Vidyamandir Classes
Gurukul for IITJEE Preparation

Mock Advanced Test-1 Paper-1

TIME : 3 hrs	M.M. : 210

Read the following Instructions very carefully before you proceed.

A. General

1. This booklet is your Question Paper. Do not break the seals of this booklet before being instructed to do so by the invigilators.

2. Blank papers, clipboards, log tables, slide rules, calculators, cameras, cellular phones, pagers, and electronic gadgets are NOT allowed inside the examination hall.

3. **Using a black ball point pen, darken the bubbles on the upper original sheet.** Apply sufficient pressure so that the impression is created on the bottom sheet.

4. DO NOT TAMPER WITH/MUTILATE THE OMR OR THE BOOKLET.

5. Read carefully the Instructions printed at the beginning of each section.

B. Filling the Right Part of the OMR

6. For answering a question, an ANSWER SHEET (OMR SHEET) is provided separately. Please fill your **Test Code, Roll No.** and **Group** properly in the space given in the ANSWER SHEET.

C. Question Paper Format :

The question paper consists of **3 Subjects** (Physics, Chemistry and Mathematics). Each subject consists of two sections i.e., Section 1 & 2.

9. **Section I** contains two Types of questions. In **Type 1**, there are 10 Multiple choice questions. Each question has four choices (A). (B), (C) and (D) out of which ONLY ONE is correct. In **Type 2**, there are 5 Multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE are correct.

10. **Section II** contains 5 questions. The answer to each question is a Single Digit Integer, ranging from 0 to 9 (both inclusive).

D. Marking Scheme :

11. **Section-I** : For each question in **Type-1**, you will be awarded **3 marks** if you darken the bubble corresponding to the correct answer ONLY and zero marks If no bubbles are darkened. In all other cases, **minus one (–1) mark will be awarded in this section.**

13. **Section-I** : For each question in **Type-2**, you will be awarded **4 marks** If you darken ALL the bubble(s) corresponding to the correct answer(s) ONLY. In all other cases zero (0) marks will be awarded. **No negative marks will be awarded for incorrect answers in this section.**

14. **Section-II** : For each question, you will be awarded **4 marks** if you darken the bubble corresponding to the correct answer ONLY. In all other cases zero (0) marks will be awarded. **No negative marks will be awarded for incorrect answers in this section.**

SUBJECT - I (PHYSICS)	70 MARKS

SECTION - I

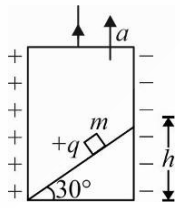
TYPE - 1 : SINGLE CORRECT ANSWER

This section contains 10 Single Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct.

1. There are two thin spheres *A* and *B* of the same material and same thickness. They emit radiation like black bodies. Radius of *A* is double that of *B*. *A* and *B* have same temperature *T*. When *A* and *B* are kept in a room of temperature $T_0 (< T)$, The ratio of the rate of cooling (rate of fall of temperature) of *A* to the rate of cooling of *B* is: [Assume negligible heat exchange between *A* and *B*]

(A) 2 : 1 **(B)** 1 : 1 **(C)** 4 : 1 **(D)** 8 : 1

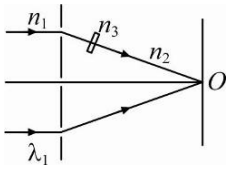
2. A small block of mass *m* is kept on top of a smooth inclined plane of angle 30° placed in an elevator going upward with acceleration *a*. A horizontal electric field E perpendicular to the left vertical wall and the right vertical wall of the elevator exists. The charge on the block is +*q*. The time taken by the block to slide to the lowest point of the inclined plane is :



(A) $\sqrt{\frac{2h}{g}}$ **(B)** $\sqrt{\frac{2h}{(g-a)+\frac{gE}{m}}}$

(C) $2\sqrt{\frac{2h}{(g+a)-\frac{qE}{m}\sqrt{3}}}$ **(D)** $\sqrt{\frac{2h}{(g+a)^2-\left(\frac{qE}{m}\right)h^2}}$

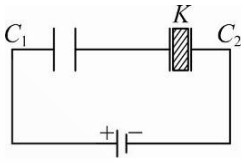
3. In the figure shown in a *YDSE*, a parallel beam of light is incident on the slits from a medium of refractive index n_1. The wavelength of light in this medium is λ_1. A transparent slab of thickness '*t*' and refractive index n_3 is put in front of one slit. The medium between the screen and the plane of the slits has refractive index n_2. Find the phase difference between the light waves reaching point '*O*' (symmetrical, relative to the slits).



(A) $\frac{2\pi}{n_1\lambda_1}(n_3-n_2)t$ **(B)** $\frac{2\pi}{\lambda_1}(n_3-n_2)t$ **(C)** $\frac{2\pi n_1}{n_2\lambda_1}\left(\frac{n_3}{n_2}-1\right)t$ **(D)** $\frac{2\pi n_1}{\lambda_1}(n_3-n_2)t$

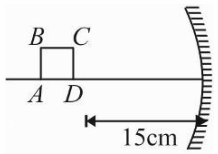
SPACE FOR ROUGH WORK

4. Two capacitors C_1 and C_2 have identical dimensions and are connected as shown. Capacitor C_1 has air between plates and capacitor C_2 contains a dielectric slab of dielectric constant K between the plates. q_1 and q_2 are the respective charges on C_1 and C_2 when they are fully charged. Now, the dielectric slab is removed and the corresponding charges are q_1' and q_2'. Then,



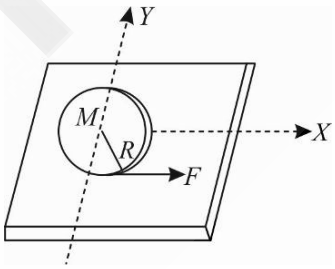
(A) $\frac{q_1'}{q_1}=\frac{K+1}{K}$ **(B)** $\frac{q_2'}{q_2}=\frac{K+1}{K}$ **(C)** $\frac{q_2'}{q_2}=\frac{K+1}{2K}$ **(D)** $\frac{q_1'}{q_1}=\frac{K}{2}$

5. A square *ABCD* of side 1 mm is kept at distance 15 cm in front of the concave mirror as shown in the figure. The focal length of the mirror is 10 cm. The length of the perimeter of its image will be:



(A) 8 mm **(B)** 2 mm
(C) 12 mm **(D)** 6 mm

6. A uniform cylindrical disc of radius R and mass M is pulled over a horizontal frictionless surface by a constant force. The force is applied by means of a string wound around the disc as shown in the figure. If it starts from rest at $t = 0$, then the linear displacement and angular displacement respectively at time t are :



(A) $\left(\frac{F}{M}\right)t^2,\left(\frac{F}{M}\right)t^2$ **(B)** $\left(\frac{F}{2M}\right)t,\left(\frac{F}{2MR}\right)t^2$

(C) $\left(\frac{F}{2M}\right)t^2,\left(\frac{F}{MR}\right)t^2$ **(D)** $\left(\frac{2F}{M}\right)t^2,\left(\frac{2F}{MR}\right)t^2$

7. The rms speed of gas molecule at 27°C and 1.0 atm pressure is 100 ms^{-1}. The rms speed of same molecule at 127°C and 2.0 atm pressure will be :

(A) 100 ms^{-1} **(B)** 200 ms^{-1} **(C)** $\frac{100}{\sqrt{3}}$ ms^{-1} **(D)** $\frac{200}{\sqrt{3}}$ ms^{-1}

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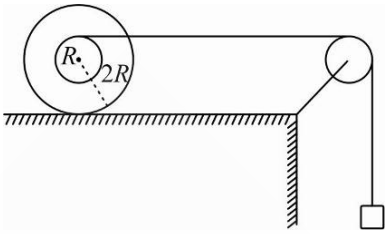
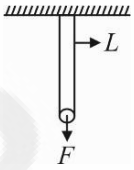
8. In the figure shown, the spherical body and block, each have a mass m. The moment of inertia of the spherical body about centre of mass is $2mR^2$. The spherical body rolls without slipping on the horizontal surface. The ratio of kinetic energy of the spherical body to that of the block is :



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

9. Searle's experiment is applicable for measurement of Young's modulus of elasticity.

In this method, $Y = \frac{FL}{Al}$

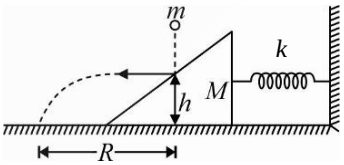


Here, F = load or force applied at the end,
L = natural length of the wire,
A = cross-sectional area of the wire,
l = extension in wire due to applied force
Y = Young's modulus of elasticity.

In Searle's experiment, the diameter of cylindrical wire is d = 0.050 cm, length of wire is L = 100 cm and when a weight, m = 15.0 kg is attached at lower end of wire, the extension in wire is 0.200 cm. Find maximum percentage error in the measurement of Young's modulus of elasticity.

(A) 6.2 % **(B)** 6 % **(C)** 4.3 % **(D)** 1.8 %

10. A ball of mass m when dropped from certain height, strikes a wedge of mass M kept on a smooth horizontal surface and moves horizontally just after impact as shown. If the ball strikes the ground at a distance R from its initial line of fall, then the amplitude of oscillation of wedge after being hit by the ball will be :



(A) $\frac{mR}{M}\sqrt{\frac{Mg}{2kh}}$ **(B)** $\frac{R}{M}\sqrt{\frac{kMg}{2h}}$ **(C)** $R\sqrt{\frac{kg}{2Mh}}$ **(D)** $R\sqrt{\frac{kg}{2mh}}$

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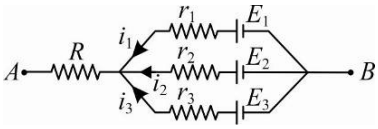
SECTION - I

TYPE - 2 : MULTIPLE CORRECT ANSWERS

This section contains 5 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:

11. For the given circuit,



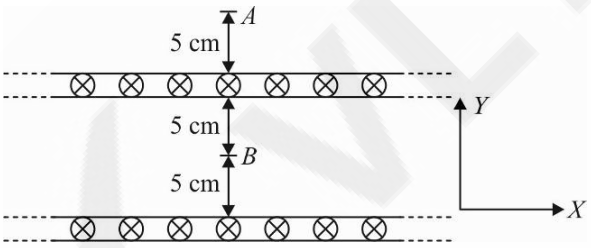
Where, $E_1 = 3V, E_2 = 2V, E_3 = 1V, r_1 = r_2 = r_3 = 1\Omega, R = 1\Omega,$ then :

(A) Current $i_1 = 1A$ **(B)** Current $i_2 = 2A$ **(C)** Current $i_3 = 1A$ **(D)** Current $i_3 = -1A$

12. Two adjacent natural frequencies of an organ pipe are found to be 550 Hz and 650 Hz. Speed of sound $= 340 \text{ms}^{-1}$. If the fundamental frequency is f_0 and length of the pipe is *L*, then

(A) $f_0 = 50$ Hz **(B)** $f_0 = 55$ **(C)** $L = 1.55$ m **(D)** $L = 1.7$ m

13. Figure shows cross-section of two large parallel metal sheets carrying electric currents along their surfaces. The current in each sheet is $\frac{10}{\pi}$ A m^{-1} along the width. Consider two points *A* and *B* as shown in the figure with their positions. Choose the correct option(s).



(A) Magnetic field at *A* is $4\mu T$ along positive *X*-direction

(B) Magnetic field at *A* is $4\mu T$ along negative *X*-direction

(C) Magnetic field at *B* is zero

(D) Magnetic field at *B* is $2\mu T$ along *X*-direction

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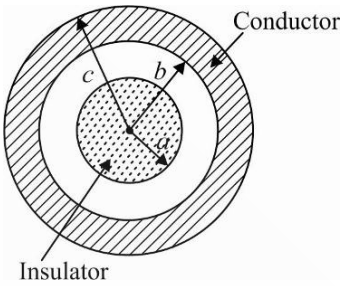
14. A solid insulating sphere of radius a has a uniform charge density ρ and a total charge Q. Concentric with this sphere is an uncharged conducting shell whose inner and outer radii are b and c. Here r is distance of a point from the common centre. Then,



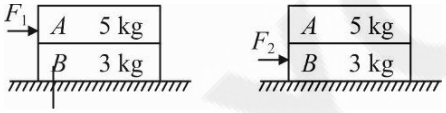
(A) for $b < r < c, E = 0$

(B) for $a < r < b, E = \dfrac{Q}{4\pi\varepsilon_0 r^2}$

(C) induced charge on the inner surface of shell is $-Q\dfrac{b}{a}$

(D) induced charge on the outer surface of shell is $+Q$

15. A block A (5 kg) rests over another block B (3 kg) placed over a smooth horizontal surface. There is friction between A and B. A horizontal force F_1 gradually increasing from zero to a maximum is applied to A so that the blocks move together without relative motion. Instead of this another horizontal force F_2, gradually increasing from zero to a maximum is applied to B so that the blocks move together without relative motion. $F_{1\max}$ and $F_{2\max}$ are the maximum respective values of F_1 and F_2. Then



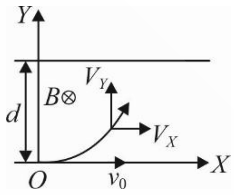
(A) $F_{1\max} = F_{2\max}$ **(B)** $F_{1\max} > F_{2\max}$ **(C)** $F_{1\max} < F_{2\max}$ **(D)** $F_{1\max} : F_{2\max} = 5:3$

SPACE FOR ROUGH WORK

SECTION - II
SINGLE INTEGER VALUE CORRECT TYPE

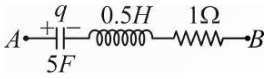
This section contains 5 single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

1. A non-uniform magnetic field $\vec{B} = B_0\left(1+\frac{y}{d}\right)(-\hat{k})$ is present in region of space in between $y = 0$ and $y = d$. A particle of mass m and positive charge q has velocity $\vec{v} = v_0\hat{i}$ at the origin O. The x-component of velocity of the particle is $v_x = v_0 - \frac{kqB_0d}{2m}$ when it leaves the field, then find the value of k.



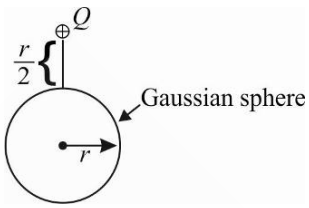
2. Consider a nuclear reaction $A + B \rightarrow C$. A nucleus 'A' moving with kinetic energy of 5 MeV collides with a nucleus 'B' moving with kinetic energy of 3.35 MeV and form a nucleus 'C' in excited state. Find the kinetic energy of nucleus 'C' just after its formation, if it is formed in a state with excitation energy 10 MeV. Take masses of nuclei of A, B and C as 25.0, 10.0, 34.995 amu respectively. 1 amu $= 930\text{MeV/c}^2$.

3. In the circuit as shown in the figure, charge q varies with time t as $q = (t^2 - 4)$, where q is in coloumbs and time t is in second. Find V_{AB} (in volt) at time $t = 3s$. $(V_{AB} = V_A - V_B)$



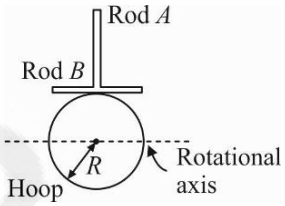
SPACE FOR ROUGH WORK

4. A point charge Q is placed at a distance $\frac{r}{2}$ above an imaginary Gaussian sphere of radius r as shown. Let E denote magnitude of electric field over the Gaussian surface. Value of $E_{max} - E_{min} = N \times \frac{6Q}{25\pi\varepsilon_0 r^2}$. Find the value of N.



5. A rigid sculpture, consisting of thin hoop (of mass m and radius R) and two thin rods (each of mass m and length $L = 2R$), is arranged as shown in the figure.

The sculpture is pivoted and can rotate about a horizontal axis in the plane of the hoop and passing through centre of the hoop. The sculpture's rotational inertia about this axis is approximately $K\ mR^2$. Find the value of K.



SPACE FOR ROUGH WORK

SUBJECT - II (CHEMISTRY)	70 MARKS

SECTION - I

TYPE - 1 : SINGLE CORRECT ANSWER

This section contains 10 Single Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct.

1. Hybridization state of carbon atom(s) in organic products X and Y of the following reaction is :

$$2\,Mg_2C_3 + 8H_2O \longrightarrow 4\,Mg(OH)_2 + X + Y$$

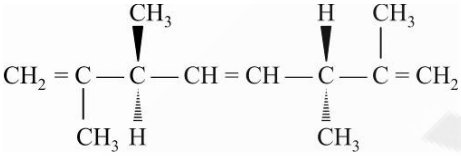
(A) sp^3, sp **(B)** sp^2, sp **(C)** Both (A) and (B) **(D)** sp^3 only

2. The relationship between the van der Waals constant '*b*' of N_2 and O_2 is :

(A) $b(N_2) = b(O_2) = 0$ **(B)** $b(N_2) = b(O_2) \neq 0$

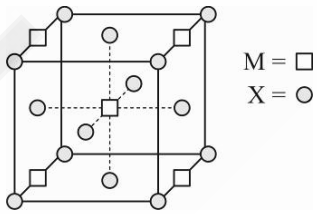
(C) $b(N_2) > b(O_2)$ **(D)** $b(N_2) < b(O_2)$

3. The number of optically active products obtained from the complete ozonolysis of the given compound is :



(A) 0 **(B)** 1 **(C)** 2 **(D)** 4

4. A compound M_pX_q has cubic close packing (ccp) arrangement of X. Its unit cell structure is as shown in figure. What is the coordination number of M?



(A) 6 **(B)** 4

(C) 12 **(D)** 8

5. Consider the following transformation : $CH_3CHO + 4HCHO \xrightarrow[NaOH]{conc.} P + HCOONa$

If product 'P' is treated with excess of CH_3COCl, then new product formed is :

(A) Mono acetate derivative of P **(B)** Penta acetate derivative of P

(C) Tri acetate derivative of P **(D)** Tetra acetate derivative of P

SPACE FOR ROUGH WORK

6. The colour of light absorbed by solution of Na in liquid NH_3 is :

(A) orange-red **(B)** blue-green **(C)** yellow **(D)** violet

7. Which of the following product(s) formed on reaction of aspirin with NaOH(aq) ?

(A) only sodium ethanoate

(B) only sodium-2-hydroxy benzoate

(C) both sodium benzoate and sodium ethanoate

(D) both sodium-2-hydroxy benzoate and sodium ethanoate

8. The potential energy of an electron in the second Bohr orbit of a hydrogen atom is : [a_0 is Bohr radius]

(A) $\frac{-h^2}{2\pi^2 m a_0^2}$ **(B)** $\frac{-h^2}{8\pi^2 m a_0^2}$ **(C)** $\frac{-h^2}{16\pi^2 m a_0^2}$ **(D)** $\frac{-h^2}{32\pi^2 m a_0^2}$

9. Which ordering of compounds is according to the decreasing order of the number of peroxide bonds ?

(A) $Na_2Cr_2O_{12}$, K_3CrO_8, CrO_5 **(B)** CrO_5, K_3CrO_8, $Na_2Cr_2O_{12}$

(C) K_3CrO_8, $Na_2Cr_2O_{12}$, CrO_5 **(D)** CrO_5, $Na_2Cr_2O_{12}$, K_3CrO_8

10. As per IUPAC nomenclature, the name of the complex $[Fe(H_2O)_5(NO)]SO_4$ is :

(A) Pentaaquanitrosoniumiron(I) sulphate **(B)** Pentaaquanitrosyliron(II) sulphate

(C) Pentaaquanitroniumiron(I) sulphate **(D)** Pentaaquanitrosoniumiron(II) sulphate

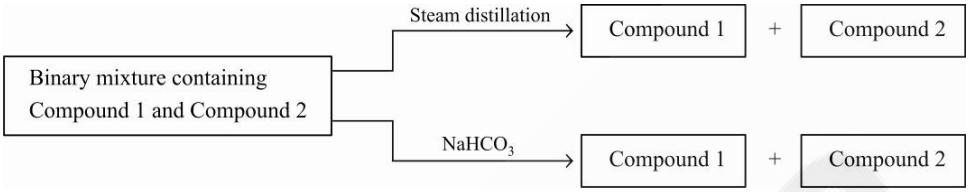
SPACE FOR ROUGH WORK

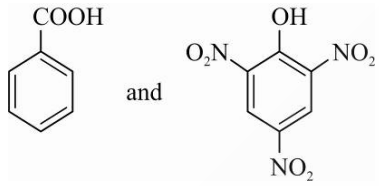
SECTION - I

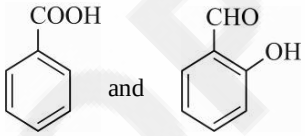
TYPE - 2 : MULTIPLE CORRECT ANSWERS

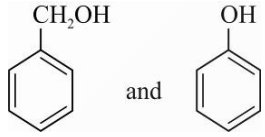
This section contains 5 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:

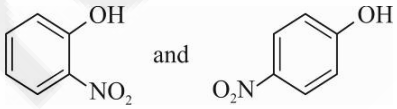
11. Identify the binary mixture(s) that can be separated into individual compounds, by processes as shown in given scheme.



(A) 

(B) 

(C) 

(D) 

12. Which of the following statement(s) is(are) correct ?

(A) Adsorption may be unilayer or multilayer type

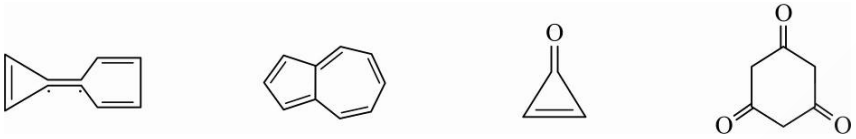
(B) Greater the valency of ion, greater is the flocculation value

(C) Octadecyl ammonium chloride is cationic surfactant

(D) Hydrolysis of $FeCl_3$ produces positively charged sol

SPACE FOR ROUGH WORK

13. Which of the following molecules, in pure form, is(are) stable at room temperature ?

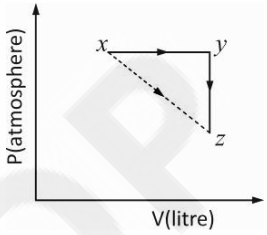


(A) **(B)** **(C)** **(D)**

14. Which of the following on heating undergoes redox change ?

(A) Ag_2CO_3 **(B)** $FeSO_4.7H_2O$ **(C)** $MgCl_2.6H_2O$ **(D)** $AgNO_3$

15. For an ideal gas, consider only P-V work in going from an initial state X to the final state Z. The final state Z can be reached by either of the two paths as shown in the figure. Which of the following choice(s) is (are) incorrect ? [Take ΔS as change in entropy and *w* as work done]



(A) $\Delta S_{x \to z} = \Delta S_{x \to y} + \Delta S_{y \to z}$

(B) $w_{x \to z} = w_{x \to y} + w_{y \to z}$

(C) $w_{x \to y \to z} = w_{x \to y}$

(D) $\Delta S_{x \to y \to z} = \Delta S_{x \to y}$

SPACE FOR ROUGH WORK

SECTION - II
SINGLE INTEGER VALUE CORRECT TYPE

This section contains 5 single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

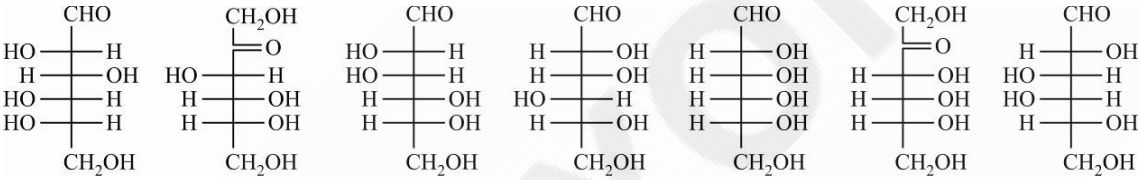
1. How many isomeric tripeptides on hydrolysis gives glycine, alanine and phenylalanine ?

2. The periodic table consists of 18 groups. An isotope of an element X, on K electron capture, undergoes a nuclear reaction yielding $_{18}Ar^{40}$ as shown below. To which group, element X belongs in the periodic table?

$$_{Z}X^{A} + {}_{-1}e^{0} \longrightarrow {}_{18}Ar^{40}$$

3. Consider the following reaction : D-glucose $\xrightarrow[\text{Cat. } H^+]{\text{Ph}-\text{NHNH}_2 \text{ (3 equiv.)}}$ X

Among the following, the compound(s) whose osazone derivative(s) will have the same melting point as that of X is(are) _____.



4. A sample of hard water contains 384 ppm SO_4^{2-} and only Ca^{2+} ion as cation. If 1L of this sample is passed through cation exchange resin (RSO_3H) then $[H^+]$ in resulting solution will be $x \times 10^{-3}$M . Find numerical value of *x*. Assume density of hard water equal to density of water, R group is long hydrocarbon chain.

[Atomic mass: S = 32, O = 16]

5. For reaction $2O_{3(g)} \longrightarrow 3O_{2(g)}$

The rate at which O_2 appears, is 6.0×10^{-5} M/s, at a particular instant and the rate at which O_3 disappears is $x \times 10^{-5}$ M/s, at this time. What is numerical value of *x* ?

SPACE FOR ROUGH WORK

SUBJECT - III (MATHEMATICS)	70 MARKS

SECTION - I

TYPE - 1 : SINGLE CORRECT ANSWER

This section contains 10 Single Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct.

1. If $f(x) = |1 - x|$, then the points where $sin^{-1}(f|x|)$ is non-differentiable are :

(A) {0, 1} **(B)** {0, – 1} **(C)** {0, 1, – 1} **(D)** None of these

2. Let $f : R \to R$ and $g : R \to R$ be two one –one and onto function such that they are the mirror images of each other about the line $y = a$. If $h(x) = f(x) + g(x)$ then $h(x)$ is :

(A) one-one and onto **(B)** only one-one and not onto

(C) only onto but not one-one **(D)** None of these

3. If tangents PQ and PR are drawn from a point P on the circle $x^2 + y^2 = 25$ to the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1, (b < 4)$, so that the fourth vertex S of parallelogram PQSR lies on the circumcircle of triangle PQR, then eccentricity of the ellipse is :

(A) $\frac{\sqrt{5}}{4}$ **(B)** $\frac{\sqrt{7}}{3}$ **(C)** $\frac{\sqrt{7}}{4}$ **(D)** $\frac{\sqrt{5}}{3}$

4. The point of intersection of the line, passing through (0, 0, 1) and intersecting the lines $x + 2y + z = 1$, $-x + y - 2z = 2$ and $x + y = 2$, $x + z = 2$ with xy-plane is :

(A) $\left(\frac{5}{3}, -\frac{1}{3}, 0\right)$ **(B)** (1, 1, 0) **(C)** $\left(\frac{2}{3}, -\frac{1}{3}, 0\right)$ **(D)** $\left(-\frac{5}{3}, \frac{1}{3}, 0\right)$

5. The line $x + y = 5$ intersects the circle $x^2 + y^2 - 6x - 8y + 21 = 0$ at points A and B, then the locus of the point C such that AC is perpendicular to BC is

(A) $x^2 + y^2 - 6x - 4y + 11 = 0$ **(B)** $x^2 + y^2 - 4x - 6y + 11 = 0$

(C) $x^2 + y^2 + 6x + 4y + 11 = 0$ **(D)** None of these

6. If A is a square matrix of order n such that $|adj(adj A)| = |A|^9$, then the value of n can be :

(A) 4 **(B)** 2 **(C)** either 4 or 2 **(D)** None of these

SPACE FOR ROUGH WORK

7. The value of $\int \frac{x\tan x\sec x}{(\tan x - x)^2}dx$ is equal to :

(A) $\frac{1}{\sin x - x\cos x} + c$ **(B)** $\frac{1}{x\cos x - \sin x} + c$

(C) $\frac{1}{x\sin x - \cos x} + c$ **(D)** None of these

8. Total number of ways in which n^2 number of identical balls can be put in n numbered boxes (1, 2, 3, ……, n) such that i^{th} box contains atleast i number of balls is :

(A) ${}^{n^2}C_{n-1}$ **(B)** ${}^{n^2-1}C_{n-1}$ **(C)** ${}^{\frac{n^2+n-2}{2}}C_{n-1}$ **(D)** None of these

9. If $\lim\limits_{x\to 1}\frac{a\sin(x-1)+b\cos(x-1)+4}{x^2-1} = -2$, then (a, b) is equal to :

(A) (2, –4) **(B)** (–4, –4) **(C)** (–4, 2) **(D)** (4, –4)

10. The number of solutions of Re $(z^2) = 0$ and $|z| = a\sqrt{2}$, where z is a complex number and $a > 0$, is :

(A) 0 **(B)** 2 **(C)** 4 **(D)** None of these

SPACE FOR ROUGH WORK

SECTION - I

TYPE - 2 : MULTIPLE CORRECT ANSWERS

This section contains 5 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:

11. Let I be the area of the region enclosed by $y = \frac{1}{1+x^{\pi/2}}$, $y = 0$, $x = 0$ and $x = 1$, then

(A) I > ln2 **(B)** I < ln2 **(C)** I < π/4 **(D)** I > π/4

12. If $y(x)$ is the solution of differential equation $(x\cos x - \sin x)\,dx = \frac{x}{y}\sin x\,dy$ and $y\left(\frac{\pi}{2}\right) = \frac{2}{\pi}$, then :

(A) $y\left(\frac{\pi}{4}\right) = \frac{2\sqrt{2}}{\pi}$ **(B)** $y\left(\frac{\pi}{4}\right) = \frac{4}{\pi}$ **(C)** $y'(2\pi) = \frac{1}{2\pi}$ **(D)** $y'(2\pi) = \frac{2\sqrt{2}}{\pi}$

13. Straight line $Ax + By + D = 0$ would be tangent to $xy = c^2$, if :

(A) A > 0 , B > 0 **(B)** A< 0 , B < 0 **(C)** A> 0 , B< 0 **(D)** A < 0 , B > 0

14. $\{\sin(\alpha - \beta) + \cos(\alpha + 2\beta)\sin\beta)\}^2 = 4\cos\alpha\sin\beta\sin(\alpha + \beta)$ and $\tan\alpha = 3\tan\beta$; $\alpha, \beta \in R$ then :

(A) $\beta = n\pi \pm \tan^{-1}\sqrt{7}$ **(B)** $\beta = n\pi \pm \tan^{-1}\frac{\sqrt{7}}{3}$

(C) $\alpha = n\pi \pm \tan^{-1}3\sqrt{7}$ **(D)** $\alpha = n\pi \pm \tan^{-1}\sqrt{7}$

15. A man has 3 coins A, B and C, A is unbiased, the probability that a head will result when B is tossed is 2/3; the probability that a head will result when C is tossed is 1/3. If one of the coins, chosen at random, is tossed 3 times, giving a total of two heads and one tail, the following events are defined

(E_1) the probability that the chosen coin was A.

(E_2) the probability that a fresh toss of the same coin will give a head.

(A) $P(E_1) = \frac{9}{25}$ **(B)** $P(E_2) = \frac{241}{1296}$ **(C)** $P(E_2) = \frac{1}{2}$ **(D)** $P(E_1) = \frac{7}{25}$

SPACE FOR ROUGH WORK

SECTION - II
SINGLE INTEGER VALUE CORRECT TYPE

This section contains 5 single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

1. If $log_3 (log_2 x) + log_{1/3} (log_{1/2} y) = 1$, then $\frac{1}{xy^3}$ is _____.

2. If a variable normal of positive slope of the circle $x^2 + y^2 - 4x - 16y + 48 = 0$ intersects the parabola $y^2 = 4x$ at two distinct points A and B, then number of possible integral values of length of AB are _____.

3. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three mutually perpendicular unit vectors and $\vec{d}$ is a unit vector which makes equal angle $\alpha \in \left(0, \frac{\pi}{2}\right)$ with $\vec{a}$, $\vec{b}$ and $\vec{c}$, then $[\,|\vec{a}+\vec{b}+\vec{c}+\vec{d}\,|^2]$ is equal to _____. (where [.] = G.I.F.)

4. Let $f(x) = sin\ 2\pi x + x - [x]$ ([.] denotes the greatest integer function). Then number of points in (–1, 2) at which $f(x)$ takes its local minimum value is _____.

5. Let $f(x)$ be the fifth degree polynomial which leaves remainder 1 when divided by $(x - 1)^3$ and remainder –1 when divided by $(x + 1)^3$, then $f^{IV}\left(\frac{1}{15}\right)$ is _____.

SPACE FOR ROUGH WORK