ADVANCED PATTERN CUMULATIVE TEST-1 (ACT-1)

TARGET : JEE (MAIN+ADVANCED) 2017

PAPER-2   COURSE : VIJETA (ADP), VIJAY (ADR)   **Revision Plan-2**

Date : 30-04-2017   **Time: 3 Hours**   **Maximum Marks : 207**

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

GENERAL :

1. The sealed booklet is your Question Paper. Do not break the seal till you are instructed to do so.
2. The question paper CODE is printed on the right hand top corner of this sheet.
3. Use the Optical Response Sheet (ORS) provided separately for answering the question.
4. Blank spaces are provided within this booklet for rough work.
5. Write your Name and Roll Number in the space provided on the below cover.
6. After the open booklet, verify that the booklet contains all the **51** questions along with the options are legible.

QUESTION PAPER FORMAT AND MARKING SCHEME :

7. The question paper has three parts : **Mathematics, Physics and Chemistry.** Each part has **three** sections.
8. Each section as detailed in the following table :

Section	Question Type	Number of Questions	Category-wise Marks for Each Question				Maximum Marks of the Section
			Full Marks	**Partial Marks**	**Zero Marks**	**Negative Marks**	
1	Single Correct Option	7	+3 If only the bubble corresponding to the correct option is darkened	–	0 If none of the bubbles is darkened	–2 In all other cases	21
2	Comprehension (One or More Correct Option(s))	8	+4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened	–	0 If none of the bubbles is darkened	–1 In all other cases	32
3	Match the Column	2	For each entry in Column-I +2 If only the bubble(s) corresponding to all the correct match(es) is(are) darkened	–	0 if not attempted	–	16

OPTICAL RESPONSE SHEET :

9. Darken the appropriate bubbles on the original by applying sufficient pressure.
10. The original is machine-gradable and will be collected by the invigilator at the end of the examination.
11. Do not tamper with or mutilate the ORS.
12. Write your name, roll number and the name of the examination centre and sign with pen in the space provided for this purpose on the original. **Do not write any of these details anywhere else**. Darken the appropriate bubble under each digit of your roll number.

DARKENING THE BUBBLES ON THE ORS :

13. Use a **BLACK BALL POINT** to darken the bubbles in the upper sheet.
14. Darken the bubble **COMPLETELY.**
15. Darken the bubble **ONLY** if you are sure of the answer.
16. The correct way of darkening a bubble is as shown here : ●
17. There is **NO** way to erase or "un-darkened bubble.
18. The marking scheme given at the beginning of each section gives details of how darkened and **not darkened** bubbles are evaluated.

NAME OF THE CANDIDATE : ………………………………………………………………..………………………

ROLL NO. : ………………………......………………………

I have read all the instructions   I have verified the identity, name and roll number
   and shall abide by them   of the candidate.

-             -
    Signature of the Candidate   Signature of the Invigilator

PART : I MATHEMATICS

SECTION – 1 : (Maximum Marks : 21)

Ñ   This section contains **SEVEN** questions

Ñ   Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four option is correct

Ñ   For each question, darken the bubble corresponding to the correct option in the ORS

Ñ   Marking scheme :

    +3 If only the bubble corresponding to the correct option is darkened

     0 If none of the bubble is darkened

    –2 In all other cases

1. If $x^4 f(x) - \sqrt{1 - \sin(2\pi x)} = |f(x)| - 2f(x)$ then f(–2) is equal to

(A) $\dfrac{1}{17}$ (B) $\dfrac{1}{11}$ (C) $\dfrac{1}{2}$ (D) 0

2. If function f : R → R satisfies the condition $\dfrac{f(2x + 2y) - f(2x - 2y)}{f(2x + 2y) + f(2x - 2y)} = \dfrac{\cos x \sin y}{\sin x \cos y}$ and $f'(0) = \dfrac{1}{2}$, then

(A) f″(x) – f(x) = 0   (B) 4f″(x) + f′(x) = 0

(C) 4f″(x) + f(x) = 0   (D) f″(x) + f(x) = 0

3. $\displaystyle\lim_{n\to\infty} \dfrac{n}{3}\left\{ \left(\dfrac{3}{n} + \dfrac{9}{n^2}\right)^2 + \left(\dfrac{3}{n} + \dfrac{18}{n^2}\right)^2 + \left(\dfrac{3}{n} + \dfrac{27}{n^2}\right)^2 \cdots + \left(\dfrac{3}{n} + \dfrac{9}{n}\right)^2 \right\}$ is equal to:

(A) $\dfrac{64}{3}$ (B) 63   (C) 189   (D) 21

Space for Rough Work

4. $\lim\limits_{n\to\infty}\sum\limits_{r=1}^{n}\dfrac{r}{1\times3\times5\times7\times9\times.......\times(2r+1)}$ is equal to

(A) $\dfrac{1}{3}$ (B) $\dfrac{3}{2}$ (C) $\dfrac{1}{2}$ (D) none of these

5. If f(x) is differentiable function such that $2f(x + y) + f(x - y) + 3y^2 = 3f(x) - 2xy$, then $\lim\limits_{x\to1}\dfrac{f(x)+1}{x-1}=\ell$

(where ℓ is a finite number). The value of ℓ is

(A) – 3   (B) 0   (C) –2   (D) 1

6. For all real value of a and b lines (2a + b)x + (a + 3b)y + b − 3a = 0 and mx + 2y + 6 = 0 are concurrent then sum of all value of |m| is equal to

(A) 0   (B) 1   (C) 2   (D) 3

7. The value of $\lim\limits_{x\to0^+}\left(\ell n\sin^3 x - \ell n(x^4 + ex^3)\right) =$

(A) 0   (B) 1   (C) –1   (D) does not exist
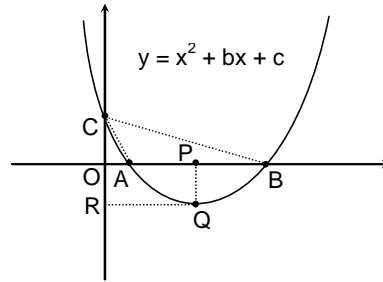
Space for Rough Work

SECTION – 2 : (Maximum Marks : 32)

Ñ   This section contains **FOUR** paragraphs
Ñ   Based on each paragraph, there will be **TWO** questions.
Ñ1   Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct 1
Ñ   Marking scheme :
     +4 If only the bubble corresponding to the correct option is darkened
      0 If none of the bubble is darkened
     −1 In all other cases

Paragraph for Question Nos. 8 to 9

In the given figure $y = x^2 + bx + c$ is a quadratic polynomial which meets x-axis at A and B and y-axis at C. Q is vertex of quadratic polynomial and foot of perpendicular from Q to x-axis and y-axis are P and R respectively. Then answer the following questions.

8. If $\dfrac{\text{Area of } \Delta ABC}{\text{Area of rectangle } OPQR} = \dfrac{8}{3}$ Satisfies the relation $b^2 = kc$ then k will lie in interval

    (A) $(0, \pi)$ (B) $(e, 2e)$ (C) $(2, 4)$ (D) $(3, 5)$

9. If two circles passing through A and B touches y-axis at C and R respectively then b^2 is divisible by
    (A) 2   (B) 3   (C) 4   (D) 6

Space for Rough Work

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Paragraph for Question Nos. 10 to 11

Every real number x can be expressed as $x = \{x\} + [x]$ where [.] represents GIF and {.} represent fractional part of x

10. Number of solutions of equation $5x + 20\{x\} - 3[x] = 7$ are

(A) 12   (B) 10   (C) 9   (D) 13

11. If S_1 is solution of inequality $[3x] + [x] < 2 + 3x$ and S_2 is the solution of $[x]^2 + [x] - 6 = 0$ then compete set of values of $S_1 \cap S_2$ is

(A) $(-\infty, 2)$ (B) $(-3, -2] \cup [2, 3)$

(C) $[-3, -2) \cup (2, 3)$ (D) $[-3, -2) \cup (2, 3) - \left\{\dfrac{7}{3}, \dfrac{8}{3}\right\}$

Space for Rough Work

Paragraph for Question No. 12 to 13

Consider a function $f(x) = \dfrac{3x + a}{x^2 + 3}$ which has greatest value equal to $\dfrac{3}{2}$.

12. The value of the constant number a is equal to
    (A) 1   (B) 2   (C) 3   (D) 4

13. The minimum value of f(x) is equal to
    (A) $\tan\left(\dfrac{-\pi}{3}\right)$ (B) $\sin\left(\dfrac{-\pi}{6}\right)$ (C) $\cos\left(\dfrac{-\pi}{3}\right)$ (D) $\cot\left(\dfrac{\pi}{2}\right)$

Paragraph for Question No. 14 to 15

Given four points A(2, 1, 0) ; B(1, 0, 1) ; C(3, 0, 1) and D(0, 0, 2).

The point D lies on a line L orthogonal to the plane determined by the point A, B and C.

14. Equation of the plane ABC is

    (A) x + y + z − 3 = 0   (B) y + z − 1 = 0   (C) x + z − 1 = 0   (D) 2y + z − 1 = 0

15. Equation of the line L is

    (A) $\vec{r} = 2\hat{k} + \lambda(\hat{i} + \hat{k})$ (B) $\vec{r} = 2\hat{k} + \lambda(2\hat{j} + \hat{k})$ (C) $\vec{r} = 2\hat{k} + \lambda(\hat{j} + \hat{k})$ (D) none of these

Space for Rough Work

SECTION – 3 : (Maximum Marks : 16)

Ñ   This section contains **TWO** questions

Ñ   Each question contains two columns, **Column I** and **Column II**

Ñ   **Column I** has **four** entries (A),(B), (C) and (D)

Ñ   **Column II** has **four** entries (P),(Q), (R) and (S)

Ñ   Match the entries in **Column I** with the entries in **Column II**

Ñ   One or more entries in **Column I** may match with one or more entries in **Column II**

Ñ   The ORS contains a 4 × 4 matrix whose layout will be similar to the one shown below :

     (A)   (P) (Q) (R) (S)
     (B)   (P) (Q) (R) (S)
     (C)   (P) (Q) (R) (S)
     (D)   (P) (Q) (R) (S)

Ñ1   For each entry in **Column I**, darken the bubbles of all the matching entries. For example, if entry (A) in **Column I**1matches with entries (P), (Q) and (R), then darken these three bubbles in the ORS. Similarly, for entries (B), (C) and (D).1

Ñ   Marking scheme :

<u>For each entry in **Column I**</u>

+2 If only the bubble(s) corresponding to all the correct match(es) is (are) darkened

  0 If none of the bubbles is darkened

  0 In all other cases

Space for Rough Work

16. **Column – I**   **Column - II**

(A)   If $f(x) = \sqrt[4]{4^x + 8^{\frac{2}{3}(x-1)} - 72 - 4^{x-\frac{3}{2}}}$ is defined, then x can be   (P)   0

(B)   The least positive integral value of 'x' satisfying $(e^x - 2)$ (Q)   3

        $\left(\sin\left(x + \dfrac{\pi}{4} \right) \right)(x - \log_2 2)(\sin x - \cos x) < 0$ is

(C)   The number of integral values of m for which f : R $\to$ R ;   (R)   6

        $f(x) = \dfrac{x^3}{3} + (m-1)x^2 + (m+5)x + n$ is bijective is

(D)   The number of roots of equation   (S)   7

        $\left(\dfrac{(x-1)(x-3)}{(x-2)(x-4)} - e^x \right)\left(\dfrac{(x+1)(x+3)}{(x+2)(x+4)} - e^{-x} \right)\left(x^3 - \cos x \right) = 0$

Space for Rough Work

17.   **Column – I**   **Column-II**

(A)   In a $\triangle ABC$ the line joining circumcentre and incentre   (P)   1

is parallel to side AB then the value of $2\left(\cos^2\dfrac{A}{2} + \cos^2\dfrac{B}{2}\right)$

(B)   In a $\triangle ABC$ if the line joining orthocentre and circumcentre   (Q)   2

is parallel to the side CA then the value of $\dfrac{2}{3}\tan A \tan C$ is

(C)   In a $\triangle ABC$ if the medians AD and BE are perpendicular then   (R)   4

the value of $\dfrac{a^2 + b^2 + c^2}{6c^2}$ is

(D)   In a $\triangle ABC$ the maximum value of $\dfrac{8r}{R}$ is   (S)   3

Space for Rough Work

SECTION – 1 : (Maximum Marks : 21)

Ñ   This section contains **SEVEN** questions
Ñ   Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four option is correct
Ñ   For each question, darken the bubble corresponding to the correct option in the ORS
Ñ   Marking scheme :
     +3 If only the bubble corresponding to the correct option is darkened
      0 If none of the bubble is darkened
     −2 In all other cases

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18.   A uniform disc of mass m and radius R, hinged at some point is performing pure rotation with respect to hinge, in horizontal plane with a constant angular velocity ω. At certain instant center of the disc is at origin in the mentioned co-ordinate system and velocity of particle A is

$\vec{V}_A = > \frac{\omega R}{4}\left(3\hat{i} - 4\hat{j}\right)$ m/s. Kinetic energy of the disc is –

(A) $\dfrac{mR^2\omega^2}{2}$ (B) $\dfrac{17mR^2\omega^2}{4}$ (C) $\dfrac{17mR^2\omega^2}{32}$ (D) $\dfrac{7mR^2\omega^2}{32}$

Space for Rough Work

19. A ball of mass m is connected by a light inextensible cord and is rotated in a circle of radius R on a smooth fixed horizontal table. Initially the angular velocity of the ball was ω_0 and pulling force applied was T_1. Now the pulling force is increased to T_2, until the radius of rotation of the ball becomes $\dfrac{R}{4}$. Then ratio $\dfrac{T_2}{T_1}$ is :
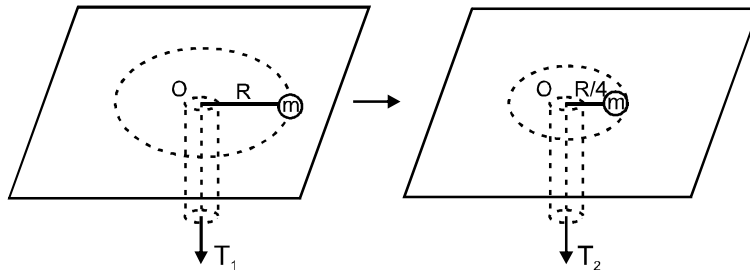

(A) $\dfrac{1}{4}$ (B) 4   (C) 16   (D) 64

20. There exist a uniform magnetic field $\vec{B} = 10T\hat{k}$ in space. A point charge (specific charge $\dfrac{q}{m} = 1\,C/kg$ is projected from (–5 m, 0, 0) with velocity $\sqrt{3}v\hat{i} + v\hat{j}$. The value of 'v' for which the charge particle will pass through origin.

(A) 5m/s   (B) 10m/s   (C) 15m/s   (D) 25m/s

Space for Rough Work

21. On a cart of mass 3 m, two blocks A and B, each of mass m are placed as shown. Upper surface of the cart is smooth, but the vertical surface is rough having friction coefficient $\mu = 0.5$. The cart is pulled with a constant force F. What should be the value of F so that neither static, nor kinetic friction acts on block A.
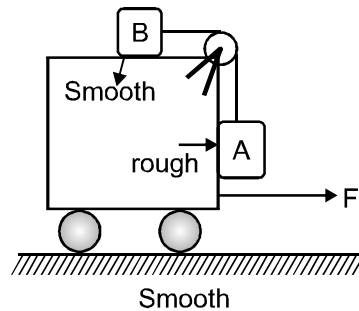

(A) 5 mg   (B) $\dfrac{5}{2}$ mg   (C) 7 mg   (D) 10 mg

22. A graph between the square of speed of a particle moving along a straight line and the distance 'S' moved is shown in the figure. The acceleration of the particle in km/hr² is –
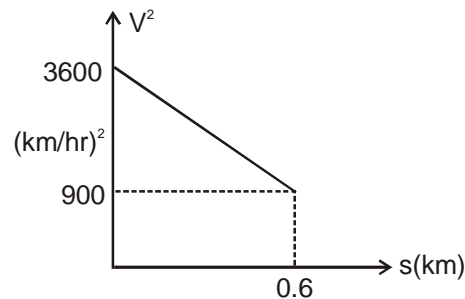
(A) 2250   (B) 225   (C) –2250   (D) –225

Space for Rough Work

23. Mass m shown in figure is in equilibrium. If it is displaced further by x and released find its acceleration just after it is released. Take pulleys to be light & smooth and strings light.
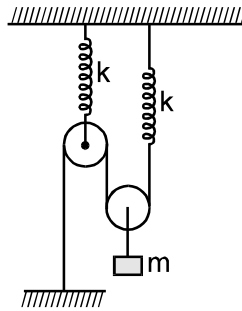
(A) $\dfrac{4kx}{5m}$ 　　　(B) $\dfrac{2kx}{5m}$ 　　　(C) $\dfrac{4kx}{m}$ 　　　(D) none of these

24. A thin converging lens L_1 forms a real image of an object located far away from the lens as shown in the figure. The image is located a distance 4ℓ and has height 'h'. A diverging lens of focal length ℓ is placed 2ℓ from lens L_1. Another converging lens of focal length 2ℓ is placed 3ℓ from lens L_1. The height of final image thus formed is (Both diverging and converging lenses are placed at right side of L_1 -
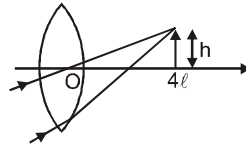

(A) h 　　　(B) $\dfrac{h}{2}$ 　　　(C) 4h 　　　(D) 2h

Space for Rough Work

SECTION – 2 : (Maximum Marks : 32)

Ñ   This section contains **FOUR** paragraphs
Ñ   Based on each paragraph, there will be **TWO** questions.
Ñ1   Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct 1
Ñ   Marking scheme :
      +4 If only the bubble corresponding to the correct option is darkened
       0 If none of the bubble is darkened
      −1 In all other cases

Paragraph for Questions 25 and 26

An ideal dipole of length ℓ and having charges A and B is released from the position shown in figure. Given that $m_A = m$, $m_B = 2m$, $q_A = + q$, $q_B = -q$ and $\vec{E}$ = uniform.
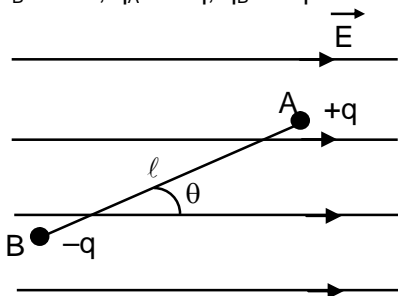
25.   For $\theta = \dfrac{\pi}{2}$, which of the following options is/are correct :

(A) Dipole will oscillate but not simple harmonically

(B) Distance travelled by particle A upto the instant when its speed is maximum is $\dfrac{\pi\ell}{4}$

(C) Initial angular acceleration of dipole is $\dfrac{3qE}{2m\ell}$

(D) maximum angular speed of dipole during the motion is $\sqrt{\dfrac{3qE}{m\ell}}$

26.   For $\theta = \theta_0$, (very small) , Which of the following options is/are correct :
(A) Maximum angular speed during the motion is independent of θ_0.
(B) Angular frequency of oscillations is independent of θ_0.

(C) Maximum speed of particle –A during the motion is $\theta_0\sqrt{\dfrac{2qE\ell}{3m}}$

(D) Maximum speed of particle –B during the motion is $\theta_0\sqrt{\dfrac{qE\ell}{6m}}$
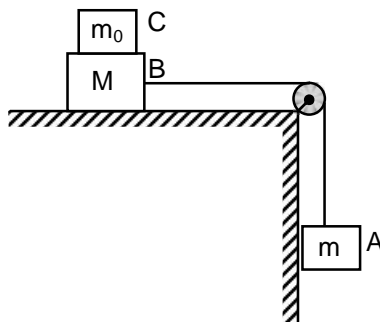
Space for Rough Work

Paragraph for Questions 27 and 28

A block B of mass M = 20 kg is placed on a horizontal surface and it is tied with an inextensible string to a block A of mass m = 10 kg. Another block C of mass m_0 = 20 kg is placed on block B and the system is released from rest as shown in figure. (string is ideal and all the contacts are smooth) (g = 10 m/s^2)

27. Which of the following options is true ?

(A) The downward acceleration of the block A is $\dfrac{10}{3}$ m/sec^2

(B) Initial acceleration of C is zero

(C) The tension in the string is $\dfrac{200}{3}$ N

(D) Initial acceleration of C is $\dfrac{10}{3}$ m/sec^2

28. If a friction force exist between block B and the horizontal surface with the coefficient of friction μ, and minimum value of μ for which the block A remains stationary is μ_{min}

(A) μ_{min} = 0.5

(B) μ_{min} = 0.25

(C) If $\mu < \mu_{min}$, then the downward acceleration of A is $\left[\dfrac{m - \sim(m_0 + M)}{m + m_0 + M}\right]g$

(D) If $\mu < \mu_{min}$, then the downward acceleration of A is $\left[\dfrac{m - \sim M}{m + m_0 + M}\right]g$

Space for Rough Work

Paragraph for Question Nos. 29 to 30

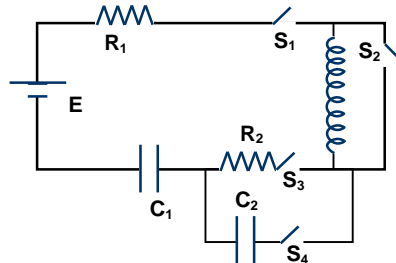With reference to the circuit shown in the figure, four events are defined as:

Event A : switch S_1 is closed

Event B: switch S_2 is closed

Event C : switch S_3 is closed

Event D: switch S_4 is closed

Assuming that one or more of these events can take place simultaneously, answer the following questions ,

29. Which of the following options is/are correct :
    (A) Voltage across capacitor C_1 immediately after (A + C) events is zero
    (B) Voltage across inductor immediately after (A + C) events is E
    (C) Long time after (A + B + C + D) events, capacitor C_2 will carry charge of C_2 E
    (D) Long time after (A + B + C + D) events, capacitor C_1 will carry charge of C_1 E

30. Voltage across inductor is zero:
    (A) after long time irrespective of any events
    (B) only when event B takes place irrespective of any other event
    (C) immediate after event (B + C + D)
    (D) only when event A does not happen

Space for Rough Work

Paragraph for Question Nos. 31 to 32

A thin uniform rod of mass M and length L is slightly disturbed from its vertical equilibrium position on smooth horizontal ground. Collision between rod and ground has coefficient of restitution 'e'.

31. Which of the following option is/are correct before collision :

(A) Work done by normal reaction on the rod before collision is zero.

(B) work done by gravity on the rod before collision is $+\dfrac{MgL}{2}$

(C) Rod will hit the ground with angular speed of $\sqrt{\dfrac{3g}{L}}$

(D) Angular impulse of normal reaction about COM before collision is $\dfrac{ML}{12}\sqrt{3gL}$

32. Which of the following option is/are correct

(A) Angular speed of rod just after collision is $e\sqrt{\dfrac{3g}{L}}$

(B) COM will rise upto height $\dfrac{e^2L}{2}$ after collision

(C) Maximum angular displacement of rod after first collision is $\sin^{-1}(e)$

(D) Maximum angular displacement of rod after n collisions is $\sin^{-1}(e^{2n})$

Space for Rough Work

SECTION – 3 : (Maximum Marks : 16)

Ñ   This section contains **TWO** questions

Ñ   Each question contains two columns, **Column I** and **Column II**

Ñ   **Column I** has **four** entries (A),(B), (C) and (D)

Ñ   **Column II** has **four** entries (P),(Q), (R) and (S)

Ñ   Match the entries in **Column I** with the entries in **Column II**

Ñ   One or more entries in **Column I** may match with one or more entries in **Column II**

Ñ   The ORS contains a 4 × 4 matrix whose layout will be similar to the one shown below :

(A)   (P) (Q) (R) (S)
(B)   (P) (Q) (R) (S)
(C)   (P) (Q) (R) (S)
(D)   (P) (Q) (R) (S)

Ñ1   For each entry in **Column I**, darken the bubbles of all the matching entries. For example, if entry (A) in **Column I**1matches with entries (P), (Q) and (R), then darken these three bubbles in the ORS. Similarly, for entries (B), (C) and (D).1

Ñ   Marking scheme :
   For each entry in **Column I**
   +2 If only the bubble(s) corresponding to all the correct match(es) is (are) darkened
    0 If none of the bubbles is darkened
    0 In all other cases

Space for Rough Work

33. A charged particle is moving in a circular path in uniform magnetic field with speed v. Match the following.

Column-I	Column-II
(A) equivalent current due to motion of charged particle,	(P) is proportional to v.
(B) Magnetic Moment	(Q) is proportional to v^2
(C) Magnetic field at centre of circle due to motion of charged particle.	(R) is proportional to v^0
(D) radius of circular path	(S) None of these.

34. A projectile is fired from a horizontal frictionless ground. Coefficient of restitution between the projectile and the ground is e. If T_1, H_1, R_1, v_1; T_2, H_2, R_2, v_2; are time flight, maximum height, range, horizontal velocities in first two collisions, then match the following.

| Column-I	Column-II
(A) T_1/T_2	(P) $1/e^2$
(B) H_1/H_2	(Q) $1/e$
(C) R_1/R_2	(R) $1/e\cos\theta$
(D) v_1/v_2	(S) 1

Space for Rough Work

PART III : CHEMISTRY

Atomic masses : [H = 1, D = 2, Li = 7, C = 12, N = 14, O = 16, F = 19, Na = 23, Mg = 24, Al = 27, Si = 28, P = 31, S = 32, Cl = 35.5, K = 39, Ca = 40, Cr = 52, Mn = 55, Fe = 56, Cu = 63.5, Zn = 65, As = 75, Br = 80, Ag = 108, I = 127, Ba = 137, Hg = 200, Pb = 207]

SECTION – 1 : (Maximum Marks : 21)

Ñ   This section contains **SEVEN** questions

Ñ   Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four option is correct

Ñ   For each question, darken the bubble corresponding to the correct option in the ORS

Ñ   Marking scheme :

+3 If only the bubble corresponding to the correct option is darkened

  0 If none of the bubble is darkened

–2 In all other cases

35.   Which of the following oxyacid is not obtained on stepwise hydrolysis of P_4O_{10}?

(A) $H_4P_2O_7$ (B) $H_4P_4O_{12}$

(C) H_3PO_4 (D) $H_4P_2O_8$
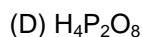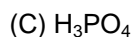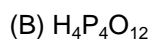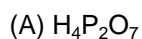
Space for Rough Work

36. Consider the cell Ag(s)|AgBr(s)|Br⁻(aq) || Cl⁻(aq)| AgCl(s)|Ag(s) at 25°C. The solubility product constants of AgBr and AgCl are respectively 8×10^{-13} and 1×10^{-10}. For what ratio of the concentrations of Br⁻ and Cl⁻ ions would the e.m.f of the cell will be zero?

(A) 7×10^{-3}

(B) 8×10^{-3}

(C) 9×10^{-3}

(D) None of these

37. Select the incorrect IUPAC name :

(A) $[Cu(gly)_2]$ – Diglycinatecopper (II)

(B) $[Pt(Py)_4] [PtCl_4]$ – Tetrapyridineplatinum(II) tetrachloridoplatinate(II)

(C) $[Ni(dmg)_2]$ – Bis(dimethylglyoximato)nickel(II)

(D) None of these.

38. $Na_3[CrF_6]$ Paramagnetic moment $= \sqrt{15}$ B.M., Then total number of electrons in $d_{x^2-y^2}$ and d_{z^2} orbitals of central metal is :

(A) 0

(B) 1

(C) 3

(D) None of these

Space for Rough Work

39. Which of the following is correct? (B.E. $\rightarrow$ Bond Dissociation Energy)

(A) $(B.E)_{F_2} > (B.E)_{I_2}$

(B) $(B.E)_{F_2} > (B.E)_{Cl_2}$

(C) $(B.E)_{F_2} > (B.E)_{Br_2}$

(D) $(B.E)_{Cl_2} < (B.E)_{I_2}$

40. Element X crystallizes in a FCC (face centered cubic arrangement) lattice. On applying high temperature it changes to BCC lattice. Find the ratio of the density of the crystal lattice before & after applying high temperature.

(A) 1 : 1

(B) 3 : 2

(C) $\sqrt{2} : \sqrt{3}$

(D) $2(\sqrt{2})^3 : (\sqrt{3})^3$

41. An H_2O_2 solution is labelled as "5.6 volume". If its molarity is $\dfrac{x}{2}$ M. Value of X is :

(A) 1

(B) 2

(C) 3

(D) None of these

Space for Rough Work

SECTION – 2 : (Maximum Marks : 32)

Ñ   This section contains **FOUR** paragraphs

Ñ   Based on each paragraph, there will be **TWO** questions.

Ñ1   Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct 1

Ñ   Marking scheme :

+4 If only the bubble corresponding to the correct option is darkened

0   If none of the bubble is darkened

−1 In all other cases

Paragraph for Question Nos. 42 to 43

Indicators are substance, which indicates the end-point of a titration by changing their colour. They are in general, either weak organic acids or weak organic bases having characteristically different colours in the ionized and unionized forms.

50 ml of 0.1M H_3PO_4 is titrated against 0.1M NaOH.

given $pK_{a1} = 3$, $pK_{a2} = 7$, $pK_{a3} = 11$

42.   What will be the colour of methyl orange indicator at 1st equivalent point ?

(A) colourless   (B) red   (C) yellow   (D) green

43.   Calculate the pH when volume of NaOH added is 125 ml to 50 ml of 0.1M H_3PO_4 :

(A) 8   (B) 11   (C) 9   (D) 7

Space for Rough Work

Paragraph for Question Nos. 44 to 45

The various thermodynamic parameters, which are studied are

U = internal energy,   H = enthalpy,   S = entropy,   G = Gibb's free energy

$\Delta U = q + w$ $\Delta H = \Delta U + \Delta(PV)$, $\Delta S = \int \dfrac{dq_{rev}}{T}$ $\Delta G = \Delta H - \Delta(TS)$

ΔU and ΔH are related to heat of process at constant volume and pressure respectively. However ΔS and ΔG are useful in predicting the spontaneity of a given process or reaction.

ΔS_{surr} is also needed to calculate the total ΔS.

$$\Delta S_{surr} = -\int \dfrac{dq_{sys}}{T_{surr}}$$

$\Delta S_{total} = \Delta S_{sys} + \Delta S_{surr}$

If $\Delta S_{total} > 0$,   process is spontaneous

< 0,   non-spontaneous

$= 0$,   reversible / equilibrium

If pressure and temperature are constant and w_{non-pv} is zero, then spontaneity condition can also be given by ΔG

$\Delta G < 0$,   spontaneous

$\Delta G > 0$,   non-spontaneous

$\Delta G = 0$,   reversible / equilibrium

On the basis of knowledge of thermodynamics, answer the following.

Space for Rough Work

44. Consider a PV diagram for reversible isothermal process carried out on an ideal gas. Which of the following quantities can be obtained from area under the curve, projected on volume axis ?

(A) $|\Delta G|$

(B) $|W_{PV}|$

(C) $|q|$

(D) $|T\Delta S|$

45. The III law of thermodynamics states that entropy of pure and perfect crystalline substances is 0 at 0 K.

Which of the following is/are true ?

(A) Standard molar entropy of any pure element / compound is greater than 0 at $T > 0$ K.

(B) Standard molar entropy of all cations in aqueous phase is greater than 0 at $T > 0$ K (as per thermodynamic data).

(C) Standard molar entropy of all cations is greater than that of H^+ (aq) at any $T > 0$ K.

(D) If -76.9^oC is the transition temperature for the conversion of P_4 (s, α) $\longrightarrow$ P_4 (s, β) and this phase transition is spontaneous at $T < -76.9^oC$, then the entropy of P_4 (s, α) is more than entropy of P_4 (s, β)

(s = solid, α and β refer to two different arrangements of P_4 molecules in solid phase)

Space for Rough Work

Paragraph for Question Nos. 46 to 47

$KMnO_4$ and $K_2Cr_2O_7$ are two important compounds of d-block metals having many uses in chemistry like oxidant, volumetric agent and also having industrial uses.

46.　(X) + KOH + Air $\xrightarrow{\text{heat}}$ (Y)

　　(Y) + Cl_2 $\longrightarrow$　(Z) Purple
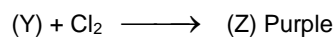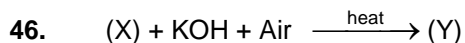
　　Select correct option(s) :

　　(A) X = green Cr_2O_3 　　　　　　　(B) X = black, MnO_2

　　(C) Y = green, K_2MnO_4 　　　　　　(D) Z = $KMnO_4$

47.　When CO_2 is passed into aqueous:

　　(A) Na_2CrO_4 solution, its yellow color changes to orange.

　　(B) K_2MnO_4 solution, it disproportionate to $KMnO_4$ and MnO_2

　　(C) $Na_2Cr_2O_7$ solution; its orange color changes to yellow.

　　(D) $KMnO_4$ solution with dissolved H_2S, its pink color changes to green.

Space for Rough Work

Paragraph for Question Nos. 48 to 49

Disproportionation reactions :

Disproportionation reactions are a special type of redox reactions. In a disproportionation reaction an element in one oxidation state is simultaneously oxidised and reduced. One of the reacting substances in a disproportionation reaction always contains an element that can exist in at least three oxidation states. The element in the form of reacting substance is in the intermediate oxidation state; and both higher and lower oxidation states of that element are formed in the reaction.

48. Which of the following disproportionate(s) on heating with sodium hydroxide ?

(A) P_4

(B) S_8

(C) F_2

(D) NO_2

49. Select the **correct** statement(s) :

(A) Cl_2 disproportionate in basic as well as in neutral medium.

(B) K_2MnO_4 disproportionate in acidic as well as in neutral medium.

(C) I_2 disproportionate in acidic medium.

(D) $NaNO_2$ disproportionate in acidic medium.

Space for Rough Work

CHEMISTRY

SECTION – 3 : (Maximum Marks : 16)

Ñ This section contains **TWO** questions

Ñ Each question contains two columns, **Column I** and **Column II**

Ñ **Column I** has **four** entries (A),(B), (C) and (D)

Ñ **Column II** has **four** entries (P),(Q), (R) and (S)

Ñ Match the entries in **Column I** with the entries in **Column II**

Ñ One or more entries in **Column I** may match with one or more entries in **Column II**

Ñ The ORS contains a 4 × 4 matrix whose layout will be similar to the one shown below :

(A)   (P)   (Q)   (R)   (S)

(B)   (P)   (Q)   (R)   (S)

(C)   (P)   (Q)   (R)   (S)

(D)   (P)   (Q)   (R)   (S)

Ñ1 For each entry in **Column I**, darken the bubbles of all the matching entries. For example, if entry (A) in **Column I**matches with entries (P), (Q) and (R), then darken these three bubbles in the ORS. Similarly, for entries (B), (C) and (D).1

1

Ñ Marking scheme :

For each entry in **Column I**

+2 If only the bubble(s) corresponding to all the correct match(es) is (are) darkened

0 If none of the bubbles is darkened

0 In all other cases

Space for Rough Work

50. Match the compounds listed in column-I with characteristic(s) / type of reaction(s) listed in column-II.

Column –I	Column –II
(A) XeF_2	(P) Undergoes hydrolysis with water.
(B) XeF_4	(Q) Acts as oxidising agent.
(C) XeF_6	(R) Has lone pair(s) of electrons.
(D) XeO_3	(S) Gives disproportionation reaction with H_2O or OH^-.

51. Match the hydrogen halides with their properties and compare.

Column –I	Column –II
(A) HF	(P) Most volatile compound amongst the given.
(B) HCl	(Q) Strongest reducing agent amongst the given.
(C) HBr	(R) Compound shows H bonding.
(D) HI	(S) On reaction with conc. H_2SO_4 produces X_2 type of molecule.

Space for Rough Work