Aakash + BYJU'S

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CODE

Corporate Office : Aakash Tower, 8, Pusa Road, New Delhi-110005, Phone : 011-47623456

Time : 3 hrs | MM : 198

MOCK TEST - 3
for JEE (Advanced) - 2022
Paper - 1

Mock Test on Complete Syllabus

Instructions:

1. Read each question carefully.
2. It is mandatory to use blue/black ballpoint pen to darken the appropriate circle in the answer sheet.
3. Mark should be dark and should completely fill the circle.
4. Rough work must not be done on the answer sheet.
5. Do not use white-fluid or any other rubbing material on answer sheet.
6. Student cannot use log table and calculator or any other material in the examination hall.
7. Before attempting the question paper, student should ensure that the test paper contains all pages and no page is missing.
8. Before handing over the answer sheet to the invigilator, candidate should check that Roll No., Centre Code and Date of Birth have been filled and marked correctly.
9. Immediately after the prescribed examination time is over, the answer sheet is to be returned to the invigilator.
10. Pattern of the questions are as under:
    (i) The question paper consists of 3 parts **(Physics, Chemistry and Mathematics)**. Each part has **3 sections**.
    (ii) **Section-1:** This section contains **6** Multiple choice questions which have **ONLY ONE** correct answer. Each question carries **+3 marks** for correct answer and **–1 mark** for wrong answer.
    (iii) **Section-2:** This section contains **6** Multiple choice questions which have **ONE OR MORE THAN ONE** correct answer(s). Each question carries **+4 marks** for correct answer and **–2 marks** for wrong answer. **+3** If all the four options are correct but **ONLY** three options are chosen. **+2** If three or more options are correct but **ONLY** two options are chosen, both of which are correct. **+1** If two or more options are correct but **ONLY** one option is chosen and it is a correct option.
    (iv) **Section-3:** This section contains **6** questions. The answer to each of the questions is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places. Each question carries **+4 marks** for correct answer and there is **No negative** marking.

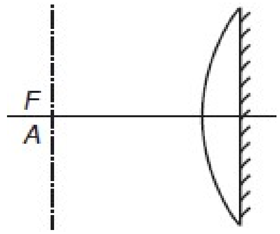
PART – I : PHYSICS

SECTION - 1

Only One Option Correct Type

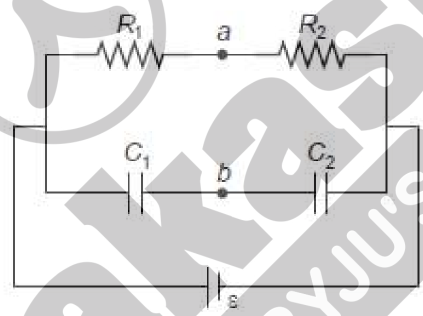
This section contains 6 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

1. The plane surface of plano-convex lens (see figure) with a focal length of 10 cm is silvered. How far from the lens will the image of a point source (in cm) be located? The object is at the focus of the lens.



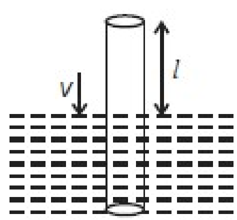
(A) 20 cm
(B) 10 cm
(C) 15 cm
(D) 25 cm

2. Two resistors with resistances R_1 and R_2 are connected in series and so are two capacitors with capacitances C_1 and C_2. These two systems are connected to a battery as shown in figure. Potential difference between *a* and *b* is zero in steady state if



(A) $R_1 + R_2 = \dfrac{C_1C_2}{C_1 + C_2}$
(B) $R_1R_2 = C_1C_2$
(C) $R_1C_2 = R_2C_1$
(D) $R_1C_1 = R_2C_2$

3. An open pipe of sufficient length is dipping in water with a speed v vertically. If at any instant l is length of tube above water, then the rate at which fundamental frequency of pipe changes is (C is the speed of sound in air)



(A) $\dfrac{Cv}{2l^2}$

(B) $\dfrac{Cv}{4l^2}$

(C) $\dfrac{Cv}{2v^2t^2}$

(D) $\dfrac{Cv}{4v^2t^2}$

4. Charge is uniformly distributed in a space. The net flux passing through the surface of an imaginary cube of side *a* in the space is ϕ. The net flux passing through the surface of an imaginary sphere of radius *a* in the space will be

(A) ϕ (B) $\frac{3}{4\pi}\phi$

(C) $\frac{2\pi}{3}\phi$ (D) $\frac{4\pi}{3}\phi$

5. A camera lens is made of glass with index of refraction n_1 = 1.50. A thin film of a material with index of refraction n_2 = 1.4 is used to coat the lens so that light incident on the lens is minimally reflected. Assume that the light is travelling perpendicular to the lens surface and has wavelength 420 nm in vacuum. What is the possible thickness of the film?

(A) 75 nm (B) 50 nm

(C) 100 nm (D) 125 nm

6. The de-Broglie wavelength (λ) of an electron is same as the wavelength of a photon. The energy of photon is *x* times the K.E. of the electron, then *x* is (*M* - mass of electron, *h* - Planck's constant, *C* - speed of light)

(A) $\frac{hC}{2\lambda M}$ (B) $\frac{2\lambda MC}{h}$

(C) $\frac{2\lambda C}{hM}$ (D) $\frac{2\lambda M}{Ch}$

SECTION - 2

One or More Options Correct Type

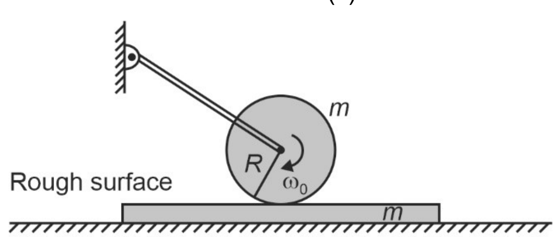
This section contains 6 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) out of which **ONE OR MORE** is/are correct.

7. A particle constrained to move along the *x*-axis is subjected to a force which varies as $F(x) = (-8x + 2x^3)$ N, where *x* is in m and $-\infty \le x \le \infty$. The potential energy of the particle at the origin is zero. If the total mechanical energy of the particle is 3.5 J. Its motion can be

(A) Between $x = -\infty$ and $x = -\sqrt{7}$ m (B) Between $x = -1$ m and $x = +1$ m

(C) Between $x = +\sqrt{7}$ m and $x = +\infty$ (D) Between $x = +1$ m and $x = +\sqrt{7}$ m

8. A solid cylinder of mass *m* is rotating with angular velocity ω_0 about its fixed axis of symmetry. It is brought in contact with a plank of equal mass *m* placed on a smooth surface. There exist friction between cylinder and plank because of which plank starts moving. After some time plank moves such that there is no slipping between cylinder and plank. Select the correct statement(s).



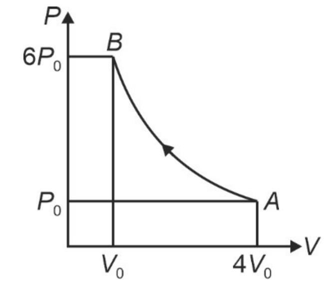
(A) Magnitude of angular impulse imparted to the cylinder (about centre of mass) during this process is $\frac{mR^2\omega_0}{3}$

(B) Magnitude of angular impulse imparted to the cylinder (about centre of mass) during this process is $\frac{2mR^2\omega_0}{3}$

(C) The total work done by friction force in this process is $-\frac{1}{9}mR^2\omega_0^2$

(D) The total work done by friction force in this process is $-\frac{1}{6}mR^2\omega_0^2$

9. One mole of a diatomic gas is taken through a process $A \to B$ as shown in figure. The gas obeys the relation $Q_{A\to B} + W_{A\to B} = 0$ for each quasi-static steps.



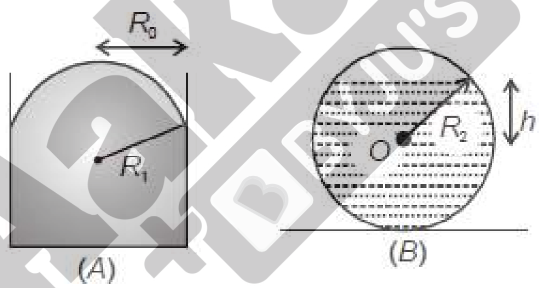
(A) The molar heat capacity for process AB is $\frac{5R}{4}$

(B) The heat supplied in the process is $\left(\frac{5}{2}\right)P_0V_0$

(C) For A to B, temperature initially decreases and then increases

(D) The temperature goes on increasing from A to B

10. A liquid is placed in a cylindrical glass container of radius R_0. In case free surface of liquid has spherical shape of radius of curvature R_1. Now same liquid is placed in a large spherical glass container of radius R_2. If surface of liquid container in spherical container is found to be flat, then choose the correct alternative(s).



(A) Angle of contact of liquid glass pair is $\pi - \cos^{-1}\left(\frac{R_0}{R_1}\right)$

(B) Angle of contact of liquid glass pair is $\cos^{-1}\left(\frac{R_0}{R_1}\right)$

(C) Height, h is $R_0\frac{R_2}{R_1}$

(D) Height, h is $R_0\frac{R_1}{R_2}$

11. Two bodies A and B have thermal emissivities of 0.01 and 0.81 respectively. The outer surface areas of the two bodies are the same. The two bodies radiate energy at the same rate. The wavelength λ_B, corresponding to the maximum spectral radiancy in the radiation from B, is shifted from the wavelength corresponding to the maximum spectral radiancy in the radiation from A by 1.00 μm. If the temperature of A is 5802 K,

(A) The temperature of B is 1934 K

(B) λ_B = 1.5 μm

(C) The temperature of B is 11604 K

(D) The temperature of B is 2901 K

12. Two capacitors of capacitance 3 μF and 6 μF are charged to a potential of 12 V each. They are now connected to each other, with the positive plate of one to the negative plate of the other. Then

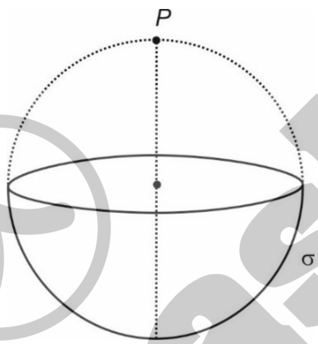
(A) The potential difference across 3 μF is zero
(B) The potential difference across 3 μF is 4 V
(C) The charge on 3 μF is zero
(D) The charge on 3 μF is 12 μC

SECTION - 3

Numerical Value Type

This section contains 6 questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.

13. Consider a hemispherical surface having surface charge density σ. If E due to this curved hemispherical surface at point P symmetrically located with respect to charge distribution as shown is $\frac{3\sigma}{N\varepsilon_0}(2-\sqrt{2})$, then find N.

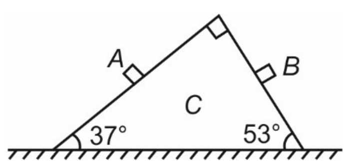


14. One mole helium in a vessel gets the heat from outside and starts expanding to make its volume 2 times the original volume. The heat capacity of the gas in this process is constant and is $\frac{R}{2}$. What is the final temperature of gas (in °C)? [Initial temperature is 327°C and initial pressure is 40 kPa]

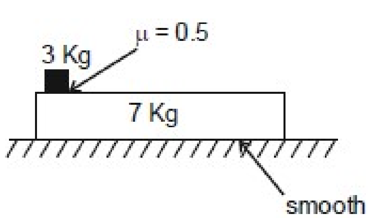
15. The plane surface of plano-convex lens is silvered and it then acts as concave mirror of 30 cm focal length. Now the silvering is removed and the lens is used to make the image of an object placed on its principal axis. The image is seen to be inverted with a magnification of $\frac{1}{2}$. At what distance from the lens (in cm) was the image formed?

16. A steel string of area 10 mm^2 and length 60 cm is fixed at both ends. It vibrates at 600 Hz in the third harmonic. The density of steel is 8000 kg/m^3. The tension in the string is 192 × k newton. The value of k is ______.

17. In the figure shown, blocks A and B are kept on a wedge C. A, B and C each have mass m. All surfaces are smooth. Find the acceleration of C.



18. A plank of mass 7 kg rests on a smooth floor with its rough surface is on upper side as shown. A particle of mass 3 kg is projected along this face with an initial velocity. The coefficient of limiting friction between the particle and the plank is 0.5. In the subsequent motion, at a certain instant, the particle is moving at 10 m/s and the plank at 3 m/s. How much time (in s) after this instant will the particle and the plank come relatively to rest? (g = 9.8 m/s^2)



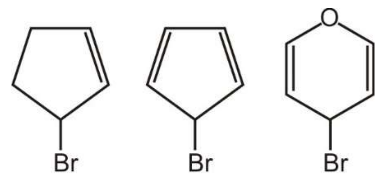
PART – II : CHEMISTRY

SECTION - 1

Only One Option Correct Type

This section contains 6 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

19. Among the bromides I-III given below, the order of reactivity in S_N1 reaction is:



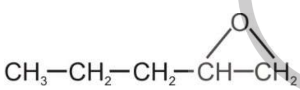
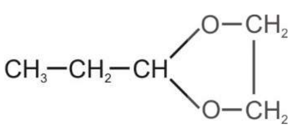
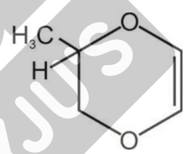
I II III

(A) III > I > II
(B) III > II > I
(C) II > III > I
(D) II > I > III

20. The reaction sequence

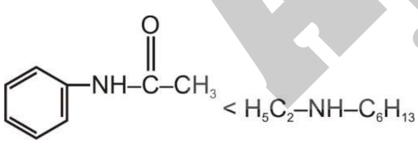
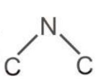
$$CH_3CH_2COOH \xrightarrow{SOCl_2} A \xrightarrow{LiAlH(O-Bu)_3} B \xrightarrow{HO-CH_2-CH_2-OH/H^+} C$$

Then C is more likely to be

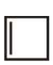
(A) 
(B) $CH_3-CH_2-CH_2-CHO$
(C) 
(D) 

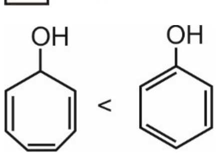
21. Use T for correct information and F for false about mentioned characteristic in bracket.

(i) $R-\overset{\ominus}{C}=O > R-C\equiv\overset{\oplus}{O}$ (Stability)

(ii)  ( bond angle)

(iii) $CH_3-\overset{\oplus}{N}(CH_3)_2-CH_2-\overset{\ominus}{C}H_2 > O_2N-\overset{\ominus}{C}H-CH_3$ (Stability of Carbanion)

(iv)  $< H_2C=CH-CH=CH_2$ (Heat of combustion)

(v)  (Acidic nature)

(A) TFTFT
(B) FFFFT
(C) TFTFF
(D) FFTFT

22. Metals M_1 and M_2 crystallise in body centred cubic lattice and face centred cubic lattice respectively. Density of both the metal lattices is same. Then select the correct combination of edge length and molar mass of metal.

(A) Edge length of B.C.C. crystal and F.C.C. crystal are same while molar mass of M_2 is 2 times of metal M_1

(B) Edge length of B.C.C. crystal is half of F.C.C. crystal while molar mass of metal M_2 is 2 times of M_1

(C) Edge length of B.C.C. crystal is half of F.C.C. crystal while molar mass of metal M_2 is 4 times of M_1

(D) Edge length of B.C.C. crystal is same of F.C.C. crystal while molar mass of metal M_2 is 4 times of M_1

23. Which of the following set contain only complexes that do not obey EAN rule?

(i) $Ni(CO)_4$ (ii) $[Ag(NH_3)_2]Cl$

(iii) $K_4[Fe(CN)_6]$ (iv) $K_2[Ni(CN)_4]$

(v) $K_2[PtCl_6]$ (vi) $K_3[Cr(C_2O_4)_3]$

[Where atomic number of Ni = 28, Ag = 47, Fe = 26, Pt = 78 and Cr = 24]

(A) (i), (iii) and (v) (B) (ii), (iii) and (v)

(C) (i), (iv) and (v) (D) (ii), (iv) and (vi)

24. The approach of ligand can break the degeneracy of *d*-orbitals. Select correct order of stability of different orbitals in square planar complex.

(A) $\begin{vmatrix} d_{yz} \\ d_{xz} \end{vmatrix} > d_{z^2} > d_{xy} > d_{x^2-y^2}$

(B) $\begin{vmatrix} d_{xy} \\ d_{yz} \\ d_{xz} \end{vmatrix} > \begin{vmatrix} d_{x^2-y^2} \\ d_{z^2} \end{vmatrix}$

(C) $d_{x^2-y^2} > d_{xy} > d_{z^2} > \begin{vmatrix} d_{yz} \\ d_{xz} \end{vmatrix}$

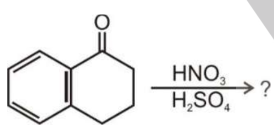
(D) $d_{x^2-y^2} > d_{xy} > d_{z^2} > d_{yz} > d_{xz}$

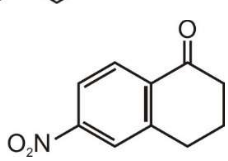
SECTION - 2

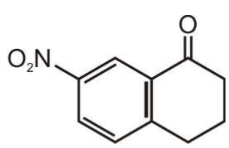
One or More Options Correct Type

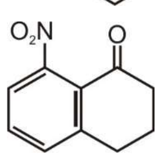
This section contains 6 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) out of which **ONE OR MORE** is/are correct.

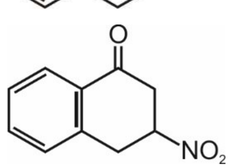
25. What is the major product of the given reaction?

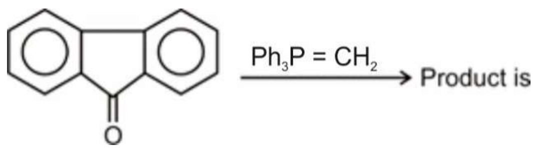


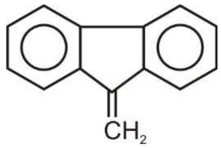
(A) 

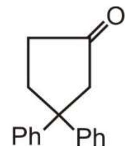
(B) 

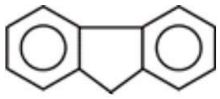
(C) 

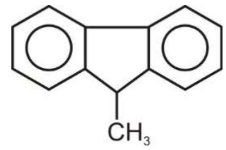
(D) 

26. 

(A) 

(B) 

(C) 

(D) 

27. Which of the following is/are product(s) of hydrolysis of XeF_6?

(A) $XeOF_2$

(B) XeO_2F_2

(C) $XeOF_4$

(D) XeO_3

28. Identify the correct relation(s) among the following given relations.

(A) $\left(\frac{\partial G}{\partial P}\right)_T = V$

(B) $\left(\frac{\partial G}{\partial T}\right)_P = -S$

(C) $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$

(D) $dH = TdS + VdP$

29. Identify P, Q, R and S in the following sequence of reactions:

(i) $P + NaOH \xrightarrow{\text{Heat}} NaCl + NH_3 + H_2O$

(ii) $NH_3 + CO_2 + H_2O \longrightarrow Q$

(iii) $Q + NaCl \longrightarrow R + NH_4Cl$

(iv) $R \xrightarrow{\Delta} Na_2CO_3 + H_2O + S$

(A) P is NH_4Cl

(B) Q is NH_4HCO_3

(C) R is $NaHCO_3$

(D) S is CO

30. Liquids X and Y form ideal solution in which 30 g of X and 40 g of Y is present at 27°C. Following information is given

	X(ℓ)	X(g)	Y(ℓ)	Y(g)
$\Delta_f H$ (kJ/mol)	2.00	10.3	10.3	17.96

ΔS_{vap} (X) = 20.75 J/mol K

ΔS_{vap} (Y) = 20.00 J/mol K

(Assume ΔH and ΔS values of each liquid remain constant till its boiling point)

[Given that $e^{5/6} = 2.3$, $e^{2/3} = 2$, $R = 8.3$ J mol^{-1} K^{-1}, molar mass of X and Y are 60 and 80 g/mol respectively]

The correct statement(s) is/are

(A) Liquid Y is more volatile than liquid X

(B) Mole fraction of X in vapour phase is 0.64 at 27°C

(C) Mole fraction of Y in vapour phase is 0.25 at 27°C

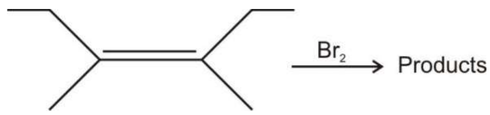
(D) Mole fraction of Y in vapour phase will be greater than 0.5 at 27°C

SECTION - 3

Numerical Value Type

This section contains 6 questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.

31. A 0.01 molal aqueous solution of $K_3[Fe(CN)_6]$ freezes at –0.062°C. What is the percentage degree of dissociation of $K_3[Fe(CN)_6]$? (Report your answer in the nearest whole number and K_f of H_2O = 1.86 K kg mol^{-1})

32. 

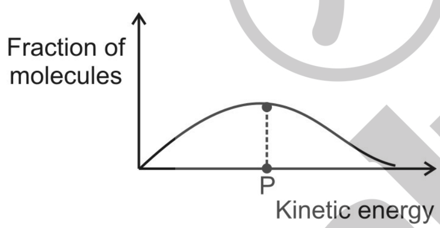
How many products can be resolved?

33. A non-electrolytic and non-volatile solute is added to pure water, difference between freezing point and boiling point is now 105°C. If the mass of solute present in 500 g of solvent is X, then the value of $\frac{X}{5}$ (to the nearest integer) is

(Given molar mass of solute = 120 g/mol, k_b = 0.512 °Cm^{-1}, k_f =1.86 °Cm^{-1})

34. Consider the following statements.

(i) Half life of a first order (except radioactivity) reaction decreases with increase in temperature.

(ii) 

Point P represents the most probable kinetic energy.

(iii) Rate and half life of a reaction of zero order is independent of concentration of reactant.

(iv) Catalyst does not change ΔG of reaction.

(v) Catalyst does not change ΔH of reaction.

(vi) Catalyst does not change ΔS of reaction.

(vii) In collision theory, only activation energy determine the criteria for an effective collision.

(viii) Order is applicable to elementary as well as complex reactions whereas molecularity is applicable only for elementary reactions.

(ix) Rate of radioactive reaction is independent of pressure and temperature.

Out of the above, total Y statements are correct. The value of Y + 10 is

35. Consider the reaction.

$Ag + PCl_5 \longrightarrow A + B$

$Sn + PCl_5 \longrightarrow A + C$

In products B, C and A, the oxidation number of silver, tin and phosphorus is t, y and z respectively. Then product of t, y and z is

36. Consider the following ores

Siderite, Iron pyrites, Haematite, Malachite, Cuprite, Copper glance, Sphalerite, Calamine, Zincite.

Out of the above ores, x is the number of ores in which oxidation number of metal is even. The value of 4x is

PART – III : MATHEMATICS

SECTION - 1

Only One Option Correct Type

This section contains 6 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

37. If S be set of all positive solutions of equation $(1 + a)\cos\theta\cos(2\theta - b) = (1 + a\cos2\theta)\cos(\theta - b)$ which depends on a and b, then conditions that should be imposed on a and b such that S is non-empty is

(A) $\left|\frac{a}{2}\sin b\right| < 1$

(B) $\left|\frac{a}{2}\sin b\right| \le 1$

(C) $|a\sin b| \le 1$

(D) None of these

38. Let $f(x) = x^3 - px + q$, where $p > 0$, $q > 0$ and all the zeros of $f(x)$ are real. If α is a zero of $f(x)$ with least absolute value, then $|\alpha|$ belongs to

(A) $\left(\frac{q}{p}, \frac{p}{q}\right)$

(B) $\left(\frac{p}{q}, \frac{q}{p}\right]$

(C) $\left(\frac{q}{p}, \frac{3q}{2p}\right]$

(D) $\left(\frac{p}{q}, \frac{3p}{2q}\right]$

39. Let $f(x)$ be a polynomial with real coefficients such that $f(x) = f'(x) \times f''(x)$. If $f(x) = 0$ is satisfied by $x = 1, 2, 3$ only, then the value of $f'(1) \times f'(2) \times f'(3)$ is

(A) Positive

(B) Negative

(C) Zero

(D) Inadequate data

40. $\int \frac{(2+\sqrt{x})dx}{(x+\sqrt{x}+1)^2}$ is equal to

(A) $\frac{x}{x+\sqrt{x}+1} + c$

(B) $\frac{2x}{x+\sqrt{x}+1} + c$

(C) $\frac{1}{x+\sqrt{x}+1} + c$

(D) None of these

41. The solution of differential equation $2x^3y\,dy + (1 - y^2)(x^2y^2 + y^2 - 1)dx = 0$

(A) $x^2y^2 = (cx + 1)(1 - y^2)$

(B) $x^2y^2 = (cx + 1)(1 + y^2)$

(C) $x^2y^2 = (cx - 1)(1 - y^2)$

(D) None of these

42. If ellipse E_n is drawn such that it touches ellipse E_{n-1} at the extremities of its major axis, and to have its foci at the extremities of the minor axis of E_{n-1}. If eccentricity e_n of ellipse E_n is independent of n, then the eccentricity of ellipse E_{n-3} is

(A) $\frac{\sqrt{3}-1}{2}$

(B) $\frac{2-\sqrt{3}}{2}$

(C) $\frac{\sqrt{5}-1}{2}$

(D) $\frac{3-\sqrt{5}}{2}$

SECTION - 2

One or More Options Correct Type

This section contains 6 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) out of which **ONE OR MORE** is/are correct.

43. Let $f: R \to R$ be a function defined by $f(x+1) = \dfrac{f(x)-5}{f(x)-3}\ \forall\ x \in R$. Then which of the following statement(s) is/are true?

(A) $f(2008) = f(2004)$
(B) $f(2006) = f(2010)$
(C) $f(2006) = f(2002)$
(D) $f(2006) = f(2018)$

44. Let $F(x) = (f(x))^2 + (f'(x))^2$, $F(0) = 6$, where $f(x)$ is a thrice differentiable function such that $|f(x)| \le 1\ \forall\ x \in [-1, 1]$, then choose the correct statement(s).

(A) There is at least one point in each of the intervals (–1, 0) and (0, 1), where $|f'(x)| \le 2$
(B) There is at least one point in each of the intervals (–1, 0) and (0, 1), where $F(x) \le 5$
(C) There is no point of local maxima of $F(x)$ in (–1, 1)
(D) For some $c \in (-1, 1)$, $F(c) \ge 6$, $F'(c) = 0$ and $F''(c) \le 0$

45. If $f'(x) > f(x)$ for all $x \ge 1$ and $f(1) = 0$, then

(A) $e^x f(x)$ is a decreasing function
(B) $e^{-x} f(x)$ is an increasing function
(C) $f(x) > 0$ for all $x \in (1, \infty)$
(D) $f(x) < 0$ for all $x \in [1, \infty)$

46. If $f(0) = 0$ and $f'(x) \in (0, 1]\ \forall\ x \in [0, 1]$, then $\dfrac{\left(\int_0^1 f'(x)dx\right)^2}{\int_0^1 (f(x))^3 dx}$ cannot take values

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

47. If Δ represents the area of the acute angled triangle ABC, then

$\sqrt{a^2b^2-(2\Delta)^2} + \sqrt{b^2c^2-(2\Delta)^2} + \sqrt{c^2a^2-(2\Delta)^2} =$

(A) $a^2 + b^2 + c^2$
(B) $\dfrac{a^2+b^2+c^2}{2}$
(C) $ab\cos C + bc\cos A + ca\cos B$
(D) $ab\sin C + bc\sin A + ca\sin B$

48. Let a, b, c be distinct complex numbers with $|a| = |b| = |c| = 1$ and z_1, z_2 be the roots of the equation $az^2 + bz + c = 0$ with $|z_1| = 1$. Also, let P and Q point represents the complex numbers z_1 and z_2 is the complex plane with $\angle POQ = \theta$, where O being the origin, then

(A) $b^2 = ac$, $\theta = \dfrac{2\pi}{3}$
(B) $\theta = \dfrac{2\pi}{3}$, $PQ = \sqrt{3}$
(C) $PQ = 2\sqrt{3}$, $b^2 = ac$
(D) $\theta = \dfrac{\pi}{3}$, $b^2 = ac$

SECTION - 3

Numerical Value Type

This section contains 6 questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.

49. If $x \in [0, 4\pi]$, then the number of solutions of the equation

$$\sin^{-1}(|\log_6^2(\cos x) - 1|) + \cos^{-1}(|3\log_6^2(\cos x) - 7|) = \frac{\pi}{2}$$ is __________.

50. The area enclosed by $\left[\frac{|3x+4y|}{5}\right] + \left[\frac{|4x-3y|}{5}\right] = 3$ is (where [·] denotes the greatest integer function)

51. A and B are two square matrices such that $A^2B = BA$ and if $(AB)^{10} = A^kB^{10}$, then k is

52. The number of three digit natural number divisible by 3 in which at least one of the digit is repeated is equal to

53. A curve is given by $f(x) = \sqrt{25 - x^2}$. A line passing through the point (–6, –2) intersects the curve at exactly two points and the slope of such line is lying in [a, b), then the value of [a + b] (where [·] denotes the greatest integer function) is __________.

54. Let $\vec{\alpha}, \vec{\beta}, \vec{\gamma}$ are non-zero, non-coplanar vectors such that $\vec{\gamma} \cdot \vec{\beta} = 0$ and $\vec{\alpha} + \vec{\gamma} \times \vec{\beta} = \vec{\alpha} \times \vec{\gamma}$. If angle between $\vec{\alpha}$ and $\vec{\beta}$ lies in $\left[\frac{\pi}{6}, \frac{\pi}{4}\right]$, then arithmetic mean of $|\vec{\gamma}|^2_{\max}$ and $|\vec{\gamma}|^2_{\min}$ is equal to __________.

❒ ❒ ❒

B
CODE

Corporate Office : Aakash Tower, 8, Pusa Road, New Delhi-110005, Phone : 011-47623456

Time : 3 hrs

MOCK TEST - 3
for JEE (Advanced) - 2022
Paper - 2

MM : 198

Mock Test on Complete Syllabus

Instructions:

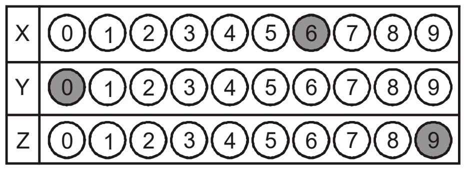
1. Read each question carefully.
2. It is mandatory to use blue/black ballpoint pen to darken the appropriate circle in the answer sheet.
3. Mark should be dark and should completely fill the circle.
4. Rough work must not be done on the answer sheet.
5. Do not use white-fluid or any other rubbing material on answer sheet.
6. Student cannot use log table and calculator or any other material in the examination hall.
7. Before attempting the question paper, student should ensure that the test paper contains all pages and no page is missing.
8. Before handing over the answer sheet to the invigilator, candidate should check that Roll No., Centre Code and Date of Birth have been filled and marked correctly.
9. Immediately after the prescribed examination time is over, the answer sheet is to be returned to the invigilator.
10. Pattern of the questions are as under:
    (i) The question paper consists of 3 parts **(Physics, Chemistry and Mathematics)**. Each part has **3 sections**.
    (ii) **Section-1:** This section contains **6** questions. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9. Each question carries **+3 marks** for correct answer and **–1 mark** for wrong answer.
    (iii) **Section-2:** This section contains **6** Multiple choice questions which have **ONE or MORE THAN ONE** correct answer(s). Each question carries **+4 marks** for correct answer and **–2 marks** for wrong answer. **+3** If all the four options are correct but **ONLY** three options are chosen. **+2** If three or more options are correct but **ONLY** two options are chosen, both of which are correct. **+1 mark** if two or more options are correct but **ONLY** one option is chosen and it is a correct option.
    (iv) **Section-3:** This section contains **6** questions. The answer to each of the questions is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places. Each question carries **+4 marks** for correct answer and there is **No negative** marking.

PART – I : PHYSICS

SECTION - 1

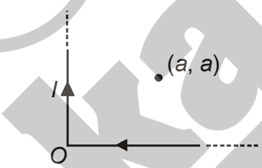
Integer Value Type

This section contains 6 questions. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9. The answer will have to be appropriately bubbled in the OMR as per the instructions as follows. **Examples-** If the correct answer to question numbers X, Y and Z (say) are 6, 0 and 9 respectively, then mark 6, 0 and 9 in OMR respectively.



1. The object is at a distance l = 45 cm from the screen. With lens in between the object and screen, we obtain a small image of the object on the screen. By moving the lens, we receive a different image on the screen, whose size is 4 times greater than the first. If focal length (in cm) of the lens is $k \times 10$, then find k.

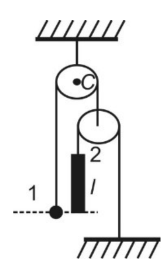
2. Two infinite long straight current carrying conductors are in L shape form as shown in figure. The common end is at origin. The value of magnetic field at a point (a, a) is $\frac{\mu_0}{4\pi}\frac{I}{a}\frac{x}{(2-\sqrt{2})}$. The value of x is



3. A uniform square plate of mass m = 100 gm and side a = 24 cm can rotate about a smooth vertical axis passing through one edge is initially at rest. A particle of mass m = 100 gm is moving horizontally and perpendicular to the plane of the plate with velocity u = 70 cm/s. It collides with the plate elastically at the centre of the plate. Find the angular velocity (in rad/s) of the plate just after collision.

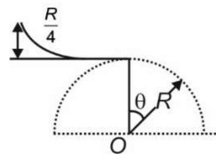
4. A reinforced concrete column consists of concrete filled with iron bars. Assume that iron occupies one-fourth of the total cross-section area of the reinforced concrete column and Young's modulus of concrete is $\frac{1}{10}$th of that of iron. The concrete column is under a compressive load P = 1300 N. Determine the load on the concrete in 10^2 N.

5. In the arrangement (shown in figure), the mass of the ball is n = 1.8 times that of rod 2. The length of the latter is l = 1 m. The masses of the pulleys and threads, as well as the friction, are negligible. The ball is set at the same level as the lower end of the rod and then released at time t = 0 s. Find the value of time t in seconds to the nearest integer, at which the ball will be opposite to the other end of the rod. (g = 10 m/s^2)



6. A skier plans to ski a smooth fixed hemisphere of radius R. He starts from rest from a curved smooth surface of height $\left(\frac{R}{4}\right)$. The angle θ with the vertical at which he leaves the hemisphere is $\cos^{-1}\left(\frac{2+x}{y}\right)$.

Find $\frac{y}{x}$ [where 2 + x, y are coprime integers].

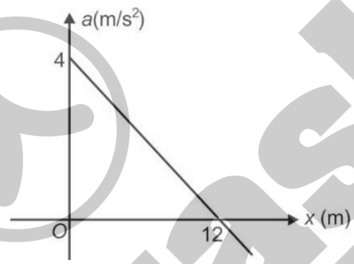


SECTION - 2

One or More Options Correct Type

This section contains 6 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) out of which **ONE OR MORE** is/are correct.

7. A particle starts from rest at x = 0 and its acceleration varies with x as shown in figure. Then



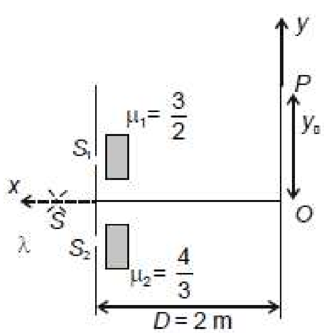
(A) Velocity at x = 6 m is 6 m/s

(B) Distance covered till the particle comes to initial position is 48 m

(C) Maximum velocity in positive x-direction is $4\sqrt{3}$ m/s

(D) Particle comes to rest at x = 12 m

8. A monochromatic source of wavelength λ = 3300 nm is placed symmetrically from slits S_1 and S_2 (S_1S_2 = 0.50 mm) as shown in a Young's double slits arrangement. Two glass plates of same thickness t = 10 μm and refractive index $\mu_1 = \frac{3}{2}$, $\mu_2 = \frac{4}{3}$ are introduced in front of S_1 and S_2. If point P is the position of central maxima on the screen, then choose the correct option(s).



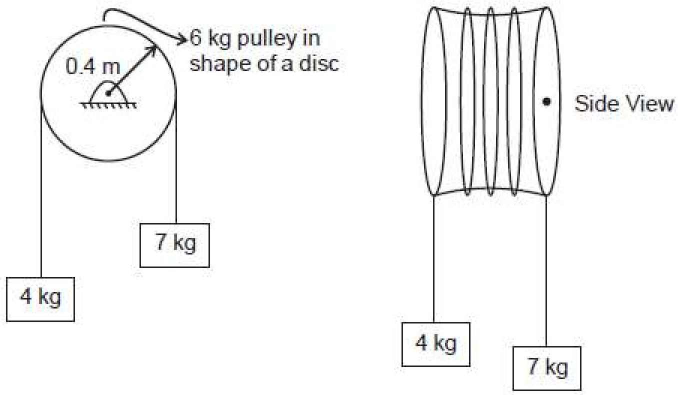
(A) Y_0 = 2.37 mm

(B) Y_0 = 6.67 mm

(C) I_o = 0, intensity at O

(D) Intensity at O is two times intensity due to single slit

9. In the figure, the massless and inextensible thread do not slip on the pulley. It is wound over pulley as shown. If the system is released from rest



(A) The tension in right side of the string is greater than that in the left side

(B) After the motion has set in kinetic energy of pulley is lesser than kinetic energy of 4 kg block

(C) The force exerted by the hinge on pulley is less than 17 g

(D) If 7 kg block suddenly strikes the ground and stops, the string on left hand side will remain taut

10. A small circular coil of radius 'r' and number of turns 'n' is placed at the centre of another big fixed circular coil of radius 'R' and number of turns N. Initially the planes of two coils are transverse to each other. If equal current I flows through each coil, then

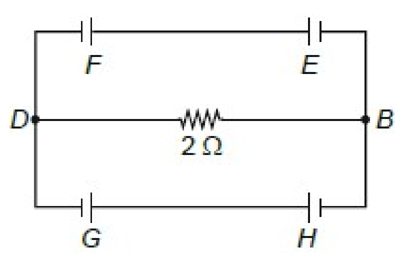
(A) The torque required to hold the smaller coil in such position is $\tau = \dfrac{\mu_0 \pi r^2 nNI^2}{2R}$

(B) The torque required to hold the smaller coil in such position is $\tau = \dfrac{\mu_0 \pi r^2 nNI^2}{4R}$

(C) The magnitude of work done by external agent in slowly rotating the smaller coil by 90° about common diameter is $\Delta W = \dfrac{\mu_0 \pi r^2 nNI^2}{4R}$

(D) The magnitude of work done by external agent in slowly turning the smaller coil 90° about common diameter is $\Delta W = \dfrac{\mu_0 \pi r^2 nNI^2}{2R}$

11. In the circuit shown E, F, G and H are cells of emf 4 V, 1 V, 5 V and 2 V respectively and their internal resistances are 4 Ω, 1 Ω, 5 Ω and 2 Ω respectively



(A) The direction of current in resistor 2 Ω is from B to D

(B) The direction of current in resistor 2 Ω is from D to B

(C) $V_G = \dfrac{160}{59}$ (potential difference across G)

(D) $V_H = \dfrac{172}{59}$ (potential difference across H)

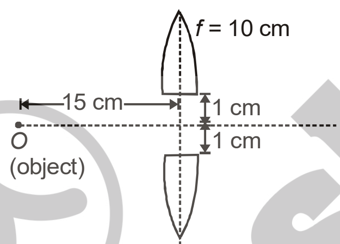
12. A positively charged conducting ball *B* is placed inside a cavity of a positively charged conductor *A*. *A* and *B* are isolated from each other. If the charges on *A* and *B* be *Q* and *q* ($Q > q$) respectively, then
    (A) The charge on the outer surface of conductor *A* is $Q + q$
    (B) Potential of *B* is equal to the potential of *A*
    (C) When *B* touches the surface of *A* then potential of *A* and *B* become equal
    (D) No charge is left on *B* when it touches the surface of *A*

SECTION - 3

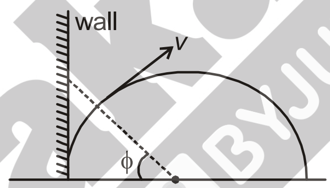
Numerical Value Type

This section contains 6 questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.

13. A point object is placed as shown. The two pieces are of same lens of focal length 10 cm. Find the distance (in cm) between the images formed.



14. A particle moving on a circular path with a constant speed *v*. Light is thrown from a projectors placed at the centre of the circular path. The shadow of the particle is formed on the wall. At the instant shown in figure if $\phi = 60^\circ$, then what is the ratio of the speed of shadow up the wall to the speed of particle



15. A star having 10^{50} deuterons, produces energy via process

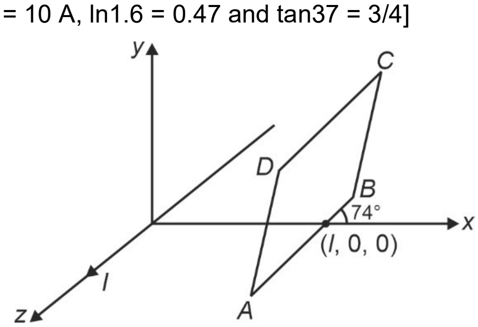
    $3\,{}_1H^2 \longrightarrow {}_2He^4 + n + p$

    Average power radiated by the star is 10^{10} W. If deuteron supply of the star is exhausted in a time 1.3×10^N s, then value of *N* is

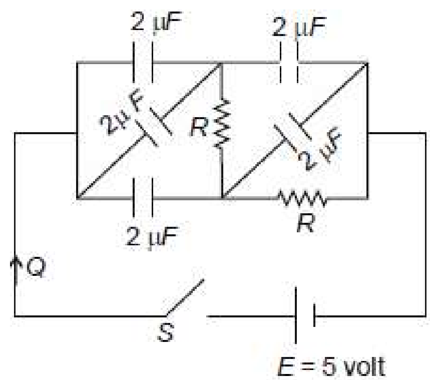
    Given, $M({}_1H^2) = 2.014$ amu, $M(n) = 1.008$ amu

    $M(p) = 1.007$ amu, $M(He^4) = 4.001$ amu

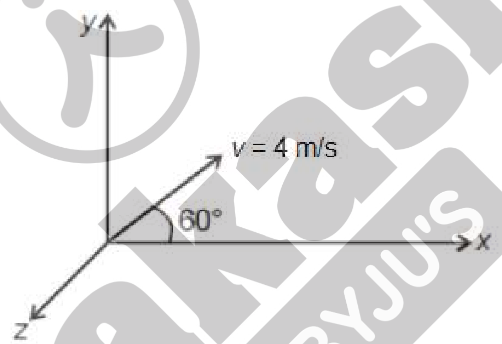
16. A wire of infinite length carrying current *I* has along the *z*-axis. A square loop of side ℓ is placed such that the plane of the loop makes an angle 74° with the positive x-axis at $(\ell, 0, 0)$ and side *AB* touches the *x*-axis and parallel to *z*-axis as shown in the figure. The magnetic flux passing through the loops is $\dfrac{k\mu_0\ell}{\pi}$. Find the value of *k*. [Given $I = 10$ A, ln1.6 = 0.47 and tan37 = 3/4]



17. Value of charge (Q) flown through the battery long time (interval) after the switch S is closed is ______ μC.



18. A positively charged particle $\left(\text{specific charge } \dfrac{q}{m} = 1\right)$ is projected in xy plane with speed 4 m/s in a gravity free space having uniform electric field $\vec{E} = -E_0\hat{j}$. Uniform magnetic field $\vec{B} = B_0\hat{j}$ is also switched on in the space at t = 0 when speed of charged particle is minimum. During motion of charged particle if $\dfrac{k}{B_0}$ is maximum possible z-coordinate of the particle, then value of k is



PART – II : CHEMISTRY

SECTION - 1

Integer Value Type

This section contains 6 questions. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9. The answer will have to be appropriately bubbled in the OMR as per the instructions as follows. **Examples-** If the correct answer to question numbers X, Y and Z (say) are 6, 0 and 9 respectively, then mark 6, 0 and 9 in OMR respectively.

X	0	1	2	3	4	5	**6**	7	8	9
Y	**0**	1	2	3	4	5	6	7	8	9
Z	0	1	2	3	4	5	6	7	8	**9**

19. A drop of solution (volume 0.05 mL) contains 3 × 10^{-6} mole H^+ ion. If the rate of disappearance of the H^+ ion is 1 × 10^{7} mol L^{-1} s^{-1}, it would take 6 × $10^{-\mathbf{z}}$ sec for H^+ ion in the drop of disappear. What is value of **z**?

20. A solution of 1.72 g of A in 100 cc of water is found to be isotonic with a 3.42% (wt./vol.) solution of sucrose ($C_{12}H_{22}O_{11}$). Molecular weight of A is x, find the value of $\dfrac{x+8}{20}$.

(Molar mass of $C_{12}H_{22}O_{11}$ = 342 g/mol)

21. The analysis of an organic compound gave the following results.
   (i) 0.402 g gave 0.6098 and 0.208 g of CO_2 and H_2O respectively.
   (ii) 1.01 g by Kjeldahl method gave NH_3 which was exactly neutralized by 23.2 ml of 0.5 M HCl (aqueous tension at 15°C = 16 mm)
   (iii) 0.1033 g of the compound gave 0.2772 g of $BaSO_4$.
   Empirical formula of compound is $C_xH_yN_zS_w$. Find the value of (x + y + z – w).

22. What are the number of geometrical isomers of $[Co(NH_3)_3(NO_2)_3]$?

23. $CH_3-CH=CH-CH_3 \xrightarrow[\text{(2) } OH^-/\Delta]{\text{(1) } O_3/Zn} X$ (major product)

   If the molar mass (g/mol) of major product X is t, then the value of $\frac{t}{9}$ is

24. A mixture consisting of CO(g) and CO_2(g) exerts a pressure of 1 atmosphere at 30°C. Enough O_2 is added to double the pressure. Subsequent passage of a spark results in a pressure to increase to 2.70 atmosphere and temperature increases to 177°C as CO(g) converts to CO_2(g). Assuming ideal behaviour, if the percent of the original mole was CO is X, then the value of $\frac{X}{10}$ is

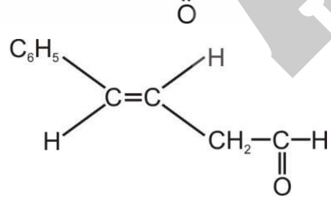
SECTION - 2

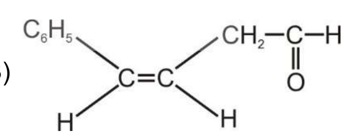
One or More Options Correct Type

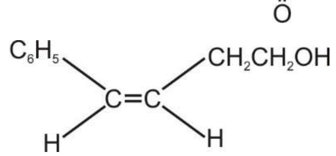
This section contains 6 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) out of which **ONE OR MORE** is/are correct.

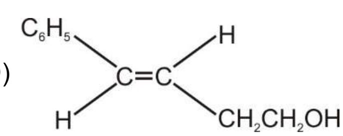
25. An aliphatic nitro compound turns red with the addition of excess $NaNO_2$ solution and then dil. H_2SO_4, followed by the addition of conc. NaOH. The colour disappears with the addition of excess of acid but reappears if the solution is made alkaline. The aliphatic nitro compound is/are
   (A) $CH_3-CH_2-NO_2$
   (B) $(CH_3)_2CHNO_2$
   (C) $CH_3-CH(CH_3)-CH_2(NO_2)$
   (D) $(CH_3)_3CNO_2$

26. $C_6H_5-C\equiv C-CH_2-\underset{\underset{O}{\|}}{C}-Cl \xrightarrow[\text{Lindlar's catalyst}]{H_2\text{ (2 eq)}} X$, the product X is/are

   (A) 

   (B) 

   (C) 

   (D) 

27. Which of the following is correct about Insulin?
   (A) Contains 51 amino acids
   (B) It is a protein hormone
   (C) It regulates glucose level in the blood
   (D) It is a globular protein

28. On the basis of structure of graphite, which of the following is(are) true for it?
   (A) It is diamagnetic substance
   (B) It behaves like metallic as well as semiconductor
   (C) C—C bond length in it is more than the diamond
   (D) It is thermodynamically more stable as well as more dense than diamond

29. Which of the following statements regarding hydrogen peroxide is(are) incorrect?
   (A) The two hydroxyl groups in hydrogen peroxide lie in the same plane
   (B) Aqueous solution of H_2O_2 turns blue litmus red
   (C) When H_2O_2 behaves as a reducing agent, the O—O bond in its molecules is not broken down
   (D) Aqueous solution of H_2O_2, is stored in plastic bottles and some urea, phosphoric acid or glycerol is added to that solution

30. Which of the following cell has highest cell potential at 25°C?
   Given,
   $(K_{sp})_{AgCl} = 10^{-10}$, $(K_{sp})_{Cu(OH)2} = 10^{-20}$, $(pK_a)_{CH3COOH} = 5$, $(pK_a)_{HCN} = 10$, $(K_{a_1})_{H_3PO_4} = 10^{-3}$, $(K_{a_2})_{H_3PO_4} = 10^{-8}$, $(K_{a_3})_{H_3PO_4} = 10^{-12}$, $E^o_{Ag^+/Ag} = 0.8\text{ V}$, $E^o_{Cu^{2+}/Cu} = 0.34\text{ V}$

   (A) $Ag \mid AgCl(s) \mid \underset{(0.1\text{ M})}{Cl^-} \parallel \underset{(10^{-3}M)}{Ag^+(aq)} \mid Ag(s)$

   (B) $Pt \mid \underset{(1\text{ atm})}{H_2(g)} \Big| Solution\Big(\underset{0.1\text{ M}}{Na_2HPO_4} + \underset{0.1\text{ M}}{Na_3PO_4}\Big) \Big\| \underset{(10^{-2}M)}{Ag^+(aq)} \Big| Ag(s)$

   (C) $Pt \mid \underset{1\text{ atm}}{H_2(g)} \Big| \underset{0.1\text{ M}}{CH_3COOH(aq)} \Big\| \underset{0.01\text{ M}}{HCN(aq)} \Big| \underset{(1\text{ atm})}{H_2(g)} \mid Pt$

   (D) $Cu(s) \mid Cu(OH)_2(s) \Big| \underset{(0.1\text{ M})}{O\bar{H}(aq)} \Big\| \underset{(0.1\text{ M})}{H^+(aq)} \Big| \underset{(1\text{ atm})}{H_2(g)} \mid Pt$

SECTION - 3

Numerical Value Type

This section contains 6 questions. The answer to each question is a **NUMERICAL VALUE**. For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.

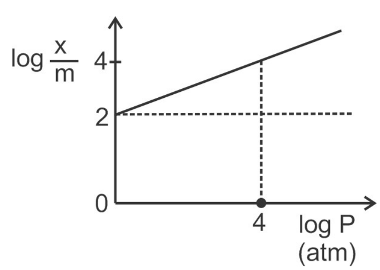
31. 50 ml of a basic solution containing 2 g of NaOH, 2.1 g of Na_2CO_3 and 2 g of $NaHCO_3$ is titrated with standard HCl (1 N) in presence of only phenolphthalein as indicator, from the very beginning then volume of HCl (in mL) used till end point will be nearly _____. (Report your answer in the nearest whole number)

32. 10 ml of a blood sample (contains calcium oxalate) is dissolved in acid. It required 20 ml of 0.001 M $KMnO_4$ (Which oxidises oxalate to carbon dioxide). What is the amount of Ca^{++} ion in mg in 10 ml blood?

33. 1.8 g of ionic solid (that has CsCl type structure and completely dissociated in water) is present in 1 L aqueous solution and osmotic pressure of this solution is 4.92 atm at 300 K. The density of ionic solid is 30 g/cm^3 with edge length a nm. The value of 100a is

$$\left(R = 0.082\,\frac{\text{L atm}}{\text{mol K}},\ N_A = 6\times10^{23}\right)$$

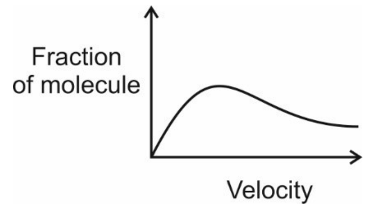
34. A 2 g uniform piece of Pt is used to adsorb H_2 gas. Adsorption follows the Freundlich adsorption isotherm and graph is given as



The total mass of H_2 gas (in g) that is adsorbed on given Pt piece when pressure is 4 atm is M. The value of $\frac{M}{5}$ is

35. White phosphorus reacts with thionyl chloride and form compounds A, B and C. Chlorine is present in compounds A and B while sulphur is present in compounds B and C. If percentage by mass of sulphur is more in C than B, the total number of lone pair of electrons in one molecule of 'A' is

36. If the velocity of gas (A), having molecular weight (90), corresponding to the maxima of given velocity graph at a given temperature is 300 m/s. Then find value (to nearest integer) of kinetic energy (in kilojoule) of 360 gram of gas "A".

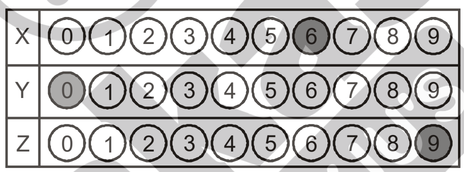


PART – III : MATHEMATICS

SECTION - 1

Integer Value Type

This section contains 6 questions. The answer to each of the questions is a **single-digit integer**, ranging from 0 to 9. The answer will have to be appropriately bubbled in the OMR as per the instructions as follows. **Examples-** If the correct answer to question numbers X, Y and Z (say) are 6, 0 and 9 respectively, then mark 6, 0 and 9 in OMR respectively.



37. Let $1+\sum_{r=1}^{10}(3^r\cdot {}^{10}C_r + r\cdot {}^{10}C_r) = 2^{10}(\alpha\cdot 4^5+\beta)$, where $\alpha, \beta \in N$ and $f(x) = x^2 - 2x - k^2 + 1$. If α, β lies between the roots of $f(x) = 0$, then find the smallest positive integral value of k.

38. The line $3x + 6y = k$ intersect the curve $2x^2 + 2xy + 3y^2 = 1$ at points A and B. The circle on AB as diameter passes through the origin. The sum of all possible values of k is equal to

39. Given three non-zero, non-coplanar vectors $\vec{a}, \vec{b}, \vec{c}$ and $\vec{r}_1 = p\vec{a} + q\vec{b} + \vec{c}$ and $\vec{r}_2 = \vec{a} + p\vec{b} + q\vec{c}$ if the vectors $\vec{r}_1 + 2\vec{r}_2$ and $2\vec{r}_1 + \vec{r}_2$ are collinear, then $(p + q)$ is equal to

40. If $\vec{a}, \vec{b}$ and $\vec{c}$ are non-zero vectors, then the value of the scalar $((\vec{a}\times\vec{b})\times\vec{a})\cdot((\vec{b}\times\vec{a})\times\vec{b}) = \lambda\cdot(\vec{a}\cdot\vec{b})|\vec{a}\times\vec{b}|^2$, then value of λ^2 is equal to

41. If sum of first n terms of an A.P. (having positive terms) is given by $S_n = (1 + 2T_n)(1 - T_n)$, where T_n is the n^{th} term of series, then $T_2^2 = \frac{\sqrt{a}-\sqrt{b}}{4}$ $(a, b \in N)$. Find the value of $(a + b)$.

42. A particle moving around the circle $S : x^2 + y^2 - 2x - 4y - 20 = 0$ in anti-clockwise direction leaves it tangentially at the point $P(-2, -2)$. After getting reflected from a straight line L, it passes through the centre of the circle. If perpendicular distance of L from P is $\frac{5}{2}$ and its equation is $(4\sqrt{3}-a)x-(b+3\sqrt{3})y-(c-2\sqrt{3})=0$, then find the value of $\frac{c}{a^2+b}$.

SECTION - 2

One or More Options Correct Type

This section contains 6 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D) out of which **ONE OR MORE** is/are correct.

43. Let a, b, c be unequal real numbers. If a, b, c are in G.P. and $a + b + c = bx$, then x cannot be equal to

(A) – 1 (B) 0

(C) 2 (D) 3

44. Let all the letters of the word 'MATHEMATICS' are arranged in all possible order. Three events A, B and C are defined as

A : Both M are together.

B : Both T are together.

C : Both A are together.

Which of the following hold(s) good?

(A) $P(A) = P(B) = \dfrac{2}{11}$ (B) $P(A \cap B) = P(B \cap C) = P(C \cap A) = \dfrac{2}{55}$

(C) $P(A \cap B \cap C) = \dfrac{4}{495}$ (D) $P((A \cap \bar{B}) / \bar{C}) = \dfrac{58}{405}$

45. TP and TQ are tangents to parabola $y^2 = 4x$ and normals at P and Q intersect at a point R on the curve. The locus of the centre of the circle circumscribing ΔTPQ is a parabola whose

(A) Vertex is (1, 0) (B) Foot of directrix is $\left(\dfrac{7}{8}, 0\right)$

(C) Length of latus rectum is $\dfrac{1}{4}$ (D) Focus is $\left(\dfrac{9}{8}, 0\right)$

46. Circles are drawn on chords of rectangular hyperbola $xy = c^2$ parallel to the line $y = x$ as diameters. All such circles pass through two fixed points whose co-ordinates are

(A) (c, c) (B) $(c, -c)$

(C) $(-c, c)$ (D) $(-c, -c)$

47. Let $f(x) = \begin{cases} \dfrac{x}{\tan x}, & -\infty < x < 0 \\ 2, & x = 0 \\ \dfrac{\ln(1+2x)}{x}, & 0 < x < \infty \end{cases}$ and $g(x) = \begin{cases} x+4, & -\infty < x < 1 \\ x^2 - 5x + 11, & 1 \le x < 2 \\ x - 3, & 2 \le x < \infty \end{cases}$, then which of the following is(are) correct?

(A) $\lim\limits_{x \to 0^-} g(f(x)) = 5$ (B) $\lim\limits_{x \to 0^-} g(f(x)) = 7$

(C) $\lim\limits_{x \to 0^+} g(f(x)) = 5$ (D) $\lim\limits_{x \to 0^+} g(f(x)) = -1$

48. If $\begin{vmatrix} x^2 + x & x+1 & x-2 \\ 2x^2 + 3x - 1 & 3x & 3x-3 \\ x^2 + 2x + 3 & 2x-1 & 2x-1 \end{vmatrix} = xA + B$, where A and B are numerical values not involving x. Then which of the following may be correct about A and B?

(A) $A = \begin{vmatrix} 2 & 3 & 1 \\ 2 & 3 & 3 \\ 4 & 0 & 2 \end{vmatrix}$ (B) $B = \begin{vmatrix} 2 & 3 & -2 \\ 2 & 3 & -3 \\ 4 & 0 & -1 \end{vmatrix}$

(C) $A \cdot B = 288$ (D) $\left|\dfrac{A}{B}\right| = 2$

SECTION - 3

Numerical Value Type

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49. If *a*, *b*, *c* are positive real numbers such that $a^{\log_3 7} = 27$; $b^{\log_7 11} = 49$ and $c^{\log_{11} 25} = \sqrt{11}$. The value of $(a^{(\log_3 7)^2} + b^{(\log_7 11)^2} + c^{(\log_{11} 25)^2})$ equals

50. Let the product of the sines of the angles of a triangle is $\frac{2}{3}$ and the product of their cosines is $\frac{1}{9}$. If tan*A*, tan*B* and tan*C* are the roots of the cubic, find the sum of the products of the roots taken two at a time.

51. A curve is defined parametrically by the equations $x = at^2$ and $y = at^3$. A variable pair of perpendicular lines through the origin *O* meet the curve at *P* and *Q*. If the locus of the point of intersection of the tangents at *P* and *Q* is $ay^2 = bx - 1$, then find the value of $(a + b)$.

52. Let $F(x)$ be a non-negative continuous function defined on *R* such that $F(x) + F\left(x + \frac{1}{2}\right) = 3$. Find the value of $\int_0^{1500} F(x)\,dx$.

53. Consider the two curves $y = \frac{1}{x^2}$ and $y = \frac{1}{4(x-1)}$. Let *k* be the value of *a* ($a > 2$) for which the reciprocal of the area of the figure bounded by the curves, the lines $x = 2$ and $x = a$ equal to *a* itself and *m* be the value of *b* ($1 < b < 2$) for which the area of the figure bounded by these curves, the lines $x = b$ and $x = 2$ equal to $1 - 1/b$. The value of $\ln\left(\frac{k}{m}\right)$ is equal to

54. Find sum of all possible integral value(s) of *p* for which the equation $\left|x + \frac{1}{x} - 3\right| = p - 3$ has exactly two distinct solutions.

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