 15$, $y = -10$

Q.88 $\sin\left(\frac{2\pi}{7}\right)\cdot\sin\left(\frac{4\pi}{7}\right)\cdot\sin\left(\frac{6\pi}{7}\right)$

$$= \sin\frac{\pi}{7}\cdot\sin\frac{2\pi}{7}\cdot\sin\frac{3\pi}{7} = \frac{\sqrt{7}}{8}$$

Q.89 $f(0^+) = \text{sgn (negative)} = -1$ and $f(0^-)$
$= \text{sgn (positive)} = 1$, discontinuous

Q.90 Area

$$= \frac{1}{2}\sqrt{\left(\frac{k^2}{lm}\right)^2 + \left(\frac{k^2}{mn}\right)^2 + \left(\frac{k^2}{nl}\right)^2} = \frac{k^2}{2lmn}$$

$$\Rightarrow \frac{l^2+m^2+n^2}{3} \geq \left(l^2m^2n^2\right)^{\frac{1}{3}}$$

$$\Rightarrow \frac{1}{3} \geq (lmn)^{\frac{2}{3}}$$

$$\Rightarrow \frac{1}{3\sqrt{3}} \geq lmn$$

$$\Rightarrow \frac{1}{lmn} \geq 3\sqrt{3} \Rightarrow \frac{k^2}{2lmn} \geq \frac{3\sqrt{3}\,k^2}{2}$$