Vidyamandir Classes
Gurukul for IITJEE Preparation

Mock Advanced Test-6 Paper-2

TIME : 3 hrs	M.M. : 186

Read the following Instructions very carefully before you proceed.

1. The question paper consists of 3 subjects : (Subject I : Chemistry, Subject II : Physics, Subject III : Mathematics). Each Subject consists of one section only.

2. **Section I** contains 3 types of questions **[Type 1, 2 & 3]**

Type 1 contains **6 Single Correct Answer Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE is correct**.

- *Marking scheme* [3 *Marks for Correct answer* & **–1** ***NEGATIVE MARKING*** *for wrong answer*]

Type 2 contains **8 Multiple Correct Answer Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE CHOICES may be correct**.

- *Marking scheme* [4 *Marks for All Correct answers*, +1 *for Partially correct answer and* **–2** ***NEGATIVE MARKING*** *for wrong answer*]

Type 3 contains **TWO** paragraphs. Based on each paragraph, there are **TWO** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.

- *Marking scheme* [3 *Marks for Correct answer* & ***NO NEGATIVE MARKING*** *for wrong answer*]

4. 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.

5. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc., except the Admit Card inside the examination hall/room.

6. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. However, the candidates are allowed to take away this Test Booklet with them.

7. **No one will be permitted to leave the test room before the end of the test, i.e. 05.00 PM**

SUBJECT - I (CHEMISTRY)	62 MARKS

SECTION - I [TYPE-1]

SINGLE CORRECT ANSWER TYPE

This section contains 6 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

Q.1 The geometry and hybridisation state of $\left[Ni(CO)_4\right]$ and $\left[Ni(PPh_3)_2Cl_2\right]$ are respectively :

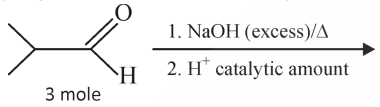
(A) dsp^2, square planar and dsp^2, square planar

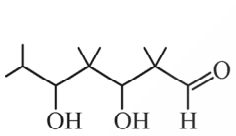
(B) dsp^2, square planar and sp^3, tetrahedral

(C) sp^3, tetrahedral and sp^3, tetrahedral

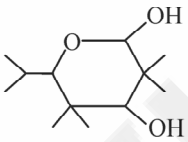
(D) sp^3, tetrahedral and dsp^2, square planar

Q.2 The major product in the following reaction sequence is :

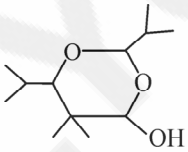




(A)



(B)



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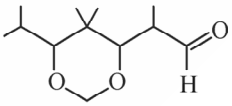
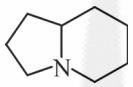
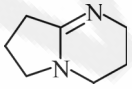
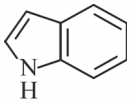


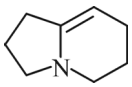
(D)

Q.3 Which of the following is stronger base ?

(A) 

(B) 

(C) 

(D) 

Q.4 For the following electrochemical cell at 298K, $Zn\left|Zn^{2+}\left(C=0.04M\right)\right\|Cd^{2+}\left(C=0.2M\right)\left|Cd\right.$, the EMF is : [Given : $E^\circ_{Cd^{2+}|Cd}=-0.403V$, $E^\circ_{Zn^{2+}|Zn}=-0.763V$]

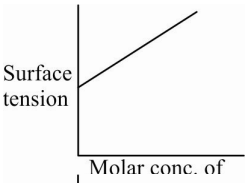
(A) $E=+0.36+\frac{0.059}{2}\log\left(\frac{0.04}{0.2}\right)$ **(B)** $E=-0.36-\frac{0.059}{2}\log\left(\frac{0.2}{0.04}\right)$

(C) $E=+0.36-\frac{0.059}{2}\log\left(\frac{0.04}{0.2}\right)$ **(D)** $E=-0.36+\frac{0.059}{2}\log\left(\frac{0.04}{0.2}\right)$

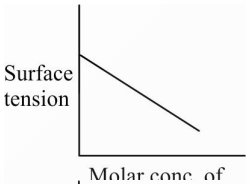
SPACE FOR ROUGH WORK

Q.5 The qualitative sketch given below shows the variation of surface tension with molar concentration of hydrophobic colloids, like sodium stearate, $C_{17}H_{35}COO^{-}Na^{+}$, at room temperature. The correct assignment of the sketches is :

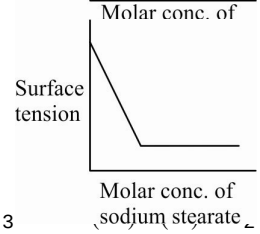
(A)



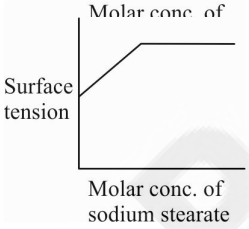
(B)



(C)



(D)



Q.6 $AgNO_3$

$(X) + H_2O \longrightarrow HNO_2 + HNO_3$

$(W) + HNO_3 \longrightarrow (Y) + NO + H_2O$

$(Y) + Na_2S_2O_3\,(\text{excess}) \longrightarrow (Z) + NaNO_3$

Identify (W) to (Z) :

(A) $W = Ag,\ X = N_2O,\ Y = AgNO_3,\ Z = Na_2\left[Ag(S_2O_3)_2\right]$

(B) $W = Ag_2O,\ X = NO,\ Y = AgNO_3,\ Z = Na_3\left[Ag(S_2O_3)_2\right]$

(C) $W = Ag,\ X = NO_2,\ Y = AgNO_3,\ Z = Na_3\left[Ag(S_2O_3)_2\right]$

(D) $W = Ag_2O,\ X = N_2,\ Y = AgNO_3,\ Z = Na\left[Ag(S_2O_3)_2\right]$

SPACE FOR ROUGH WORK

SECTION - I [TYPE-2]

MULTIPLE CORRECT ANSWERS TYPE

This section contains 8 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:

Q.7 The function of adding cryolite in the electrolytic reduction of alumina by Hall Heroult process is to :

(A) reduce alumina **(B)** lower the melting point of alumina

(C) lower the fuel cost **(D)** increase the electrical conductivity of alumina

Q.8 Which of the following is/are correct regarding sulphur containing compounds ?

$S_2O_3^{2-}, S_2O, S_2, H_2S_2$

(A) $H_2S_2 > S_2O_3^{2-} > S_2O$: order of $S-S$ bond length

(B) S_2O, S_2, H_2S_2 : equal number of lone pairs of electron

(C) $S_2O_3^{2-}, S_2O$: different oxidation state of two sulphur atom

(D) S_2 : paramagnetic

Q.9 Which of the following do not form an ideal solution ?

(A) Ethyl alcohol + water **(B)** Ethyl bromide + ethyl iodide

(C) Benzene + toluene **(D)** Chloroform + Benzene

SPACE FOR ROUGH WORK

Q.10 Which of the following statement(s) is/are correct ?

(A) Hydrolysis of sucrose with dilute acid yields an equimolar mixture of D-glucose and D-fructose

(B) α-D-glucose and β-D-glucose are anomers

(C) In sucrose the glycosidic linkage is between C-1 of fructose and C-2 of glucose

(D) Pentaacetate derivative of glucose does not react with H_2NOH

Q.11 Which of the following is correct for NiO doped with Li_2O ?

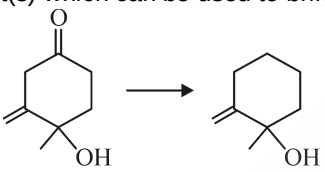
(A) It possess cationic vacancies

(B) It possess interstitial cationic impurities

(C) It possess non-stoichiometric point defects

(D) It possess nickel ions in d^8 and d^7 configuration

Q.12 Reagent(s) which can be used to bring about the following transformation is are :

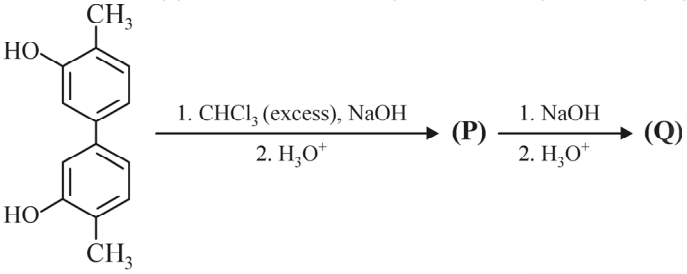


(A) $Zn-Hg/conc.HCl$ **(B)** $N_2H_4/alc.KOH$

(C) $conc.HI/RedP$ **(D)** $H_2/Pd-C$

SPACE FOR ROUGH WORK

Q.13 The correct statement(s) about the following reaction sequence is(are) :



(A) **P** gives dark violet colouration with 1% aqueous $FeCl_3$ solution

(B) **P** gives yellow precipitate with 2, 4-dinitrophenyl hydrazine

(C) **Q** reacts with $LiAlH_4$

(D) **Q** gives effervascence with aqueous $NaHCO_3$ solution

Q.14 Which of the following statements are true about P_4O_6 and P_4O_{10} ?

(A) Both these oxides have a closed cage structure

(B) Each oxide requires 6 water molecules for complete hydrolysis to form their respective oxoacids

(C) Both these oxides contain 12 equivalent P-O bonds

(D) P_4O_6 and P_4O_{10} both contains $p\pi - d\pi$ bonds

SPACE FOR ROUGH WORK

SECTION - I [TYPE-3]

COMPREHENSION TYPE

This section contains 2 paragraphs, each describing theory, experiments, data etc. 4 questions related to the two paragraphs with two questions on each paragraph. Each question has Only One option is correct among the four given options (A), (B), (C) and (D).

Paragraph for questions 15 and 16

PCl_5 when heated in a sealed tube at 523 K undergoes decomposition as follows

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g) (\Delta H > 0)$$

At this temperature its vapour density is found to be 57.92

Q.15 For the decomposition of $PCl_5(g)$ in a closed vessel which is the correct relation between total pressure (P), equilibrium constant. (K_p) and degree of dissociation (α):

(A) $\alpha = \sqrt{(Kp + P)}$ **(B)** $\alpha = \sqrt{\frac{1}{(Kp - P)}}$ **(C)** $\alpha = \sqrt{\frac{Kp}{(Kp + P)}}$ **(D)** $\alpha = \sqrt{\frac{(Kp + P)}{Kp}}$

Q.16 Find the volume percent of Cl_2 at equilibrium under a total pressure of 1.6 atmosphere if equilibrium constant K_p is 0.2 atm :

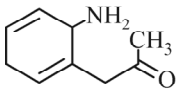
(A) 34% **(B)** 12.5% **(C)** 25% **(D)** 1.28%

SPACE FOR ROUGH WORK

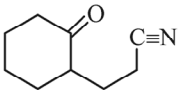
Paragraph for questions 17 and 18

An organic compound **P** has molecular formula $C_9H_{13}NO$ and it can be resolved into enantiomers. **P** does not decolourise bromine water solution. **P** on refluxing with dilute H_2SO_4 yields another resolvable compound $\mathbf{Q}(C_9H_{14}O_3)$ which gives effervescence with $NaHCO_3$. **Q** on treatment with $NaBH_4$ yields $\mathbf{R}(C_9H_{16}O_3)$, which on heating with concentrated H_2SO_4 yields ester $\mathbf{S}(C_9H_{14}O_2)$.

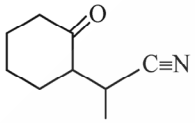
Q.17 Find out correct structure of compound **P** is :



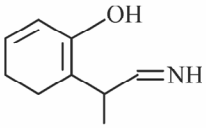
(A)



(B)

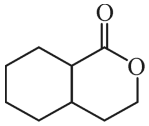


(C)

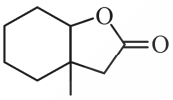


(D)

Q.18 The correct structure of compound **S** is :



(A)



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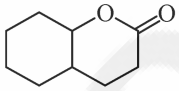
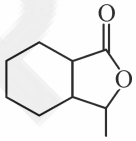


(C)



(D)

SPACE FOR ROUGH WORK

SUBJECT - II (PHYSICS)	62 MARKS

SECTION - I [TYPE-1]

SINGLE CORRECT ANSWER TYPE

This section contains 6 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

Q.1 Rate of disintegration of a active nuclei $R \propto \frac{Z(Z-1)}{B}$. Where Z = Atomic number (Number of Protons)

B = Binding energy per nucleon. Measured masses of neutron, ${}_1^1H$, ${}_7^{15}N$ & ${}_8^{15}O$ are 1.008665u, 1.007825u, 15.000109u and 15.003065u respectively. 1u = 931.5 Mev/C^2 (C = speed of light) Find the ratio of rate of disintegration of ${}_7^{15}N$ to that of ${}_8^{15}O$.

(A) 1.0 **(B)** 0.73 **(C)** 0.54 **(D)** 0.47

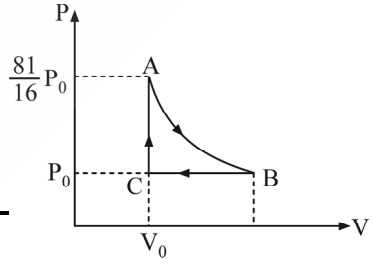
Q.2 $A \xrightarrow{\lambda_1} 2B$

$B \xrightarrow{\lambda_2} 5C$

A disintegrates to B with rate constant λ_2. Initially N_0 number of nuclei of A is present and no. of nuclei of B & C were zero. It was found that after $t = \frac{0.693}{\lambda_1}$ sec, number of Nuclei of B is max. and number of Nuclei of C is N_0. Find relation between λ_1 & λ_2.

(A) $\frac{\lambda_1}{\lambda_2} = \frac{4}{5}$ **(B)** $\frac{\lambda_1}{\lambda_2} = \frac{16}{27}$ **(C)** $\frac{\lambda_1}{\lambda_2} = \frac{4}{25}$ **(D)** $\frac{\lambda_1}{\lambda_2} = \frac{3}{7}$

Q.3 A triatomic (Non-linear) gas undergoes a cyclic process as shown. AB is an adiabatic process. Find the efficiency of the process.



(A) 31% **(B)** 22 %

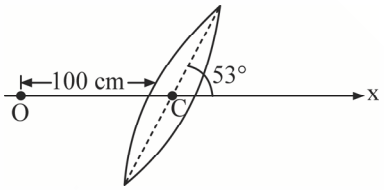
(C) 11 % **(D)** Data is insufficient

SPACE FOR ROUGH WORK

Q.4 A rod *AB* of length *L* is initially at a temperature of 50°*C*. Find the expansion in the length of the rod if one end is maintained at 100°*C* and other end is maintained at 25°*C*.
Thermal conductivity of the rod = *k*, coefficient of Linear Expansion of the rod = α.

(A) Zero **(B)** $\frac{125L\alpha}{2}$ **(C)** $-\frac{25L\alpha}{2}$ **(D)** $\frac{25L\alpha}{2}$

Q.5 As shown in figure, a thin convex lens of focal length 20 *cm* is inclined at an angle of 53° with *x*-axis. A point object is placed on the *x* axis at a distance of 100 *cm* from the centre of the lens. Taking the origin as the centre of lens, find the *x* coordinate of the image :



(A) 26.7 *cm* **(B)** 25 *cm* **(C)** 33.3 *cm*

Q.6 There is vernier caliper *A* (at Room temperature), which is having 1 cm divided in 10 equal divisions on main scale and vernier scale is such that 10 V.S.D = 9 M.S.D. The coefficient of thermal expansion of vernier caliper *A* is α_A and body which is being measured is α_B (α_A & α_B is in /°*C*). Initially the length of the body is measured as in figure A. Temperature of the body & scale increases by 1°C and it measures the body and the reading is shown in figure B. Find an approximate relation between α_A and α_B.

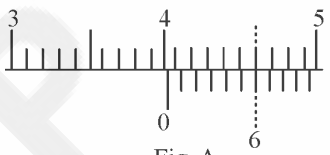


Fig. A

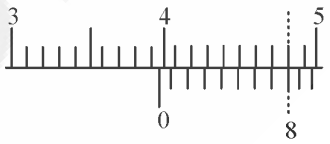


Fig. B

(A) $\alpha_B = \alpha_A - 0.034$ **(B)** $\alpha_A = \alpha_B - 0.034$

(C) $\alpha_B = \alpha_A + 0.02$ **(D)** $\alpha_B = \alpha_A - 0.02$

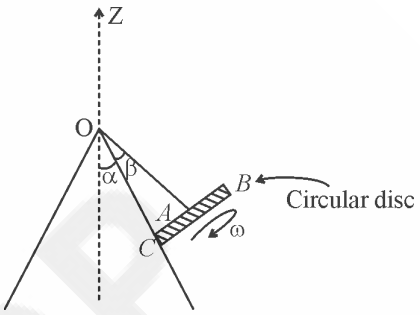
SPACE FOR ROUGH WORK

SECTION - I [TYPE-2]

MULTIPLE CORRECT ANSWERS TYPE

This section contains 8 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:

Q.7 A thin circular disc of mass m is rigidly fixed from its center A to point *O* via a massless rigid rod. Length $OC = l$ The disc is rolling over the conical surface, such that angular velocity of disc about its C.O.M. is given as ω (as shown). $\alpha = 30°, \beta = 45°$. Which of the following statements is / are true?



(A) The center of mass of disc rotates about z-axis with angular speed of 2ω.

(B) Angular momentum of disc about its center of mass is $\frac{m l^2\omega}{4}$

(C) Torque due to external force about point *O* is $\frac{m l^2\omega^2}{8}\left(\sqrt{3}+1\right)$.

(D) Z-component of angular momentum about C.O.M. is $\frac{\left(\sqrt{3}-1\right)}{4\sqrt{2}} m l^2\omega$

SPACE FOR ROUGH WORK

Q.8 Photoelectric effect can be used to determine the chemical composition of sample. The Light of appropriate frequency is incident on sample and from electron analyzer the emitted electrons are analyzed.

Electron analyzer calculate the flux of e^- of particular kinetic energy.

For any sample,

$hf = E_{\underset{Energy}{Binding}} + K.E._{electron}$

$f =$ frequency of incident photon

$E_{\underset{Energy}{Binding}} =$ Binding energy of electron

$K.E._{electron} =$ Kinetic energy of ejected electron

For Neutral Oxygen atom the variation of no. of electron with B.E. is given in fig. (a).

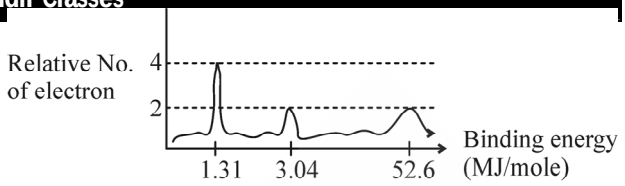


Fig. (a)

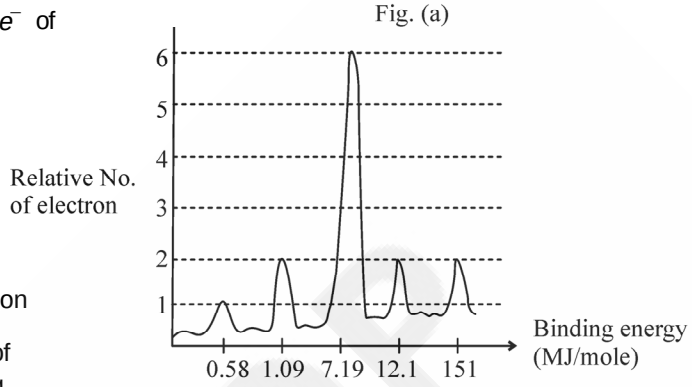


Fig. (b)

The peaks are obtained because of quantum resonance phenomenon for the electrons present in allowed sub shells of atom.

Reading for unknown element is in fig. (b).

Which of the following is/are correct?

(A) Unknown element X is Aluminium

(B) Average excitation energy of e^- for unknown element X from 1s to 3s is 1.6 keV (Aprox.)

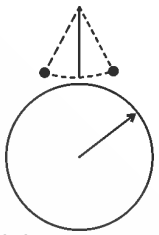
(C) Binding energy of 3p electron of element X is $6\times10^{-6}\,eV$.

(D) Difference of energy of 1s subshells of oxygen and unknown element is $98.4\,MJ/mole$.

SPACE FOR ROUGH WORK

Q.9 In an experiment to measure g over a surface of a planet the formula used is

$$T = \frac{2\pi}{\sqrt{g\left(\frac{1}{l}+\frac{1}{R}\right)}}$$



Where, $g = acc^n$ due to gravity near surface

$l =$ length of simple pendulum

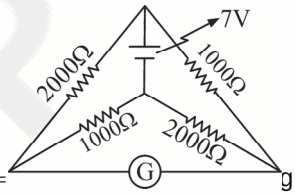
$R =$ radius of planet

Values of R is (6000 $\pm$ 100) km. and l is $(1000 \pm 100)\,km$. The experiment showed the percentage error in T to be 0.1% which of the following statement(s) is (are) true?

(A) % error in R is 1.67% **(B)** % error in l is 10%

(C) % error in g is 10% **(D)** % error in g is 9%

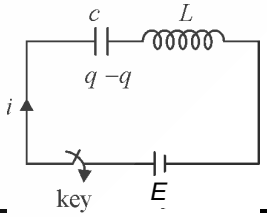
Q.10 In the following circuit the values of resistance in various arms are as shown. The galvanometer has a current sensitivity of $1mm/100\mu A$ and an internal resistance of 1000Ω. Calculate the deflection in galvanometer.



(A) Zero **(B)** 10 *mm*

(C) 20 *mm* **(D)** 30 *mm*

Q.11 Initially charge $q = 0$ and current $i = 0$ and now the switch is closed at $t =$ g is/are correct?



(A) $q = CE\left(1-\cos\left(\frac{1}{\sqrt{LC}}t\right)\right)$ **(B)** $q = CE\sin\left(\frac{1}{\sqrt{LC}}t\right)$

(C) $i = E\sqrt{\frac{C}{L}}\sin\left(\frac{1}{\sqrt{LC}}t\right)$ **(D)** $i = E\sqrt{\frac{C}{L}}\cos\left(\frac{1}{\sqrt{LC}}t\right)$

SPACE FOR ROUGH WORK

Q.12 A body is attached to one end of a vertically hanging spring is performing SHM about mean position with angular frequency ω and amplitude A. The object is detached from spring if it is at height y from mean pos. and moving up which of the following is (are) true?

(A) value of y for which height reached by object above mean position is max after getting detached from spring is, g/ω^2.

(B) value of y for which height reached by object above mean position is max after getting detached from spring is, zero

(C) value of y for which height reached by object above pt. of detaching the spring is max. after getting detached is zero.

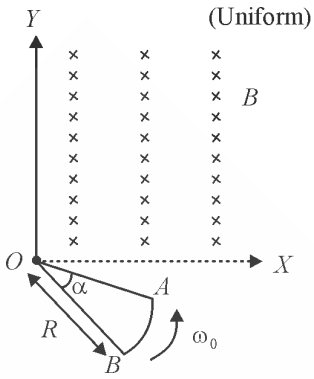
(D) value of y for which height reached by object above pt. of detaching the spring is max. after getting detached is g/ω^2.

Q.13 In Young's Double slit experiment, the intensity of light at a point on the screen, where the path difference is λ is I_0. The path difference at the point where intensity is $\frac{I_0}{2}$ can be :

(A) $\frac{\lambda}{4}$ **(B)** $\frac{7\lambda}{4}$ **(C)** $\frac{3\lambda}{4}$ **(D)** $\frac{5\lambda}{2}$

SPACE FOR ROUGH WORK

Q.14 A wire is folded in shape *OAB* such that are *AB* has radius *R* forming an angle α at O and $OA = OB = R$ (radius). It is rotating with constant angular velocity $\omega_0\hat{k}$ about fixed axis passing through *O* & $\perp$ to *xy* plane. Given that when OA crosses x-axis, time is zero. Moment of Inertia of frame about z-axis passing through *O* is *I*, and resistance of frame $= r$. Magnetic field (*B*) is shown in the figure. Which of the following is/are true ?



(A) Current in the loop while entering the magnetic field region is $\frac{BR^2\omega}{2r}$ clockwise

(B) Current in the loop while entering the magnetic field region is $\frac{BR^2\omega}{2r}$ anti-clockwise

(C) Torque due to magnetic field while entering the magnetic field region is $\frac{B^2R^4\omega}{4r}$ clockwise

(D) Torque due to magnetic field while leaving the magnetic field region is $\frac{B^2R^4\omega}{4r}$ clockwise

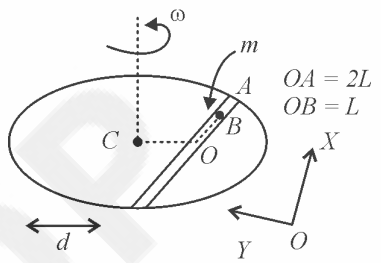
SPACE FOR ROUGH WORK

SECTION - I [TYPE-3]
COMPREHENSION TYPE

This section contains 2 paragraphs, each describing theory, experiments, data etc. 4 questions related to the two paragraphs with two questions on each paragraph. Each question has Only One option is correct among the four given options (A), (B), (C) and (D).

Paragraph for questions 15 and 16

A frame of reference that is accelerated w.r.t. an inertial frame of reference is called a non-inertial frame of refrence. A coordinate system fixed on a circular disc rotating about a fixed axis with constant angular velocity ω is an example of non-inertial frame and reference the relationship between the force $\vec{F}_{rot}$ experienced by a particle of mass m moving on rotating disc and the force $\vec{F}_{in}$ experienced by particle in an inertial frame is $\vec{F}_{rot} = \vec{F}_{in} + 2m\ \vec{V}_{rot} \times \vec{\omega} + m\ (\vec{\omega} \times \vec{r}) \times \vec{\omega}$.



Where $\vec{V}_{rot}$ is velocity of particle in rotating frame of reference and $\vec{r}$ is position vector w.r.t. center and disc. Now consider a smooth slot along a chord at a distance 'd' from the centre of a disc rotating counter clockwise with const. Angular velocity ω about its vertical axis through center. We assign $\times$ axis along chord with origin at middle of chord. A small block & man m is gently placed at $t = 0$ at $x = L$ and is constraint to move along slot only.

Q.15 The distance r of particle at time t is :

(A) $\frac{L}{2}\left(e^{\omega t} + e^{-\omega t}\right)$ **(B)** $L\cos\omega t$ **(C)** $\frac{L}{2}\left(e^{2\omega t} + e^{-2\omega t}\right)$ **(D)** $L\cos 2\omega t$

Q.16 Net reaction force by disc on particle is :

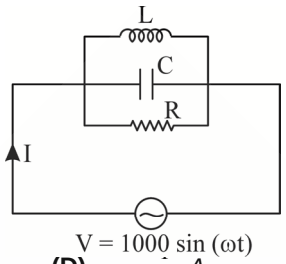
(A) $m\omega^2\left[d + L\left(e^{2\omega t} - e^{-2\omega t}\right)\right]\hat{j} + mg\hat{k}$ **(B)** $m\omega^2(d + L\cos 2\omega t)\,\hat{j} + mg\hat{k}$

(C) $m\omega^2\left[d + L\left(e^{\omega t} - e^{-\omega t}\right)\right]\hat{j} + mg\hat{k}$ **(D)** $m\omega^2(d + L\cos\omega t)\,\hat{j} + mg\hat{k}$

SPACE FOR ROUGH WORK

Paragraph for questions 17 and 18

An inductor a capacitor and a resistor are connected in parallel across an *AC* voltage supply as shown in the figure.



[Given $\omega L = 1000\Omega, \frac{1}{\omega C} = 500\Omega, R = 500\Omega$]

Q.17 Find the peak value of the current through the circuit :

(A) $\sqrt{2}A$ **(B)** $\sqrt{5}\,A$ **(C)** $\frac{1}{\sqrt{2}}\,A$ **(D)** $\frac{1}{\sqrt{5}}\,A$

Q.18 Power factor of the circuit is :

(A) $\frac{1}{\sqrt{2}}$ **(B)** $\frac{2}{\sqrt{5}}$ **(C)** $\frac{1}{2}$ **(D)** 1

SPACE FOR ROUGH WORK

SUBJECT - III (MATHEMATICS)	62 MARKS

SECTION - I [TYPE-1]

SINGLE CORRECT ANSWER TYPE

This section contains 6 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

Q.1 Which of the following statements are true ?

$S_1 : \int_0^{\pi} \sin 2x \sin\left(\frac{\pi}{2}\cos x\right) dx = \frac{16}{\pi^2}$

$S_2 : \int \sqrt{x-3}\left(\sin^{-1}(\ln x) + \cos^{-1}\ln(x)\right) dx = \frac{\pi}{3}(x-3)^{3/2} + C$

S_3 : *If* $u(x) = \int (u(x))^{-2} dx$ and $u(1) = 0$ then $u(x) = \sqrt[3]{3(x-1)}$

S_4 : The equation of the plane passes through x-axis and perpendicular to the line $\frac{x-1}{\cos\theta} = \frac{y+2}{\sin\theta} = \frac{z-3}{0}$ is $x\cos\theta + y\sin\theta = 0$

(A) S_1, S_2, S_3 **(B)** S_2, S_3, S_4 **(C)** S_1, S_2, S_3, S_4 **(D)** S_1, S_3, S_4

Q.2 Let the function 'f' satisfies $f(-x)\,f'(x) = f(x)\,f'(-x)$ for all 'x' and $f(0) = 3$, then $\int_{-2010}^{2010} \frac{dx}{3 + f(x)} =$

(A) 0 **(B)** 2010 **(C)** 4020 **(D)** 670

SPACE FOR ROUGH WORK

Q.3 If z-axis be vertical, then the equation of the line of greatest slope through the point $(2,-1,0)$ on the plane $2x+3y-4z=1$ is :

(A) $\frac{x-2}{2}=\frac{y+1}{-1}=\frac{z}{0}$ **(B)** $\frac{x-2}{3}=\frac{y+1}{4}=\frac{z-0}{5}$

(C) $\frac{x-2}{2}=\frac{y+1}{3}=\frac{z-0}{-4}$ **(D)** $\frac{x-2}{8}=\frac{y+1}{12}=\frac{z}{13}$

Q.4 If a, b are two positive co-prime integers such that $\lim_{n\to\infty}\left(\frac{^{3n}C_n}{^{2n}C_n}\right)^{1/n}=\frac{a}{b}$, then $a+b=$

(A) 27 **(B)** 43 **(C)** 16 **(D)** 53

Q.5 If $x^4+3\cos(ax^2+bx+c)=2(x^2-2)$ has two distinct solution with $a,b,c\in(2,5)$, then the maximum value of $\frac{ac}{b^2}$ is :

(A) 1 **(B)** 2 **(C)** 3 **(D)** $\frac{16}{3}$

Q.6 If $M=\sum_{k=1}^{59}\min\left(\phi\left(\frac{k}{30}\right),\phi\left(\frac{k}{60}\right)\right)$, where $\phi(\lambda)=\min(\lambda-[\lambda],[\lambda]-\lambda+1)$, (where $[\lambda]$ is a greatest integer less than or equal to λ). Then M is equal to :

(A) 30 **(B)** 10 **(C)** 60 **(D)** 61

SPACE FOR ROUGH WORK

SECTION - I [TYPE-2]
MULTIPLE CORRECT ANSWERS TYPE

This section contains 8 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct:

Q.7 Suppose 'f' is a function that satisfies the equation $f(x+y)=f(x)+f(y)+x^2y+xy^2$ for all real numbers 'x' and 'y'. If $\lim_{x\to 0}\frac{f(x)}{x}=1$, then

(A) $f(x)>0$ for $x>0$ and $f(x)<0$ for $x<0$

(B) $f'(0)=1$ **(C)** $f''(0)=1$ **(D)** $f''(0)=6$

Q.8 Consider the function $f(x)=\sin^5 x+\cos^5 x-1, x\in\left[0,\frac{\pi}{2}\right]$. Which of the following is/are correct ?

(A) 'f' is strictly decreasing in $\left[0,\frac{\pi}{4}\right]$

(B) 'f' is strictly increasing in $\left[\frac{\pi}{4},\frac{\pi}{2}\right]$

(C) There exists a number 'c' in $\left(0,\frac{\pi}{2}\right)$ such that $f'(c)=0$

(D) The equation $f(x)=0$ has only two roots in $\left[0,\frac{\pi}{2}\right]$

SPACE FOR ROUGH WORK

Q.9 Let t and $f(t)$ be the eccentrities of the ellipses $\frac{x^2}{3b^2-2a^2}+\frac{y^2}{2b^2-a^2}=1$ and $\frac{x^2}{2b^2-a^2}+\frac{y^2}{b^2}=1$, where $b^2>a^2$, $a\neq 0$ respectively, then :

(A) $f(t)=\frac{\sqrt{2}\,t}{\sqrt{1+t^2}}$ **(B)** $fofof(t)=2\sqrt{2}\,t$

(C) $\int_0^{1/2} fofofof(t)=\frac{1}{4}$ **(D)** $\int e^t[f(t)-f''(t)]dt=e^t\left[-\frac{1}{(1-t^2)^{3/2}}+\frac{t}{\sqrt{1-t^2}}\right]+C$

Q.10 Given a real valued function f such that $f(x)=\begin{cases}\frac{\tan^2\{x\}}{\left(x^2-[x]^2\right)}, & x>0\\ 1, & x=0\\ \sqrt{\{x\}\cot\{x\}} & x<0\end{cases}$ where [x] is integral part of x and {.} is Fractional part of x. Then :

(A) $\lim_{x\to 0^+} f(x)=1$ **(B)** $\lim_{x\to 0^-} f(x)=\cot 1$

(C) $\cot^{-1}\left(\lim_{x\to 0^-} f(x)\right)^2=1$ **(D)** $\tan^{-1}\left(\lim_{x\to 0^+} f(x)\right)=\frac{\pi}{4}$

Q.11 Let $f(x)$ be strictly monotonic differentiable function on $[0,1]$ such that $f(0)=1$, $f(1)=-1$ then $2\int_{-1}^{1} x(f^{-1}(x)-1)dx=$

(A) $\int_0^1 f^2(x)dx-1$ **(B)** $\int_0^1 f(x)dx$ exists **(C)** $1+\int_0^1 f^2(x)dx$ **(D)** is positive

SPACE FOR ROUGH WORK

Q.**12** If $S=\left\{x : x=\sum_{j=n}^{m}\left(i^{j}\right), i=\sqrt{-1}, \forall m, n \in Z\right\}$ then number of elements in *S* is equal to :

(A) 5 **(B)** 9 **(C)** 10 **(D)** 4

Q.13 If *f* is continuous and one-one function for $x \geq 0$ and $\int_{0}^{x} f(t)dt < \frac{x}{2}\left(f(0)+f(x)\right)$ then correct option may be :

(A) $f'(x)<0; f''(x)<0$ **(B)** $f'(x)<0; f'(x)>0$

(C) $f'(x)>0; f''(x)<0$ **(D)** $f'(x)>0; f''(x)>0$

Q.14 Let *A, B, C* represent the vertices of a triangle, where *A* is the origin and *B* and *C* have position vectors $\vec{b}$ *and* $\vec{c}$ respectively. Points *M*, *N* and *P* are taken on sides *AB,* BC and *CA* respectively such that $\frac{AM}{AB}=\frac{BN}{BC}=\frac{CP}{CA}=\alpha, \left(\alpha \in R-\{0\}\right)$, then which of the followings are correct ?

(A) $\overrightarrow{AN}+\overrightarrow{BP}+\overrightarrow{CM}=$ is equal to $\vec{0}$

(B) If Δ represents the area enclosed by the three vectors $\overrightarrow{AN}, \overrightarrow{BP}, \overrightarrow{CM}$ then $\Delta=\left|\frac{\vec{b}\times\vec{c}}{2}\right|\left(\alpha^{2}-\alpha+1\right)$

(C) The value of α for which Δ is least is $\frac{1}{2}$

(D) $\overrightarrow{AN}+\overrightarrow{BP}+\overrightarrow{CM}=3\alpha\left(\vec{b}+\vec{c}\right)$

SPACE FOR ROUGH WORK

SECTION - I [TYPE-3]
COMPREHENSION TYPE

This section contains 2 paragraphs, each describing theory, experiments, data etc. 4 questions related to the two paragraphs with two questions on each paragraph. Each question has Only One option is correct among the four given options (A), (B), (C) and (D).

Paragraph for Questions 15 - 16

Consider a conic of the form $ax^2+2hxy+by^2=1----(1)$ and a circle $\frac{x^2}{r^2}+\frac{y^2}{r^2}=1-----(2)$

(1) – (2) gives $\left(a-\frac{1}{r^2}\right)x^2+2hxy+\left(b-\frac{1}{r^2}\right)y^2=0-----(3)$

(3) represents a pair of lines passing through the origin and the intersection of the circle and the conic. If these lines coincide they are with either major axis or minor axis.

(3) represent coincident lines if $\left(a-\frac{1}{r^2}\right)\left(b-\frac{1}{r^2}\right)=h^2$. This is a quadratic equation interms of r^2 whose roots be r_1^2 and r_2^2 : If r_1^2 and r_2^2 are both positive then the conic is an ellipse and lengths of its axes are $2r_1$ and $2r_2$. If r_1^2 is positive and r_2^2 is negative then the conic is a hyperbola and lengths of its axes are $2r_1$ and $2\sqrt{-r_2^2}$. Given conic is $5x^2-6xy+5y^2+22x-26y+29=0$. The axes being rectangular. Now answer the following questions.

Q.15 Lengths of major and minor axes respectively are :

(A) 8, 4 **(B)** 16, 4 **(C)** 4, 2 **(D)** 16, 8

Q.16 Equations of the major and minor axes respectively are :

(A) $2x+y=0, x-2y+5=0$ **(B)** $2x-y+4=0, x+2y-3=0$

(C) $x-y+1=0, x+y-3=0$ **(D)** $x-y+3=0, x+y-1=0$

SPACE FOR ROUGH WORK

Paragraph for Questions 17 - 18

Let A and B be two events such that $P(A \cup B) \geq \frac{4}{5}$ and $\frac{1}{10} \leq P(A \cap B) \leq \frac{3}{10}$ Let $P(A)$ and $P(B)$ be represented by x any y respectively then :

Q.17 Find the area of region defined by $S(x,y)$:

(A) $\frac{11}{25}$ **(B)** $\frac{1}{2}$ **(C)** $\frac{7}{20}$ **(D)** $\frac{81}{200}$

Q.18 If a point $Q(x,y)$ be selected from the region given by $x^2 + y^2 \leq 2, x, y \geq 0$ then the probability that the point belong to the region defined above is :

(A) $\frac{22}{25\pi}$ **(B)** $\frac{1}{\pi}$ **(C)** $\frac{81}{100\pi}$ **(D)** $\frac{7}{10\pi}$

SPACE FOR ROUGH WORK

End of Mock JEE Advanced-6/PAPER-2