FIITJEE RET – 3

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2015 (P1)_SET–A

DATE: 25.06.2018

Time: 3 hours **Maximum Marks: 264**

INSTRUCTIONS:

A. General

1. This booklet is your Question Paper containing 60 questions.
2. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
3. Fill in the boxes provided for Name and Enrolment No.
4. The answer sheet, a machine-readable Objective Response (ORS), is provided separately.
5. DO NOT TAMPER WITH / MULTILATE THE ORS OR THE BOOKLET.

B. Filling in the OMR:

6. The instructions for the OMR sheet are given on the OMR itself.

C. Question paper format:

7. The question paper consists of **3 parts (Physics, Chemistry and Mathematics)**. Each part consists of **two sections**.
8. **Section I** contains **8 questions**. The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).
9. **Section II** contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** are correct.
10. **Section III** contains **2 Match the following** type questions and you will have to match entries in Column I with the entries in Column II

D. Marking Scheme

11. For each question in **Section I**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **No negative marks** will be awarded for incorrect answers in this section.
12. For each question in **Section II**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **–2 marks** will be awarded for incorrect answers in this section.
13. For each question in **Section III**, you will be awarded **2 marks** for each entry in Column I; if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **–1 marks** will be awarded for incorrect answers in this section.

Don't write / mark your answers in this question booklet.
If you mark the answers in question booklet, you will not be allowed to continue the exam.

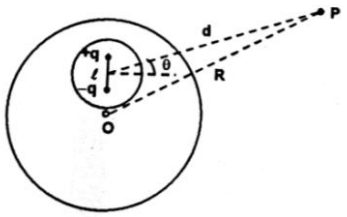
NAME: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐

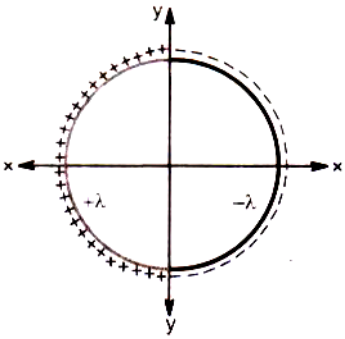
PAPER–I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 32)

- This section contains **EIGHT** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive.
- For each question, darken the bubble corresponding to the correct integer in the ORS.
- Marking scheme:
  - **+4** If the bubble corresponding to the answer is darkened.
  - **0** In all other cases.

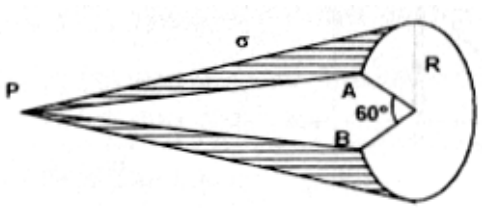
1. A cavity is taken out from a uniform conducting sphere. Inside the cavity a dipole is placed as shown in the figure. The potential at point P (in volt) is n. Then n is
($q = 10^{-8}$ C, $\ell = 0.1$ mm, $\theta = 30°$, d = 10 cm, R = 12 cm)



2. A thin ring of radius R metres is placed in x–y plane such that its centre lies on origin. The half ring in region x < 0 carries uniform linear charge density +λC/m and the remaining half ring in region x > 0 carries uniform linear charge density –λ C/m.
The dipole moment of the ring in C–m is $\frac{n\lambda R^2}{2}$. Then n is

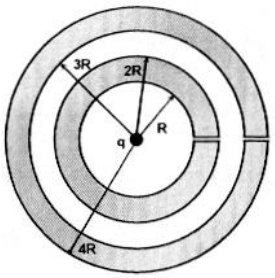


3. A non – conducting hollow cone has charge density σ. A part ABP is cut and removed from the cone. The potential due to the remaining portion of the cone at point 'P' is $\frac{x\sigma R}{12\epsilon_0}$. Then x is

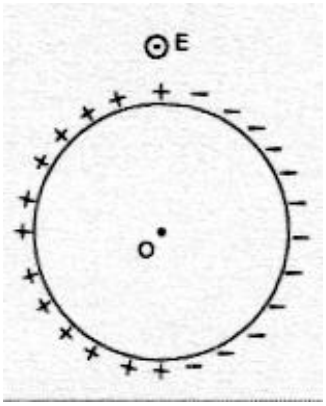


Space for rough work

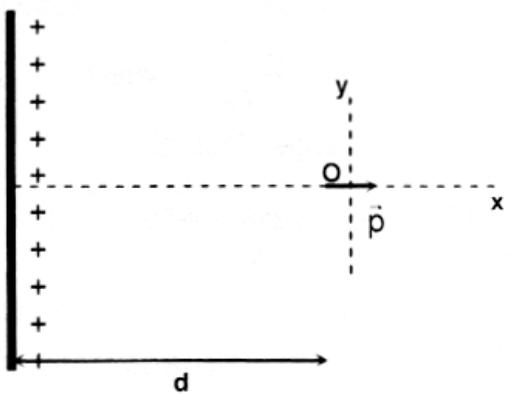
4. A charge particle 'q' lies at the centre of two concentric hollow sphere of inner radii R and 3R and outer radii 2R and 4r respectively amount of work has to be performed to slowly transfer the charge 'q' from center through the orifice to infinity is. $\frac{nq^2}{96\pi \in_0 R}$ Then n is



5. A uniform ring of mass m and radius R is placed freely in a gravity free region. Half of the ring is positively charged with uniform linear charge density $+\lambda$ and other half is negatively charged with uniform charged density $-\lambda$. A uniform electric filed E is switched on along the normal to the plane of the ring. IF the angular speed of the ring when it turns through an angle 90^0 is $n\left(\sqrt{\frac{\lambda E}{m}}\right)$, find the value of n

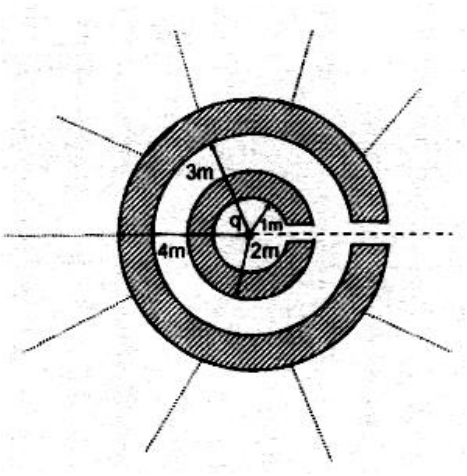


6.. An infinite non – conducting plane with uniform charge density σ is kept parallel to yz plane and at a distance 'd' from a dipole $\vec{p}$ which itself is located at the origin. An equipotential surface for this system is spherical, centred at origin, having radius R(<d). Given that $R = \left(\frac{p}{n\pi\sigma}\right)^{1/3}$ find the integer n.
(Direction of $\vec{p}$ is away from the plane)



Space for rough work

7. A charge 'q' is placed at the origin of an infinite chain of thick spherical conductors, whose inner and outer radii vary as (1m, 2m), (3m, 4m);(5m,6m) and so on. The work needed to take the charge 'q' from centre of the system to infinite separation , through the orifice, is found to be $kq^2\ell n\sqrt{n-4}$. Find 'n'



8. The electrostatic potential existing in the space is given as $V=\left(\frac{x^3}{6\varepsilon_0}+2\right)$ volts. Find the charge density (in coulomb /m^3) at x = 2m.

SECTION 2 (Maximum Marks: 40)

- This section contains **TEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- Marking scheme:
  - **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–2** In all other cases

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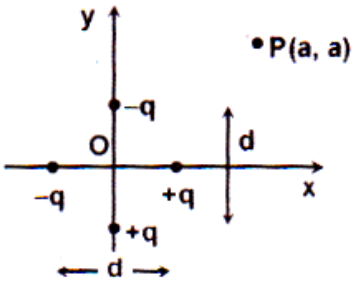
9. Two positive and two negative charges are kept in x- y plane in free space as shown in the figure. The magnitude of electric field due to the system of charges at a point P(a,a) will be (a>>d)

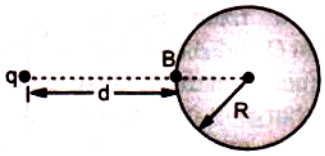


(A) $\frac{\sqrt{5}qd}{4\pi\varepsilon_0 a^3}$ (B) $\frac{2dq}{4\pi\varepsilon_0 a^3}$

(C) $\frac{dq}{8\pi\varepsilon_0 a^3}$ (D) $\frac{3dq}{4\pi\varepsilon_0 a^3}$

Space for rough work

10. For the situation shown in the figure, select the correct statement(s):



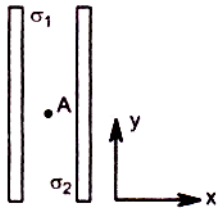
(A) Potential of the conductor is $\frac{q}{4\pi\varepsilon_0(d+R)}$

(B) Potential of the conductor is $\frac{q}{4\pi\varepsilon_0 d}$

(C) Potential of the conductor can't be determined as nature of distribution of induced charges is not known.

(D) Potential at point B due to induced charges is $\frac{-qR}{4\pi\varepsilon_0(d+R)d}$

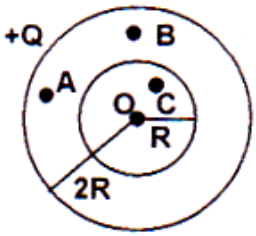
11. Two large conducting sheets are kept parallel to each other as shown in fig. In equilibrium, the charge density on facing surfaces is σ_1 and σ_2. What is the value of electric field at A:



(A) $\frac{\sigma_1\hat{i}}{\varepsilon_0}$ (B) $-\frac{\sigma_2}{\varepsilon_0}i$

(C) $\frac{\sigma_1+\sigma_2}{2\varepsilon_0}i$ (D) $\frac{\sigma_1-\sigma_2}{2\varepsilon_0}i$

12. A hollow conducting sphere of inner radius R and outer radius 2R is given a charge Q as shown in the figure. A point charge Q is placed at the centre.



(A) potential at A and B are different
(B) potential at and B are different
(C) potential at A and C are the same
(D) potential at A,B,C and O are same

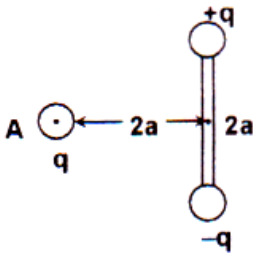
13. Three charges q,q and -2q are fixed on the vertices of an equilateral triangular plate of edge length a. This plate is in equilibrium between two very large plates having surface charge density σ_1 and σ_2 respectively. Find the period of small angular oscillation about an axis passing through its centroid and perpendicular to plane. Moment of inertia of the system about this axis I.

(A) $2\pi\sqrt{\frac{\varepsilon_0 I}{qa|\sigma_1-\sigma_2|}}$ (B) $2\pi\sqrt{\frac{\varepsilon_0 I}{2qa|\sigma_1-\sigma_2|}}$

(C) $2\pi\sqrt{\frac{2\varepsilon_0 I}{\sqrt{3}qa|\sigma_1-\sigma_2|}}$ (D) $2\pi\sqrt{\frac{2\varepsilon_0 I}{qa|\sigma_1-\sigma_2|}}$

Space for rough work

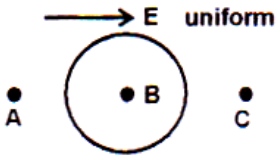
14. As the shown figure a ball having a charge q fixed at a point A. Two identical balls having charge +q and –q and mass each are attached to the ends of a light rod of length 2a. The system is released from the situation shown in the figure. Find the angular velocity of the rod when the rod becomes horizontal. Rod is hinged at centre.



(A) $\frac{\sqrt{2q}}{3\pi\varepsilon_0 ma^3}$ (B) $\frac{q}{\sqrt{3\pi\varepsilon_0 ma^3}}$

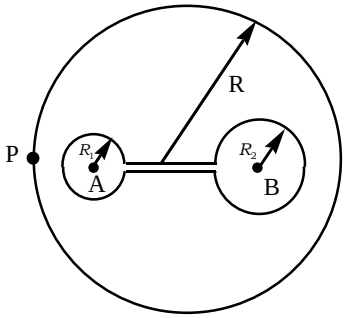
(C) $\frac{q}{\sqrt{6\pi\varepsilon_0 ma^3}}$ (D) $\frac{\sqrt{2q}}{4\pi\varepsilon_0 ma^3}$

15. In a uniform electric field E, a conductor in the form of a sphere is introduced. How will the intensity of the field at points A, B and C change ?



(A) Field at A will increase.
(B) Field at B will decrease
(C) Field at C will increase
(D) Field at all points will remain same

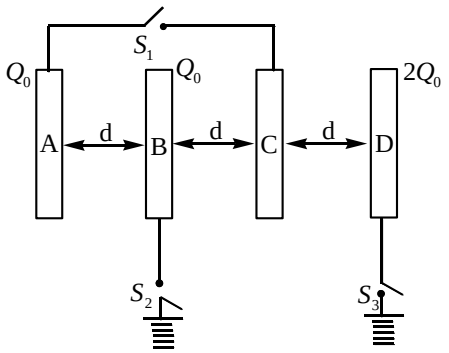
16. An uncharged spherical conductor of radius R = 10r has two spherical cavities of radii R_1 = 2r and R_2 = 3r connected by an extremely narrow smooth tunnel. A,B are the centers of the cavities as shown. A point charge 'q' is arranged at B. Then it is transferred very slowly from B to A. Which of the following statements is true



(A) Initial and final surface charge densities on the sphere at the point P are same.
(B) Initial and final energy densities at a distance *l*(=16r) from the centre of the sphere are same
(C) The net electro static potential energy within the cavities increases as the charge is transferred from B to A
(D) Work done by the agent in transferring the charge is $\frac{q^2}{24\pi\varepsilon_0 r}$

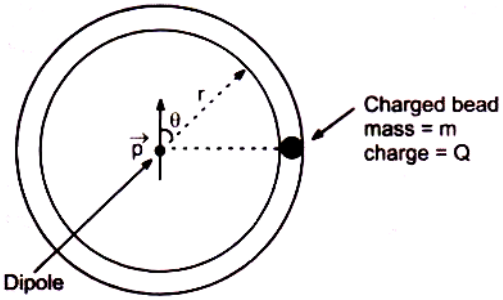
Space for rough work

17. In the given arrangement the charges given to the metal plates A, B and D are Q_0, Q_0, $2Q_0$ and C is the neutral plate ('d' is very small when compared to plate area dimensions)



If the switch S_3 is closed then;
(A) the amount of charge flowing through the switch will be $2Q_0$
(B) the amount of charge flowing through the switch will be $4Q_0$
(C) the charge on the outer surface of A will be equal to the charge on the outer surface of D
(D) the charge on the outer surface of A will not be equal to the charge on the outer surface of D

18. A small charged bead can slide on a circular frictionless, insulating wire frame. A point like dipole is fixed at the centre of circle, dipole moment is $\vec{p}$. Initially the bead is on the plane of symmetry of the dipole. Bead is released from rest. Ignore the effect of gravity. Select the correct options.



(A) Magnitude of velocity of bead as function of its angular position is $\sqrt{\frac{Qp\cos\theta}{2\pi\varepsilon_0 mr^2}}$
(B) Normal force exerted by the wire frame on bead is zero
(C) If the wire frame were not present bead executes circular motion and returns to initial point after tracing a complete circle.
(D) Bead would move along a circular path until it reached the opposite its starting position and then executes periodic motion.

Space for rough work

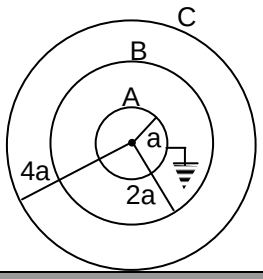
SECTION 3 (Maximum Marks: 16)

- This section contains **TWO** questions.
- Each question contains two columns, **Column I** and **Column II**
- **Column I** has **four** entries (A), (B), (C) and (D)
- **Column II** has **five** entries (P), (Q), (R), (S) and (T)
- Match the entries in **Column I** with the entries in **Column II**
- One or more entries in **Column I** may match with one or more entries in **Column II**.
- The ORS contains a 4 × 5 matrix whose layout will be similar to the one shown below:

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

- 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 (Q), (R) and (T), then darken these three bubbles in the ORS. Similarly, for entries (V), (C) and (D).
- Marking entry in Column I.
  - **+2** If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–1** In all other cases.

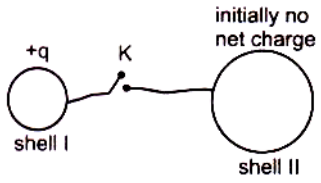
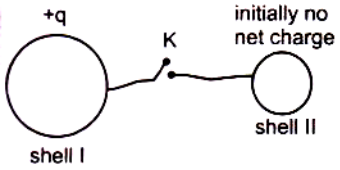
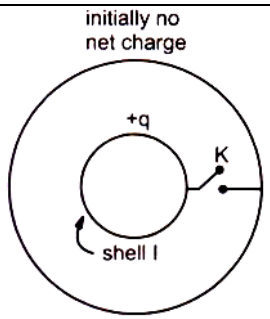
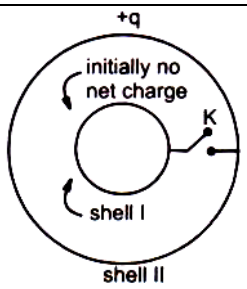
19. Three concentric shells of A, B and C of radius a, 2a and 4a are shown in figure. The shell B is given some positive charge +Q and then shell A is earthed. Then $\left[K = \frac{1}{4\pi\varepsilon_0}\right]$.



Column I		Column II	
(A)	$v_B - v_A$ after earthing A	(p)	$-\frac{KQ}{4a}$
(B)	Change in v_B on earthing A	(q)	$\frac{KQ}{4a}$
(C)	$v_B - v_C$ after earthing A	(r)	$\frac{KQ}{8a}$
(D)	Change in v_C on earthing A	(s)	$\frac{KQ}{2a}$
		(t)	$-\frac{KQ}{8a}$

Space for rough work

20. Column I gives certain situations involving two thin conducting shells connected by a conducting wire via a key K. In all situations one sphere has net charge +q and other sphere has no net charge. After the key K is pressed, column II gives some resulting effect. Match the figures in column I with the statements in column II.

Column – I		Column – II	
(A)		(p)	Charge flows through connecting wire
(B)		(q)	Potential energy of system of sphere decreases.
(C)		(r)	No heat is produced
(D)		(s)	The sphere I ahs no charge after equilibrium is reached.
		(t)	None.

Space for rough work

PART II: CHEMISTRY

SECTION 1 (Maximum Marks: 32)

- This section contains **EIGHT** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive.
- For each question, darken the bubble corresponding to the correct integer in the ORS.
- Marking scheme:
  - **+4** If the bubble corresponding to the answer is darkened.
  - **0** In all other cases.

21. Benzene diazonium chloride on reaction with phenol in a basic medium gives A. Then number of double bonds present in A.

22. Numebrs of moles of NaOH required to covert phenol into o–hydroxyl benzaldehyde in reimen tiemann reaction is

23. The number of aromatic isomers of C_7H_8O is

24. The reaction of phenol with $(CH_3)_2SO_4$ in alkaline solution gives a product with 'x' no. of sp^3 hybridised carbon. The value of x is

25. The number of bromines substituted when Phenol is treated with bromine water

26. How many of the following compounds liberate H_2 gas, when they reacts with Na metal.
Diethyl ether, dimethyl ether, methyl ethyl ether, methyl propyl ether, ethyl alcohol, methyl alcohol, phenol, ter–butyl alcohol

27. How many of the following ethers can't be prepared in William son's synthasis.
$CH_3-O-CH_2-CH_3$, $C_6H_5-OCH_3$, $C_6H_5-O-C_6H_5$, $(CH_3)_3C-O-C(CH_3)_3$,
$CH_2=CH-O-CH=CH_2$, $(CH_3)_3C-O-CH=CH_2$, $C_6H_5-O-CH=CH_2$, $C_2H_5-O-C_2H_5$

28. How many of the following alcohols gives yellow ppt with NaOH + I_2,
CH_3–OH, CH_3–CH_2–OH, CH_3–CH_2–CH_2–OH, CH_3–CH(OH)–CH_3, $(CH_3)_3$C–OH, cyclohexanol

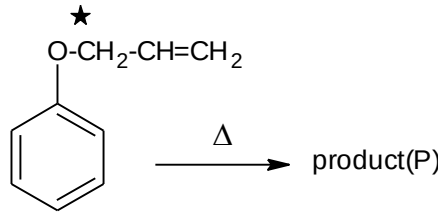
Space for rough work

SECTION 2 (Maximum Marks: 40)

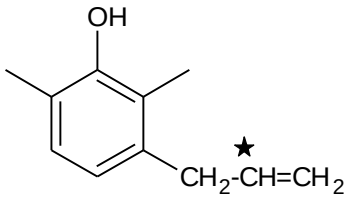
- This section contains **TEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- Marking scheme:
  - **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–2** In all other cases

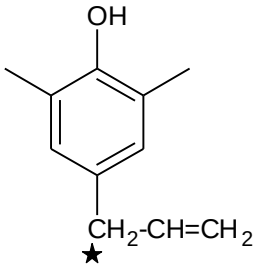
29. Phenol can be prepared by
(A) Hydrolysis of chlorobenzene with aqueous KOH solution at room temperature
(B) Heating sodium salicylate with NaOH + CaO
(C) Reacting cumene hydroperoxide with dil H_2SO_4
(D) Heating benzene diazonium chloride with dil. H_2SO_4

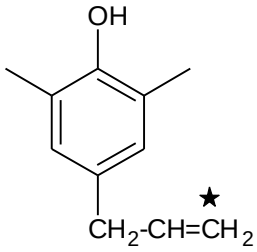
30.

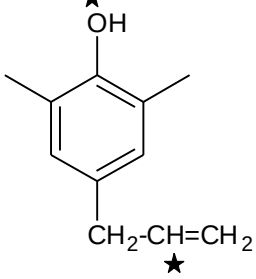


Then which is incorrect about product (P)

(A) 

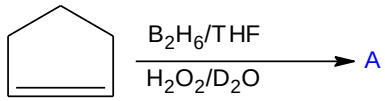
(B) 

(C) 

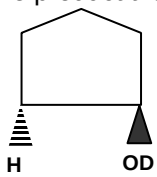
(D) 

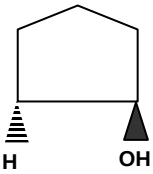
Space for rough work

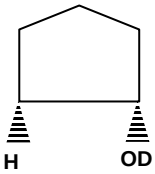
31.

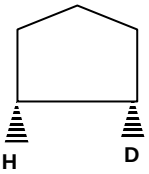


The product that will be obtained is:

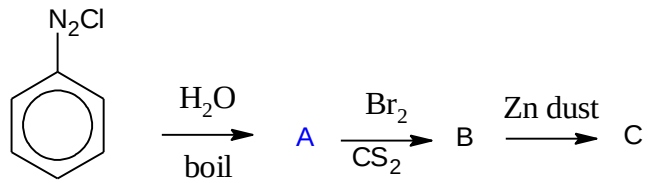
(A) 

(B) 

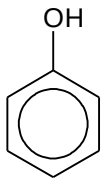
(C) 

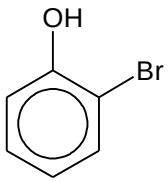
(D) 

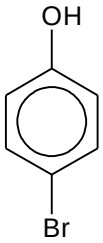
32

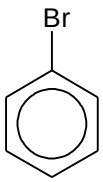


The possible products in the above reaction

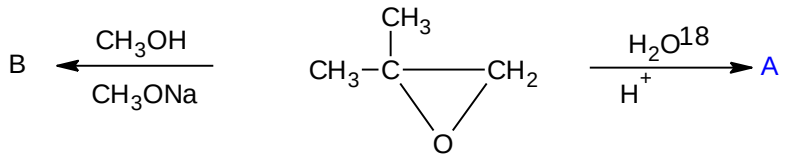
(A) 

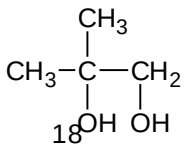
(B) 

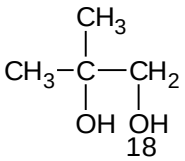
(C) 

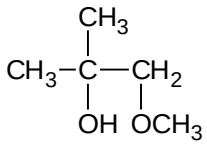
(D) 

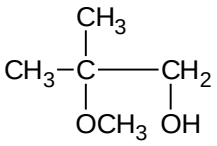
33.



(A) A = 

(B) A = 

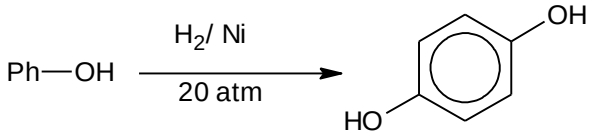
(C) B = 

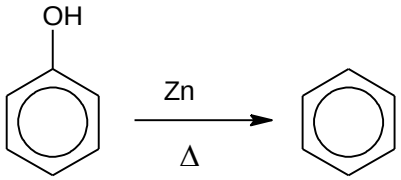
(D) B = 

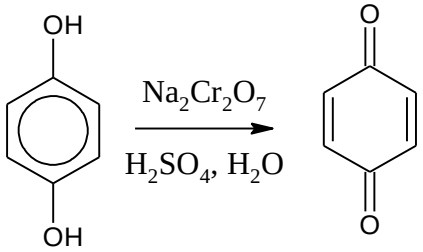
Space for rough work

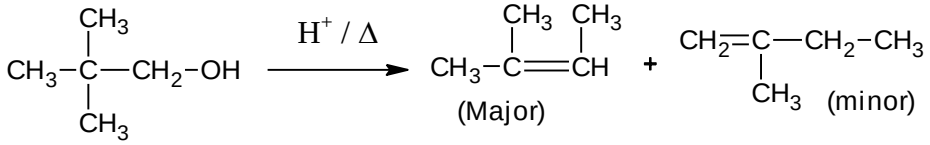
34. Identify the correct statement related to phenol.
(A) Phenol is a weaker acid than Carbonic acid.
(B) when distilled with zinc, phenol gives benzene
(C) formation of phenol from chlorobenzene is an example of nucleophilic aromatic substation.
(D) Among three isomers of nitrophenol, the one that is least soluble in water is para nitro phenol.

35. Identify the reaction which is correctly represented.

(A) 

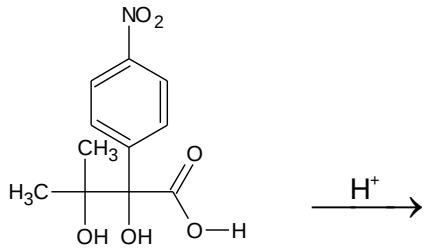
(B) 

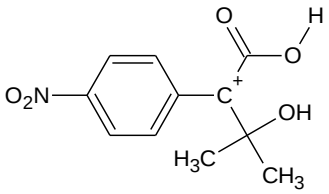
(C) 

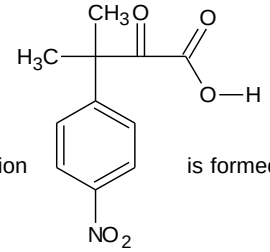
(D) 

Space for rough work

36. For the reaction



(A) In the above reaction  is formed as major proudct

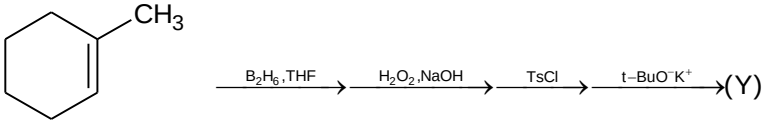
(B) 

In the above reaction is formed as major proudct

(C) In the above reaction benzylic carbonium ion is more stable than tertiary carbocation

(D) In the above reaction Racemic Mixture is obtained

37. In the given reaction



(X)

The product 'Y' is

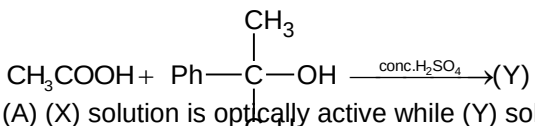
(A) Position isomer of X

(B) Identical to X

(C) Chain isomer of X

(D) An oxidation product of (X)

38. $CH_3COOH +$



(A) (X) solution is optically active while (Y) solution is optically inactive

(B) Both (X) & (Y) solutions are optically active

(C) Both (X) & (Y) solutions are optically inactive

(D) (X) solution is optically inactive while (Y) solution is optically active

Space for rough work

SECTION 3 (Maximum Marks: 16)

- This section contains **TWO** questions.
- Each question contains two columns, **Column I** and **Column II**
- **Column I** has **four** entries (A), (B), (C) and (D)
- **Column II** has **five** entries (P), (Q), (R), (S) and (T)
- Match the entries in **Column I** with the entries in **Column II**
- One or more entries in **Column I** may match with one or more entries in **Column II**.
- The ORS contains a 4×5 matrix whose layout will be similar to the one shown below:

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

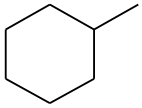
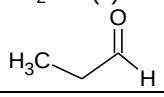
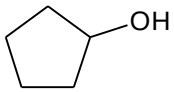
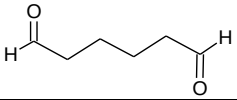
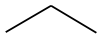
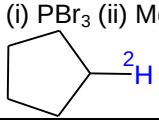
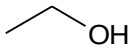
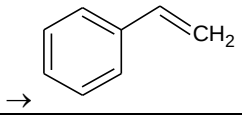
- For each entry in Column I, darken the bubbles of all the matching entries. For example, if entry (A) in **Column I** matches with entries (Q), (R) and (T), then darken these three bubbles in the ORS. Similarly, for entries (V), (C) and (D).
- Marking entry in Column I.
  - **+2** If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–1** In all other cases.

39.

Column – I		Column – II	
(A)	Phenol + Neutral $FeCl_3$	(p)	No reaction
(B)	Phenol + Br_2(aq.)	(q)	Violet colour
(C)	Phenol + $NaHCO_3$	(r)	White ppt.
(D)	Picric acid + $NaHCO_3$	(s)	CO_2 gas is evolved

Space for rough work

40.

Column – I (Reactant)		Column – II (Scheme)	
(A)		(p)	(i) $Br_2/h\upsilon$ (ii) alc. KOH (iii) HBO (iv) PCC → 
(B)		(q)	(i) $Br_2/h\upsilon$ (ii) $C_2H_5O^{(-)}$ (iii) dil. $KMnO_4$ (iv) HIO_4 → 
(C)		(r)	(i) PBr_3 (ii) Mg/ether (iii) DOD → 
(D)		(s)	(i) $KMnO_4$ (ii) PhMgBr $H^{(+)}$ (iii) $SOCl_2$ (iv) $EtO^{(-)}$/EtOH 

PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 32)

- This section contains **EIGHT** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive.
- For each question, darken the bubble corresponding to the correct integer in the ORS.
- Marking scheme:
  - **+4** If the bubble corresponding to the answer is darkened.
  - **0** In all other cases.

41. Let the lines $(y - 2) = m_1 (x - 5)$ and $(y + 4) = m_2 (x - 3)$ intersect at right angles at P (where m_1 and m_2 are parameters). If locus of P is $x^2 + y^2 + gx + fy + 7 = 0$, then the value of $|f + g|$ is

42. The number of points P(x, y) lying inside or on the circle $x^2 + y^2 = 9$ and satisfying the equation $\tan^4 x + \cot^4 x + 2 = 4 \sin^2 y$, is

43. If real numbers x and y satisfy $(x + 5)^2 + (y - 12)^2 = (14)^2$, then the minimum value of $\sqrt{x^2 + y^2}$ is

Space for rough work

44. 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. Then the value of k^2 is

45. The circle $x^2 + y^2 + 4x - 7y + 12 = 0$ cuts an intercept on y-axis of length

46. The line $Ax + By + C = 0$ cuts the circle $x^2 + y^2 + gx + fy + c = 0$ at P and Q. The line $A'x + B'y + C' = 0$ cuts the circle $x^2 + y^2 + g'x + f'y + c' = 0$ at R and S. If P,Q,R and S are concyclic, then the value of the determinant $\begin{vmatrix} g-g' & f-f' & c-c' \\ A & B & C \\ A' & B' & C' \end{vmatrix}$ is

47. Let $a = 3^{\frac{1}{223}} + 1$ and for all $n \geq 3$,
Let $f(n) = {}^nC_0 \cdot a^{n-1} - {}^nC_1 \cdot a^{n-1} + {}^nC_2 \cdot a^{n-3} - \ldots\ldots + (-1)^{n-1} \cdot {}^nC_{n-1}\, a^0$.
If the value of $f(2007) + f(2008) = 3^k$, where $k \in N$, then the value of k is

48. Let m be the smallest positive integer such that the coefficient of x^2 in the expansion of $(1 + x)^2 + (1 + x)^3 + \ldots\ldots + (1 + x)^{49} + (1 + mx)^{50}$ is $(3n + 1)\ {}^{51}C_3$ for some positive integer n. Then the value of n is

SECTION 2 (Maximum Marks: 40)

- This section contains **TEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- Marking scheme:
  - **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–2** In all other cases

49. Let x, y be real variable satisfying the $x^2 + y^2 + 8x - 10y - 40 = 0$. Let $a = \max\left\{\sqrt{(x+2)^2 + (y-3)^2}\right\}$ and $b = \min\left\{\sqrt{(x+2)^2 + (y-3)^2}\right\}$, then

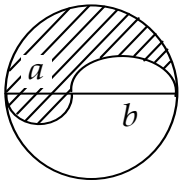
(A) $a + b = 18$ (B) $a + b = \sqrt{2}$ (C) $a - b = 4\sqrt{2}$ (D) $a.b = 73$

Space for rough work

50. Three sides of a triangle have the equation $L_i = y - m_i x = 0$; i = 1, 2, 3. Then $L_1L_2 + \lambda L_2L_3 + \mu L_3L_1 = 0$, where $\lambda \neq 0$, $\mu \neq 0$, is the equation of the circumcircle of the triangle if
(A) $1 + \lambda + \mu = m_1m_2 + \lambda m_2m_3 + \lambda m_3m_1$ (B) $m_1(1 + \mu) + m_2(1 + \lambda) + m_3(\mu + \lambda) = 0$
(C) $\frac{1}{m_3} + \frac{1}{m_1} + \frac{1}{m_2} = 1 + \lambda + \mu$ (D) none of these

51. If equation $x^2 + y^2 + 2hxy + 2gx + 2fy + c = 0$ represents a circle, then the condition for that circle to pass through three quadrants only but not passing through the origin is
(A) $f^2 > c$ (B) $g^2 > c$ (C) $c > 0$ (D) $h = 0$

52. The figure shown is the union of a circle and two semi–circles of a diameter 'a' and 'b' all of whose centres are collinear. Then the ratio of the area of the shaded region to that of the unshaded regions is



(A) $\frac{\pi}{ab}$ (B) $\frac{a\pi}{b}$ (C) $\frac{b}{a}$ (D) $\frac{a}{b}$

53. The vertices of a triangle ABC are the points (6, 0), (0, 6) and (7, 7). The equation of the circle inscribed in the triangle is
(A) $x^2 + y^2 - 9x - 9y + 36 = 0$ (B) $x^2 + y^2 - 9x - 9y - 36 = 0$
(C) $x^2 + y^2 - 9x + 9y + 36 = 0$ (D) $x^2 + y^2 + 9x - 9y + 36 = 0$

54. The equation of the circle which touches the axis of coordinates and the line $\frac{x}{3} + \frac{y}{4} = 1$ and whose centre lies in the first quadrant is $x^2 + y^2 - 2\lambda x - 2\lambda y + \lambda^2 = 0$, where λ is equal to
(A) 1 (B) 2 (C) 3 (D) 6

55. If P is a point on the circle $x^2 + y^2 = 9$, Q is a point on the line $7x + y + 3 = 0$, and the line $x - y + 1 = 0$, is the perpendicular bisector of PQ, then the coordinates of P are
(A) (3, 0) (B) $\left(\frac{72}{25}, -\frac{21}{25}\right)$ (C) (0, 3) (D) $\left(-\frac{72}{25}, \frac{21}{25}\right)$

Space for rough work

56. If a chord of the circle $x^2 + y^2 - 4x - 2y - c = 0$ is trisected at the points $\left(\frac{1}{3},\frac{1}{3}\right)$ and $\left(\frac{8}{3},\frac{8}{3}\right)$, then

(A) c = 10 (B) c = 20 (C) c = 15 (D) $c^2 - 40c + 400 = 0$

57. If $(a\cos\theta_i, a\sin\theta_i)$; i = 1, 2, 3 represent the vertices of an equilateral triangle inscribed in a circle, then

(A) $\cos\theta_1 + \cos\theta_2 + \cos\theta_3 = 0$ (B) $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 0$

(C) $\tan\theta_1 + \tan\theta_2 + \tan\theta_3 = 0$ (D) $\cot\theta_1 + \cot\theta_2 + \cot\theta_3 = 0$

58. An isosceles ΔABC is inscribed in a circle $x^2 + y^2 = a^2$ with the vertex A at (a, 0) and the base angles B and C each equal to 75°, then coordinates of an end point of the base are

(A) $\left(\frac{\sqrt{3}a}{2},\frac{a}{2}\right)$ (B) $\left(-\frac{\sqrt{3}a}{2},\frac{a}{2}\right)$ (C) $\left(-\frac{\sqrt{3}a}{2},-\frac{a}{2}\right)$ (D) $\left(\frac{\sqrt{3}a}{2},-\frac{a}{2}\right)$

SECTION 3 (Maximum Marks: 16)

- This section contains **TWO** questions.
- Each question contains two columns, **Column I** and **Column II**
- **Column I** has **four** entries (A), (B), (C) and (D)
- **Column II** has **five** entries (P), (Q), (R), (S) and (T)
- Match the entries in **Column I** with the entries in **Column II**
- One or more entries in **Column I** may match with one or more entries in **Column II**.
- The ORS contains a 4×5 matrix whose layout will be similar to the one shown below:

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

- 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 (Q), (R) and (T), then darken these three bubbles in the ORS. Similarly, for entries (V), (C) and (D).
- Marking entry in Column I.

+2 If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.
0 If none of the bubbles is darkened.
–1 In all other cases.

Space for rough work

59. Let $x^2 + y^2 + 2gx + 2fy + c = 0$ be an equation of circle

Column I		Column II	
(A)	If circle lie in first quadrant, then	p.	$g < 0$
(B)	If circle lie above x-axis, then	q.	$g > 0$
(C)	If circle lie on the left of y-axis, then	r.	$g^2 - c < 0$
(D)	If circle touches positive x-axis and does not intersect y-axis, then	s.	$c > 0$

60. Let C and C_1 be circles of radii 1 and $r > 1$ respectively touching the coordinates axes, Column-II gives values of r for the conditions in Column-I

Column I		Column II	
(A)	C passes thorough the centre of C_1	p.	3
(B)	C and C_1 touch each other	q.	$\frac{2+\sqrt{2}}{2}$
(C)	C and C_1 are orthogonal	r.	$2+\sqrt{3}$
(D)	C and C_1 have longest common chord	s.	$3+2\sqrt{2}$

pace for rough work

FIITJEE RET – 3

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2015 (P1)_SET–A

DATE: 25.06.2018

ANSWERS

PHYSICS

1.	**0**	2.	**8**	3.	**5**	4.	**7**
5.	**4**	6.	**2**	7.	**6**	8.	**2**
9.	**C**	10.	**A,D**	11.	**A,B,D**	12.	**B**
13.	**C**	14.	**C**	15.	**A,B,C**	16.	**A,B**
17.	**B,C**	18.	**A,B,D**	19.	**A → q; B → p; C → r; D → t**		
20.	**A → p, q; B → p, q; C → p, q, s; D → r, s**						

CHEMISTRY

21.	**7**	22.	**4**	23.	**5**	24.	**1**
25.	**3**	26.	**4**	27.	**5**	28.	**2**
29.	**B, C, D**	30.	**A, C, D**	31.	**C**	32.	**A,B,C,D**
33.	**A, C**	34.	**A,B,C**	35.	**B,C,D**	36.	**B**
37.	**A**	38.	**A**				
39.	**A → q ; B → r ; C → p ; D → s**						
40.	**A → q ; B → s ; C → p ; D → r**						

MATHEMATICS

41.	**6**	42.	**8**	43.	**1**	44.	**9**
45.	**1**	46.	**0**	47.	**9**	48.	**5**
49.	**ACD**	50.	**AB**	51.	**ABCD**	52.	**D**
53.	**A**	54.	**AD**	55.	**AD**	56.	**BD**
57.	**AB**	58.	**BC**	59.	**A → p, r, s; B → r, s; C → q, s; D → p, s**		
60.	**A → q; B → s; C → r; D → p**						

FIITJEE RET – 3

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2015 (P1)_SET–B

DATE: 25.06.2018

Time: 3 hours **Maximum Marks: 264**

INSTRUCTIONS:

A. General

1. This booklet is your Question Paper containing 60 questions.
6. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
7. Fill in the boxes provided for Name and Enrolment No.
8. The answer sheet, a machine-readable Objective Response (ORS), is provided separately.
9. DO NOT TAMPER WITH / MULTILATE THE ORS OR THE BOOKLET.

B. Filling in the OMR:

6. The instructions for the OMR sheet are given on the OMR itself.

C. Question paper format:

14. The question paper consists of **3 parts (Physics, Chemistry and Mathematics)**. Each part consists of **two sections**.
15. **Section I** contains **8 questions**. The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).
16. **Section II** contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** are correct.
17. **Section III** contains **2 Match the following** type questions and you will have to match entries in Column I with the entries in Column II

D. Marking Scheme

18. For each question in **Section I**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **No negative marks** will be awarded for incorrect answers in this section.
19. For each question in **Section II**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **–2 marks** will be awarded for incorrect answers in this section.
20. For each question in **Section III**, you will be awarded **2 marks** for each entry in Column I; if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **–1 marks** will be awarded for incorrect answers in this section.

Don't write / mark your answers in this question booklet.
If you mark the answers in question booklet, you will not be allowed to continue the exam.

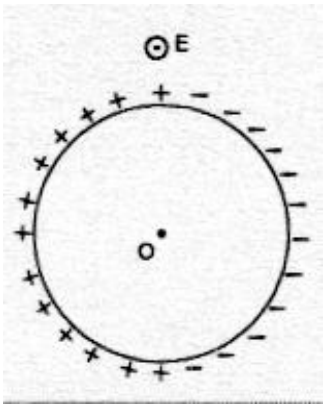
NAME: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐

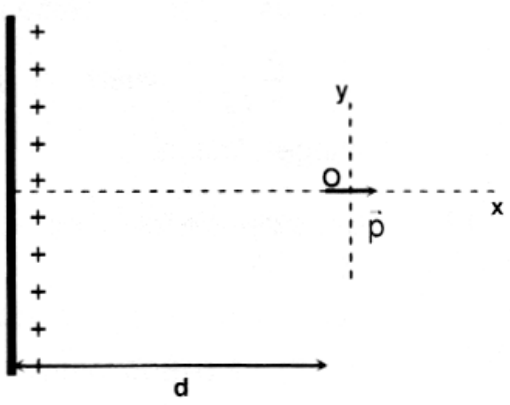
PAPER–I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 32)

- This section contains **EIGHT** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive.
- For each question, darken the bubble corresponding to the correct integer in the ORS.
- Marking scheme:
  - **+4** If the bubble corresponding to the answer is darkened.
  - **0** In all other cases.

1. A uniform ring of mass m and radius R is placed freely in a gravity free region. Half of the ring is positively charged with uniform linear charge density $+\lambda$ and other half is negatively charged with uniform charged density $-\lambda$. A uniform electric filed E is switched on along the normal to the plane of the ring. IF the angular speed of the ring when it turns through an angle 90^0 is $n\left(\sqrt{\frac{\lambda E}{m}}\right)$, find the value of n

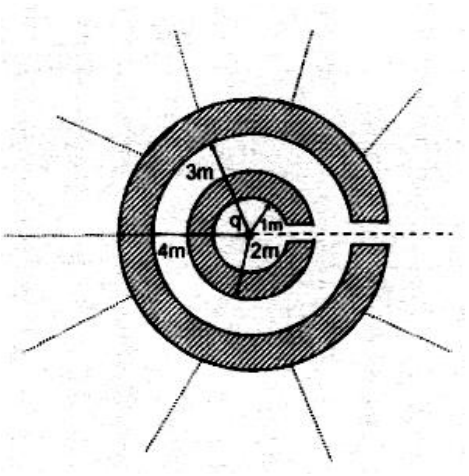


2. An infinite non – conducting plane with uniform charge density σ is kept parallel to yz plane and at a distance 'd' from a dipole $\vec{p}$ which itself is located at the origin. An equipotential surface for this system is spherical, centred at origin, having radius R(<d). Given that $R = \left(\frac{p}{n\pi\sigma}\right)^{1/3}$ find the integer n.
(Direction of $\vec{p}$ is away from the plane)



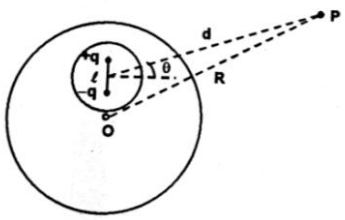
pace for rough work

3. A charge 'q' is placed at the origin of an infinite chain of thick spherical conductors, whose inner and outer radii vary as (1m, 2m), (3m, 4m);(5m,6m) and so on. The work needed to take the charge 'q' from centre of the system to infinite separation , through the orifice, is found to be $kq^2\ell n\sqrt{n-4}$. Find 'n'

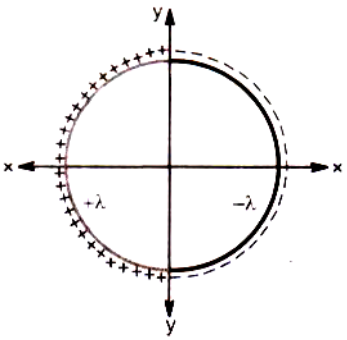


4. The electrostatic potential existing in the space is given as $V=\left(\frac{x^3}{6\varepsilon_0}+2\right)$ volts. Find the charge density (in coulomb /m^3) at x = 2m.

5. A cavity is taken out from a uniform conducting sphere. Inside the cavity a dipole is placed as shown in the figure. The potential at point P (in volt) is n. Then n is
($q = 10^{-8}$ C, ℓ = 0.1 mm, $\theta = 30°$, d = 10 cm, R = 12 cm)

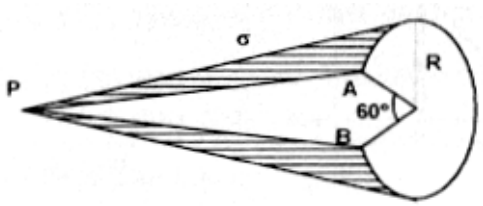


6. A thin ring of radius R metres is placed in x–y plane such that its centre lies on origin. The half ring in region x < 0 carries uniform linear charge density +λC/m and the remaining half ring in region x > 0 carries uniform linear charge density –λ C/m.
The dipole moment of the ring in C–m is
$\frac{n\lambda R^2}{2}$. Then n is

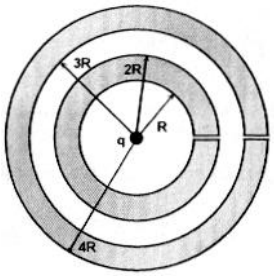


pace for rough work

7. A non – conducting hollow cone has charge density σ. A part ABP is cut and removed from the cone. The potential due to the remaining portion of the cone at point 'P' is $\frac{x\sigma R}{12 \in_0}$. Then x is



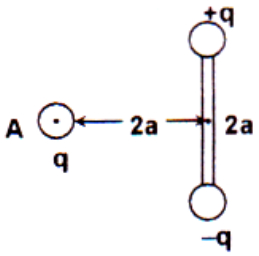
8. A charge particle 'q' lies at the centre of two concentric hollow sphere of inner radii R and 3R and outer radii 2R and 4r respectively amount of work has to be performed to slowly transfer the charge 'q' from center through the orifice to infinity is. $\frac{nq^2}{96\pi \in_0 R}$ Then n is



SECTION 2 (Maximum Marks: 40)

- This section contains **TEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- Marking scheme:
  - **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–2** In all other cases

9. As the shown figure a ball having a charge q fixed at a point A. Two identical balls having charge +q and –q and mass each are attached to the ends of a light rod of length 2a. The system is released from the situation shown in the figure. Find the angular velocity of the rod when the rod becomes horizontal. Rod is hinged at centre.

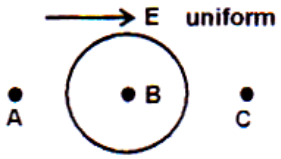


(A) $\frac{\sqrt{2q}}{3\pi\varepsilon_0 ma^3}$ (B) $\frac{q}{\sqrt{3\pi\varepsilon_0 ma^3}}$

(C) $\frac{q}{\sqrt{6\pi\varepsilon_0 ma^3}}$ (D) $\frac{\sqrt{2q}}{4\pi\varepsilon_0 ma^3}$

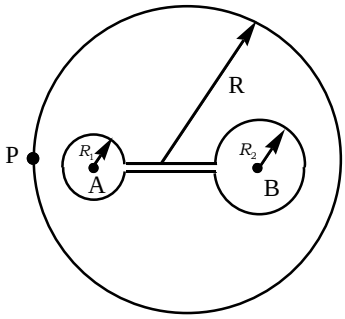
pace for rough work

10. In a uniform electric field E, a conductor in the form of a sphere is introduced. How will the intensity of the field at points A, B and C change ?



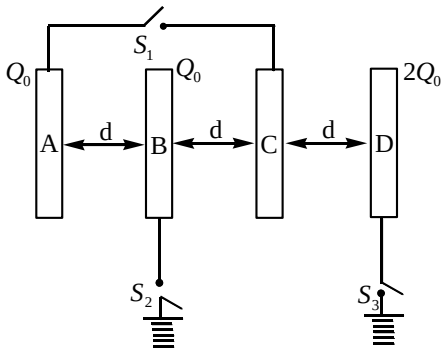
(A) Field at A will increase.
(B) Field at B will decrease
(C) Field at C will increase
(D) Field at all points will remain same

11. An uncharged spherical conductor of radius R = 10r has two spherical cavities of radii R_1 = 2r and R_2 = 3r connected by an extremely narrow smooth tunnel. A,B are the centers of the cavities as shown. A point charge 'q' is arranged at B. Then it is transferred very slowly from B to A. Which of the following statements is true



(A) Initial and final surface charge densities on the sphere at the point P are same.
(B) Initial and final energy densities at a distance *l*(=16r) from the centre of the sphere are same
(C) The net electro static potential energy within the cavities increases as the charge is transferred from B to A
(D) Work done by the agent in transferring the charge is $\frac{q^2}{24\pi\varepsilon_0 r}$

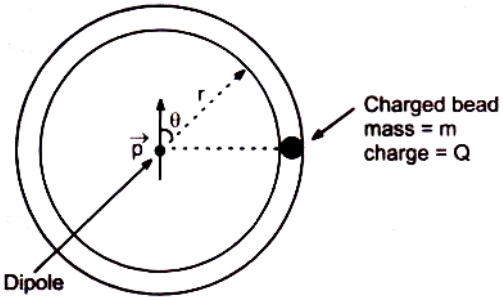
12. In the given arrangement the charges given to the metal plates A, B and D are Q_0, Q_0, $2Q_0$ and C is the neutral plate ('d' is very small when compared to plate area dimensions)



If the switch S_3 is closed then;
(A) the amount of charge flowing through the switch will be $2Q_0$
(B) the amount of charge flowing through the switch will be $4Q_0$
(C) the charge on the outer surface of A will be equal to the charge on the outer surface of D
(D) the charge on the outer surface of A will not be equal to the charge on the outer surface of D

pace for rough work

13. A small charged bead can slide on a circular frictionless, insulating wire frame. A point like dipole is fixed at the centre of circle, dipole moment is $\vec{p}$. Initially the bead is on the plane of symmetry of the dipole. Bead is released from rest. Ignore the effect of gravity. Select the correct options.



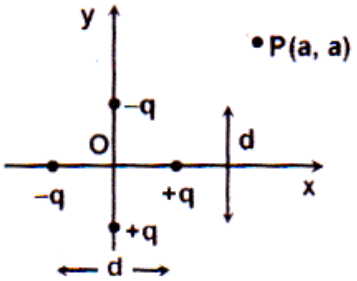
(A) Magnitude of velocity of bead as function of its angular position is $\sqrt{\frac{Qp\cos\theta}{2\pi\varepsilon_0 mr^2}}$

(B) Normal force exerted by the wire frame on bead is zero

(C) If the wire frame were not present bead executes circular motion and returns to initial point after tracing a complete circle.

(D) Bead would move along a circular path until it reached the opposite its starting position and then executes periodic motion.

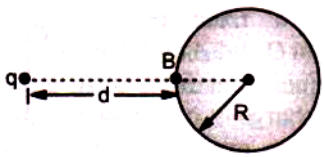
14. Two positive and two negative charges are kept in x- y plane in free space as shown in the figure. The magnitude of electric field due to the system of charges at a point P(a,a) will be (a>>d)



(A) $\frac{\sqrt{5}qd}{4\pi\varepsilon_0 a^3}$ (B) $\frac{2dq}{4\pi\varepsilon_0 a^3}$

(C) $\frac{dq}{8\pi\varepsilon_0 a^3}$ (D) $\frac{3dq}{4\pi\varepsilon_0 a^3}$

15. For the situation shown in the figure, select the correct statement(s):



(A) Potential of the conductor is $\frac{q}{4\pi\varepsilon_0(d+R)}$

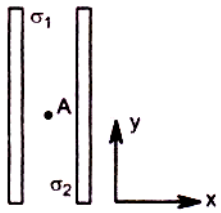
(B) Potential of the conductor is $\frac{q}{4\pi\varepsilon_0 d}$

(C) Potential of the conductor can't be determined as nature of distribution of induced charges is not known.

(D) Potential at point B due to induced charges is $\frac{-qR}{4\pi\varepsilon_0(d+R)d}$

pace for rough work

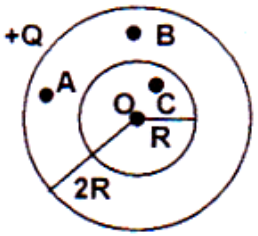
16. Two large conducting sheets are kept parallel to each other as shown in fig. In equilibrium, the charge density on facing surfaces is σ_1 and σ_2. What is the value of electric field at A:



(A) $\frac{\sigma_1 \hat{i}}{\varepsilon_0}$ (B) $-\frac{\sigma_2}{\varepsilon_0} i$

(C) $\frac{\sigma_1 + \sigma_2}{2\varepsilon_0} i$ (D) $\frac{\sigma_1 - \sigma_2}{2\varepsilon_0} i$

17. A hollow conducting sphere of inner radius R and outer radius 2R is given a charge Q as shown in the figure. A point charge Q is placed at the centre.



(A) potential at A and B are different
(B) potential at and B are different
(C) potential at A and C are the same
(D) potential at A,B,C and O are same

18. Three charges q,q and -2q are fixed on the vertices of an equilateral triangular plate of edge length a. This plate is in equilibrium between two very large plates having surface charge density σ_1 and σ_2 respectively. Find the period of small angular oscillation about an axis passing through its centroid and perpendicular to plane. Moment of inertia of the system about this axis I.

(A) $2\pi\sqrt{\frac{\varepsilon_0 I}{qa|\sigma_1 - \sigma_2|}}$ (B) $2\pi\sqrt{\frac{\varepsilon_0 I}{2qa|\sigma_1 - \sigma_2|}}$

(C) $2\pi\sqrt{\frac{2\varepsilon_0 I}{\sqrt{3}qa|\sigma_1 - \sigma_2|}}$ (D) $2\pi\sqrt{\frac{2\varepsilon_0 I}{qa|\sigma_1 - \sigma_2|}}$

SECTION 3 (Maximum Marks: 16)

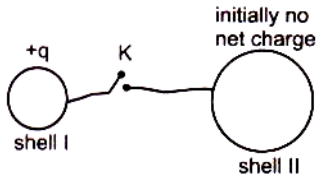
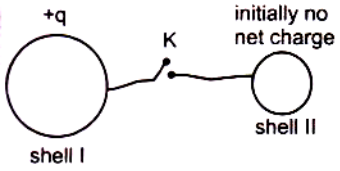
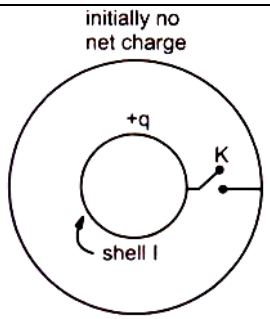
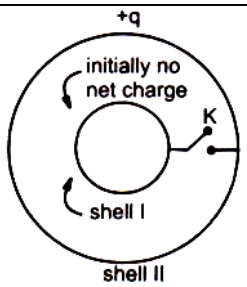
- This section contains **TWO** questions.
- Each question contains two columns, **Column I** and **Column II**
- **Column I** has **four** entries (A), (B), (C) and (D)
- **Column II** has **five** entries (P), (Q), (R), (S) and (T)
- Match the entries in **Column I** with the entries in **Column II**
- One or more entries in **Column I** may match with one or more entries in **Column II**.
- The ORS contains a 4 × 5 matrix whose layout will be similar to the one shown below:

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

- 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 (Q), (R) and (T), then darken these three bubbles in the ORS. Similarly, for entries (V), (C) and (D).
- Marking entry in Column I.
  - **+2** If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–1** In all other cases.

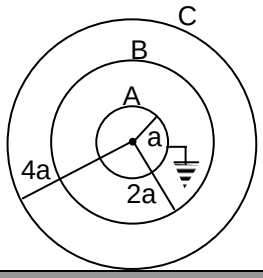
pace for rough work

19. Column I gives certain situations involving two thin conducting shells connected by a conducting wire via a key K. In all situations one sphere has net charge +q and other sphere has no net charge. After the key K is pressed, column II gives some resulting effect. Match the figures in column I with the statements in column II.

Column – I		Column – II	
(A)		(p)	Charge flows through connecting wire
(B)		(q)	Potential energy of system of sphere decreases.
(C)		(r)	No heat is produced
(D)		(s)	The sphere I ahs no charge after equilibrium is reached.
		(t)	None.

pace for rough work

20. Three concentric shells of A, B and C of radius a, 2a and 4a are shown in figure. The shell B is given some positive charge +Q and then shell A is earthed. Then $\left[K = \frac{1}{4\pi\varepsilon_0}\right]$.



Column I		Column II	
(A)	$v_B - v_A$ after earthing A	(p)	$-\frac{KQ}{4a}$
(B)	Change in v_B on earthing A	(q)	$\frac{KQ}{4a}$
(C)	$v_B - v_C$ after earthing A	(r)	$\frac{KQ}{8a}$
(D)	Change in v_C on earthing A	(s)	$\frac{KQ}{2a}$
		(t)	$-\frac{KQ}{8a}$

PART II: CHEMISTRY

SECTION 1 (Maximum Marks: 32)

- This section contains **EIGHT** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive.
- For each question, darken the bubble corresponding to the correct integer in the ORS.
- Marking scheme:
  - **+4** If the bubble corresponding to the answer is darkened.
  - **0** In all other cases.

21. The number of bromines substituted when Phenol is treated with bromine water

22. How many of the following compounds liberate H_2 gas, when they reacts with Na metal.
Diethyl ether, dimethyl ether, methyl ethyl ether, methyl propyl ether, ethyl alcohol, methyl alcohol, phenol, ter–butyl alcohol

pace for rough work

23. How many of the following ethers can't be prepared in William son's synthasis.
$CH_3-O-CH_2-CH_3$, $C_6H_5-OCH_3$, $C_6H_5-O-C_6H_5$, $(CH_3)_3C-O-C(CH_3)_3$,
$CH_2=CH-O-CH=CH_2$, $(CH_3)_3C-O-CH=CH_2$, $C_6H_5-O-CH=CH_2$, $C_2H_5-O-C_2H_5$

24. How many of the following alcohols gives yellow ppt with NaOH + I_2,
CH_3–OH, CH_3–CH_2–OH, CH_3–CH_2–CH_2–OH, CH_3–CH(OH)–CH_3, $(CH_3)_3$C–OH, cyclohexanol

25. Benzene diazonium chloride on reaction with phenol in a basic medium gives A. Then number of double bonds present in A.

26. Numebrs of moles of NaOH required to covert phenol into o–hydroxyl benzaldehyde in reimen tiemann reaction is

27. The number of aromatic isomers of C_7H_8O is

28. The reaction of phenol with $(CH_3)_2SO_4$ in alkaline solution gives a product with 'x' no. of sp^3 hybridised carbon. The value of x is

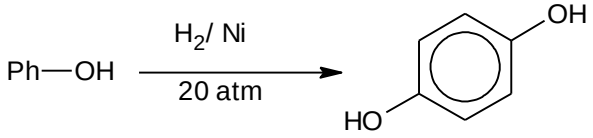
SECTION 2 (Maximum Marks: 40)

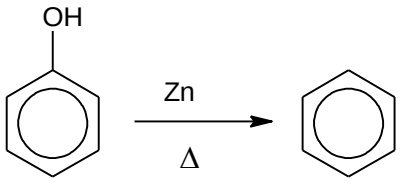
- This section contains **TEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- Marking scheme:
  - **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–2** In all other cases

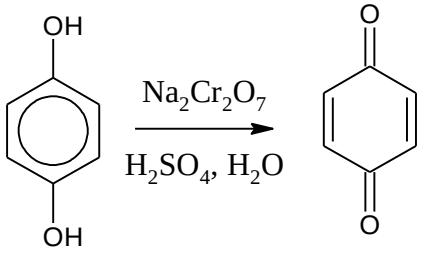
29. Identify the correct statement related to phenol
(A) Phenol is a weaker acid than Carbonic acid
(B) when distilled with zinc, phenol gives benzene
(C) formation of phenol from chlorobenzene is an example of nucleophilic aromatic substation
(D) Among three isomers of nitrophenol, the one that is least soluble in water is para nitro phenol

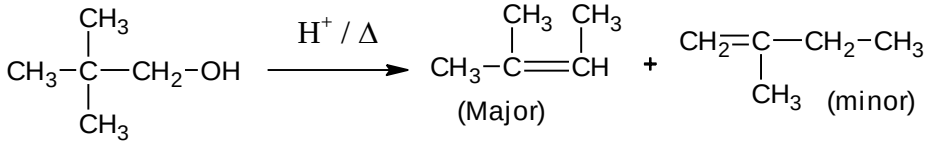
pace for rough work

30. Identify the reaction which is correctly represented

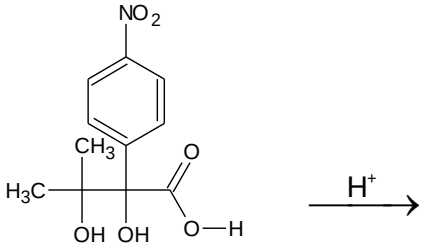
(A) 

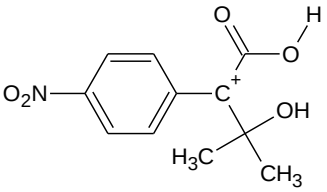
(B) 

(C) 

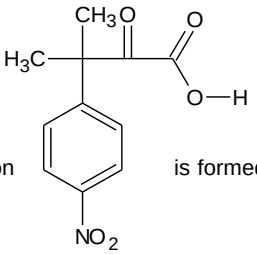
(D) 

31. For the reaction



(A) In the above reaction 

is formed as major proudct

(B) 

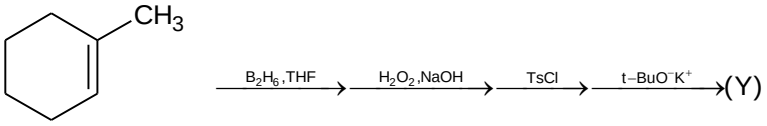
In the above reaction is formed as major proudct

(C) In the above reaction benzylic carbonium ion is more stable than tertiary carbocation

(D) In the above reaction Racemic Mixture is obtained

pace for rough work

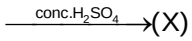
32. In the given reaction

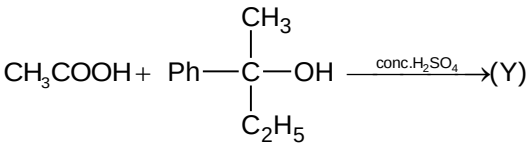


(X)

The product 'Y' is

(A) Position isomer of X
(B) Identical to X
(C) Chain isomer of X
(D) An oxidation product of (X)

33. $CH_3COOH +$ 

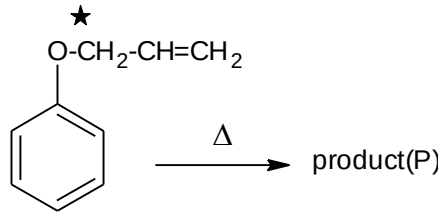


(A) (X) solution is optically active while (Y) solution is optically inactive
(B) Both (X) & (Y) solutions are optically active
(C) Both (X) & (Y) solutions are optically inactive
(D) (X) solution is optically inactive while (Y) solution is optically active

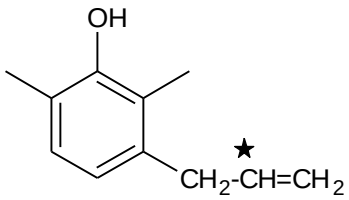
34. Phenol can be prepared by
(A) Hydrolysis of chlorobenzene with aqueous KOH solution at room temperature
(B) Heating sodium salicylate with NaOH + CaO
(C) Reacting cumene hydroperoxide with dil H_2SO_4
(D) Heating benzene diazonium chloride with dil. H_2SO_4

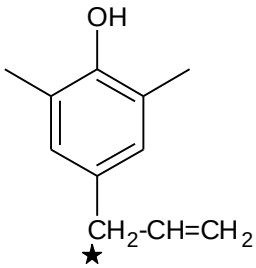
pace for rough work

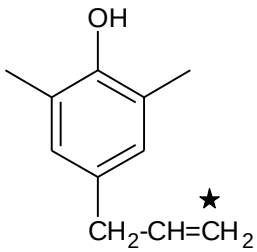
35.

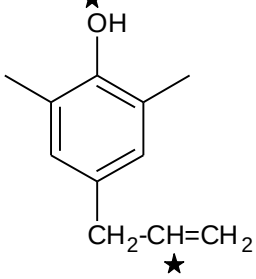


Then which is incorrect about product (P)

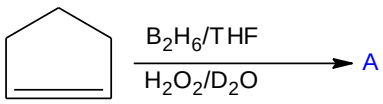
(A) 

(B) 

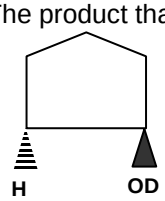
(C) 

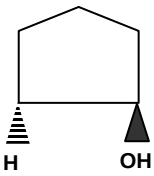
(D) 

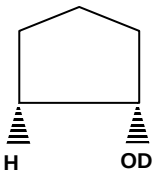
36.

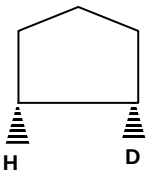


The product that will be obtained is:

(A) 

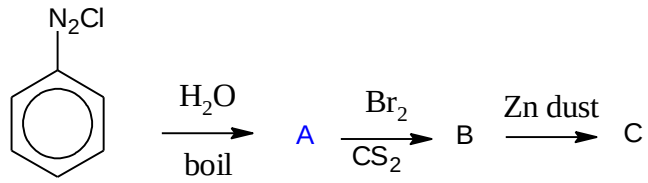
(B) 

(C) 

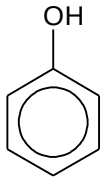
(D) 

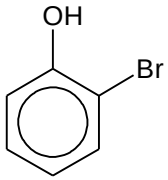
pace for rough work

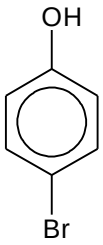
37

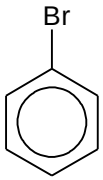


The possible products in the above reaction

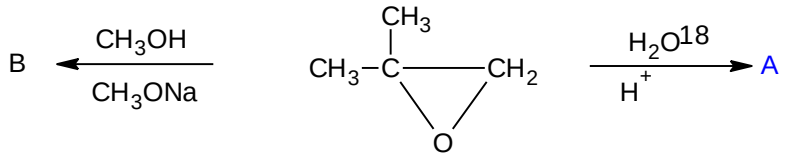
(A) 

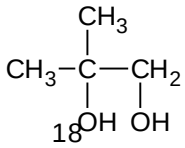
(B) 

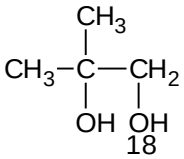
(C) 

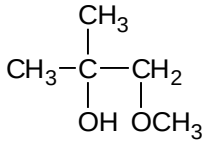
(D) 

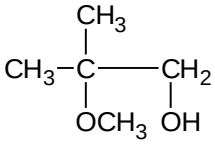
38.



(A) A = 

(B) A = 

(C) B = 

(D) B = 

pace for rough work

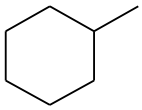
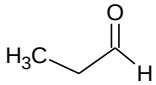
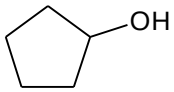
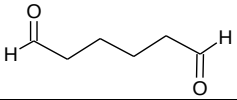
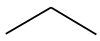
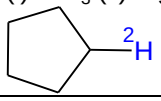
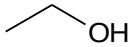
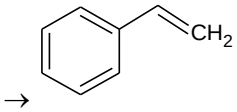
SECTION 3 (Maximum Marks: 16)

- This section contains **TWO** questions.
- Each question contains two columns, **Column I** and **Column II**
- **Column I** has **four** entries (A), (B), (C) and (D)
- **Column II** has **five** entries (P), (Q), (R), (S) and (T)
- Match the entries in **Column I** with the entries in **Column II**
- One or more entries in **Column I** may match with one or more entries in **Column II**.
- The ORS contains a 4 × 5 matrix whose layout will be similar to the one shown below:

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

- 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 (Q), (R) and (T), then darken these three bubbles in the ORS. Similarly, for entries (V), (C) and (D).
- Marking entry in Column I.
  - **+2** If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–1** In all other cases.

39.

Column – I (Reactant)		Column – II (Scheme)	
(A)		(p)	(i) $Br_2/h\upsilon$ (ii) alc. KOH (iii) HBO (iv) PCC → 
(B)		(q)	(i) $Br_2/h\upsilon$ (ii) $C_2H_5O^{(-)}$ (iii) dil. $KMnO_4$ (iv) HIO_4 → 
(C)		(r)	(i) PBr_3 (ii) Mg/ether (iii) DOD → 
(D)		(s)	(i) $KMnO_4$ (ii) PhMgBr $H^{(+)}$ (iii) $SOCl_2$ (iv) $EtO^{(-)}$/EtOH 

pace for rough work

40.

Column – I		Column – II	
(A)	Phenol + Neutral $FeCl_3$	(p)	No reaction
(B)	Phenol + Br_2(aq.)	(q)	Violet colour
(C)	Phenol + $NaHCO_3$	(r)	White ppt.
(D)	Picric acid + $NaHCO_3$	(s)	CO_2 gas is evolved

PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 32)

- This section contains **EIGHT** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive.
- For each question, darken the bubble corresponding to the correct integer in the ORS.
- Marking scheme:
  - **+4** If the bubble corresponding to the answer is darkened.
  - **0** In all other cases.

41. The circle $x^2 + y^2 + 4x - 7y + 12 = 0$ cuts an intercept on y-axis of length

42. The line $Ax + By + C = 0$ cuts the circle $x^2 + y^2 + gx + fy + c = 0$ at P and Q. The line $A'x + B'y + C' = 0$ cuts the circle $x^2 + y^2 + g'x + f'y + c' = 0$ at R and S. If P,Q,R and S are concyclic, then the value of the determinant $\begin{vmatrix} g-g' & f-f' & c-c' \\ A & B & C \\ A' & B' & C' \end{vmatrix}$ is

43. Let $a = 3^{\frac{1}{223}} + 1$ and for all $n \geq 3$,
Let $f(n) = {}^nC_0 \cdot a^{n-1} - {}^nC_1 \cdot a^{n-1} + {}^nC_2 \cdot a^{n-3} - \ldots\ldots + (-1)^{n-1} \cdot {}^nC_{n-1}\, a^0$.
If the value of $f(2007) + f(2008) = 3^k$, where $k \in N$, then the value of k is

pace for rough work

44. Let m be the smallest positive integer such that the coefficient of x^2 in the expansion of $(1 + x)^2 + (1 + x)^3 + ... + (1 + x)^{49} + (1 + mx)^{50}$ is $(3n + 1)\ {}^{51}C_3$ for some positive integer n. Then the value of n is

45. Let the lines $(y – 2) = m_1 (x – 5)$ and $(y + 4) = m_2 (x – 3)$ intersect at right angles at P (where m_1 and m_2 are parameters). If locus of P is $x^2 + y^2 + gx + fy + 7 = 0$, then the value of $|f + g|$ is

46. The number of points P(x, y) lying inside or on the circle $x^2 + y^2 = 9$ and satisfying the equation $\tan^4 x + \cot^4 x + 2 = 4 \sin^2 y$, is

47. If real numbers x and y satisfy $(x + 5)^2 + (y – 12)^2 = (14)^2$, then the minimum value of $\sqrt{x^2 + y^2}$ is

48. 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. Then the value of k^2 is

SECTION 2 (Maximum Marks: 40)

- This section contains **TEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- Marking scheme:
  - **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–2** In all other cases

49. The equation of the circle which touches the axis of coordinates and the line $\frac{x}{3} + \frac{y}{4} = 1$ and whose centre lies in the first quadrant is $x^2 + y^2 – 2\lambda x – 2\lambda y + \lambda^2 = 0$, where λ is equal to
(A) 1 (B) 2 (C) 3 (D) 6

50. If P is a point on the circle $x^2 + y^2 = 9$, Q is a point on the line $7x + y + 3 = 0$, and the line $x – y + 1 = 0$, is the perpendicular bisector of PQ, then the coordinates of P are
(A) (3, 0) (B) $\left(\frac{72}{25}, -\frac{21}{25}\right)$ (C) (0, 3) (D) $\left(-\frac{72}{25}, \frac{21}{25}\right)$

pace for rough work

51. If a chord of the circle $x^2 + y^2 - 4x - 2y - c = 0$ is trisected at the points $\left(\frac{1}{3},\frac{1}{3}\right)$ and $\left(\frac{8}{3},\frac{8}{3}\right)$, then

(A) c = 10 (B) c = 20 (C) c = 15 (D) $c^2 - 40c + 400 = 0$

52. If $(a\cos\theta_i, a\sin\theta_i)$; i = 1, 2, 3 represent the vertices of an equilateral triangle inscribed in a circle, then

(A) $\cos\theta_1 + \cos\theta_2 + \cos\theta_3 = 0$ (B) $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 0$

(C) $\tan\theta_1 + \tan\theta_2 + \tan\theta_3 = 0$ (D) $\cot\theta_1 + \cot\theta_2 + \cot\theta_3 = 0$

53. An isosceles ΔABC is inscribed in a circle $x^2 + y^2 = a^2$ with the vertex A at (a, 0) and the base angles B and C each equal to 75°, then coordinates of an end point of the base are

(A) $\left(\frac{\sqrt{3}a}{2},\frac{a}{2}\right)$ (B) $\left(-\frac{\sqrt{3}a}{2},\frac{a}{2}\right)$ (C) $\left(-\frac{\sqrt{3}a}{2},-\frac{a}{2}\right)$ (D) $\left(\frac{\sqrt{3}a}{2},-\frac{a}{2}\right)$

54. Let x, y be real variable satisfying the $x^2 + y^2 + 8x - 10y - 40 = 0$. Let $a = \max\left\{\sqrt{(x+2)^2+(y-3)^2}\right\}$ and $b = \min\left\{\sqrt{(x+2)^2+(y-3)^2}\right\}$, then

(A) a + b = 18 (B) $a + b = \sqrt{2}$ (C) $a - b = 4\sqrt{2}$ (D) a.b = 73

55. Three sides of a triangle have the equation $L_i = y - m_i x = 0$; i = 1, 2, 3. Then $L_1L_2 + \lambda L_2L_3 + \mu L_3L_1 = 0$, where $\lambda \neq 0$, $\mu \neq 0$, is the equation of the circumcircle of the triangle if

(A) $1 + \lambda + \mu = m_1m_2 + \lambda m_2m_3 + \lambda m_3m_1$ (B) $m_1(1 + \mu) + m_2(1 + \lambda) + m_3(\mu + \lambda) = 0$

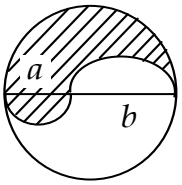
(C) $\frac{1}{m_3}+\frac{1}{m_1}+\frac{1}{m_2} = 1 + \lambda + \mu$ (D) none of these

56. If equation $x^2 + y^2 + 2hxy + 2gx + 2fy + c = 0$ represents a circle, then the condition for that circle to pass through three quadrants only but not passing through the origin is

(A) $f^2 > c$ (B) $g^2 > c$ (C) c > 0 (D) h = 0

pace for rough work

57. The figure shown is the union of a circle and two semi–circles of a diameter 'a' and 'b' all of whose centres are collinear. Then the ratio of the area of the shaded region to that of the unshaded regions is



(A) $\frac{\pi}{ab}$ (B) $\frac{a\pi}{b}$ (C) $\frac{b}{a}$ (D) $\frac{a}{b}$

58. The vertices of a triangle ABC are the points (6, 0), (0, 6) and (7, 7). The equation of the circle inscribed in the triangle is

(A) $x^2 + y^2 – 9x – 9y + 36 = 0$ (B) $x^2 + y^2 – 9x – 9y – 36 = 0$
(C) $x^2 + y^2 – 9x + 9y + 36 = 0$ (D) $x^2 + y^2 + 9x – 9y + 36 = 0$

SECTION 3 (Maximum Marks: 16)

- This section contains **TWO** questions.
- Each question contains two columns, **Column I** and **Column II**
- **Column I** has **four** entries (A), (B), (C) and (D)
- **Column II** has **five** entries (P), (Q), (R), (S) and (T)
- Match the entries in **Column I** with the entries in **Column II**
- One or more entries in **Column I** may match with one or more entries in **Column II**.
- The ORS contains a 4×5 matrix whose layout will be similar to the one shown below:

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

- 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 (Q), (R) and (T), then darken these three bubbles in the ORS. Similarly, for entries (V), (C) and (D).
- Marking entry in Column I.

+2	If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.
0	If none of the bubbles is darkened.
–1	In all other cases.

pace for rough work

59. Let C and C_1 be circles of radii 1 and r > 1 respectively touching the coordinates axes, Column-II gives values of r for the conditions in Column-I

Column I		Column II	
(A)	C passes thorough the centre of C_1	p.	3
(B)	C and C_1 touch each other	q.	$\frac{2+\sqrt{2}}{2}$
(C)	C and C_1 are orthogonal	r.	$2+\sqrt{3}$
(D)	C and C_1 have longest common chord	s.	$3+2\sqrt{2}$

60. Let $x^2 + y^2 + 2gx + 2fy + c = 0$ be an equation of circle

Column I		Column II	
(A)	If circle lie in first quadrant, then	p.	$g < 0$
(B)	If circle lie above x-axis, then	q.	$g > 0$
(C)	If circle lie on the left of y-axis, then	r.	$g^2 - c < 0$
(D)	If circle touches positive x-axis and does not intersect y-axis, then	s.	$c > 0$

pace for rough work

FIITJEE RET – 3

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2015 (P1)_SET–B

DATE: 25.06.2018

ANSWERS

PHYSICS

1.	**4**	2.	**2**	3.	**6**	4.	**2**
5.	**0**	6.	**8**	7.	**5**	8.	**7**
9.	**C**	10.	**A,B,C**	11.	**A,B**	12.	**B,C**
13.	**A,B,D**	14.	**C**	15.	**A,D**	16.	**A,B,D**
17.	**B**	18.	**C**	19.	**A → p, q; B → p, q; C → p, q, s; D → r, s**		
20.	**A → q; B → p; C → r; D → t**						

CHEMISTRY

21.	**3**	22.	**4**	23.	**5**	24.	**2**
25.	**7**	26.	**4**	27.	**5**	28.	**1**
29.	**A,B,C**	30.	**B,C,D**	31.	**B**	32.	**A**
33.	**A**	34.	**B, C, D**	35.	**A, C, D**	36.	**C**
37.	**A,B,C,D**	38.	**A, C**	39.	**A → q ; B → s ; C → p ; D → r**		
40.	**A → q ; B → r ; C → p ; D → s**						

MATHEMATICS

41.	**1**	42.	**0**	43.	**9**	44.	**5**
45.	**6**	46.	**8**	47.	**1**	48.	**9**
49.	**AD**	50.	**AD**	51.	**BD**	52.	**AB**
53.	**BC**	54.	**ACD**	55.	**AB**	56.	**ABCD**
57.	**D**	58.	**A**	59.	**A → q; B → s; C → r; D → p**		
60.	**A → p, r, s; B → r, s; C → q, s; D → p, s**						