FIITJEE RET – 8

EXTENDED_2019

IIT-2015 (P1)

DATE: 17.09.2018

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: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

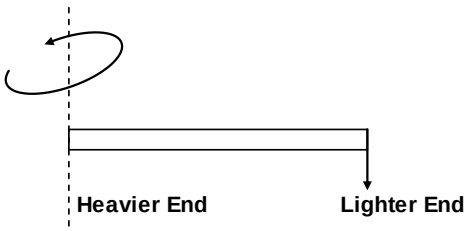
ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐

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.

Question (1-2)

A rod of mass m and length L has a varying linear density given by $\lambda = \lambda_0 x^2$ where λ_0 is constant and 'x' is distance from one end of rod.



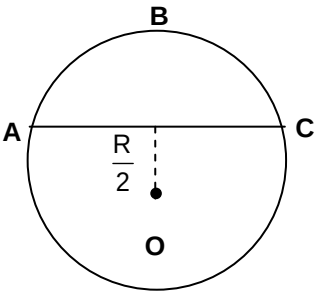
1. The distance between the centre of mass of rod and lighter end is $\frac{aL}{b}$. Then a +b = 0 ?

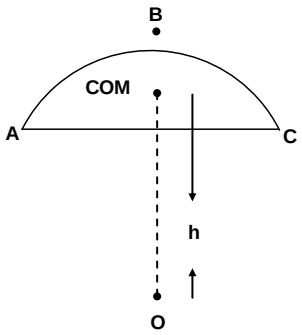
2. About an axis passing through heavier end and perpendicular to length of rod, the rod is rotated with an angular velocity 'ω'. The tension at heavier end of rod is $\frac{nML\omega^2}{8}$. Then n = ?

Space for rough work

Question (3-4)

In the figure, a sphere of radius 'R' is cut by a plane passing through the sphere at a distance of $\frac{R}{2}$ from the centre. The distance between the centre of mass of the separated part (ABC) and centre of sphere is h.



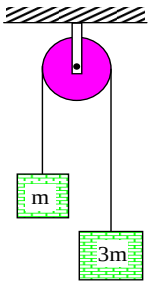


$\left(\int \cos^3 x\,dx = \sin x - \frac{\sin^3 x}{3}\right)$ $\left(\int \sin^3 x\,dx = \frac{\cos^3 x}{3} - \cos x\right)$

3. If sphere is a solid sphere, then h = $\frac{nR}{40}$ sum of digits in number n = ?

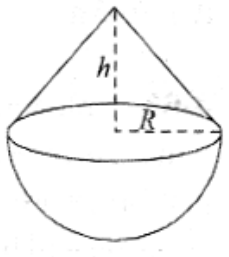
4. If sphere is a hollow sphere then h = $\frac{nR}{8}$ n = ?

5. If the system is released, then the acceleration of the centre of mass of the system is $\frac{g}{n}$ then n = ?



Space for rough work

6. A uniform solid right circular cone of base radius R is joined to a uniform solid hemisphere of radius R and of the same density, so as to have a common face. The centre of mass of the composite solid lies on the common face. If the height of the cone is given by $\sqrt{K_0}$ R then value of K_0 is _____.



7. If the centre of mass of a non uniform rod of length L whose mass per unit length ρ varies as $\rho = \frac{kx^2}{L}$ where k is a positive constant and x is the distance of any point from one end, is given by $\frac{aL}{8}$ then value of a is_____ (take rod to be placed between x = 0 to x = L)

8. Two particles A, B of masses 1Kg and 2Kg move in same direction such that their COM moves with a velocity of 2 m/s and velocity of A is 4 m/s. The K.E of system of particles is (in Joules)

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

(Question – 9-10)

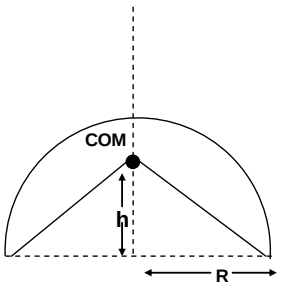
If from a larger body of mass m_1 a smaller body of mass m_2 is removed, then the centre of mass of the leftover part is given by $\vec{R}_{cm} = \frac{m_1\vec{r}_1 - m_2\vec{r}_2}{m_1 - m_2}$ where $\vec{r}_1$ and $\vec{r}_2$ are position vectors of centre of mass m_1 and m_2 respectively

Space for rough work

9. From a solid hemisphere of radius R, another concentric solid hemisphere of radius 'r' is removed such that the centre of mass of the leftover part is situated at a distance of $\frac{5R}{8}$ from the centre then r =

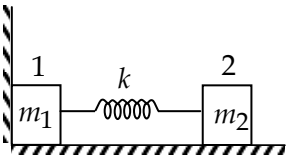
(A) $\frac{7R}{8}$ (B) $\frac{3R}{4}$ (C) $\frac{3+\sqrt{5}}{8}R$ (D) None of these

10. From a solid hemisphere of radius 'R' a cone of radius R and height 'h' is removed such that centre of mass of the leftover part lies at the tip of the cone then h = ?



(A) $\frac{4+\sqrt{7}}{3}R$ (B) $\frac{4-\sqrt{7}}{3}R$ (C) $\frac{3+\sqrt{5}}{8}R$ (D) None of these

11. Two bars of masses m_1 and m_2 are connected by a weight less Spring of Stiffness K as shown in the figure. Bar 2 is shifted to left to a small distance x and released. When bar 1 breaks off the wall



(A) velocity of bar 2 is $x\sqrt{k/m_2}$

(B) velocity of bar 2 is $2x\sqrt{k/m_2}$

(C) velocity of centre of mass of the blocks is $\frac{x\sqrt{km_2}}{m_1+m_2}$

(D) For the entire duration momentum of the system (m_1,m_2 and spring) is conserved

Space for rough work

12. If the external forces acting on a system have zero resultant the centre of mass

(A) must not move (B) must not accelerate (C) may move (D) may accelerate

13. A cubical block of ice of mass m_1 and edge L is placed in a large tray of mass m_2. If the ice melts

(A) centre of mass of " ice plus tray " system doesn't move

(B) Shift in centre of mass of system = $\frac{m_1 L}{2\ m_1 + m_2}$

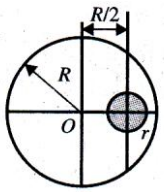
(C) In gravity free space centre of mass of the system moves up

(D) In gravity free space centre of mass of the system remains at rest

14. Find the position of centre of mass of a uniform disc of radius R from which a hole of radius r is cut out. The centre of the hole is at a distance R/2 from the centre of the disc.

a. $\frac{Rr^2}{2(R^2-r^2)}$ towards right of O c. $\frac{2Rr^2}{(R^2+r^2)}$ towards right of O

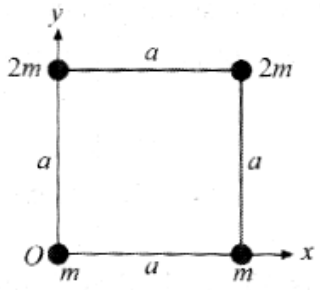
b. $\frac{Rr^2}{2(R^2-r^2)}$ towards left of O d. $\frac{2Rr^2}{(R^2+r^2)}$ towards left of O



15. Four particles of masses m, m, 2 m and 2 m are placed at the four corners of a square of side a as shown in figure. The (x, y) coordinates of the centre of mass are.

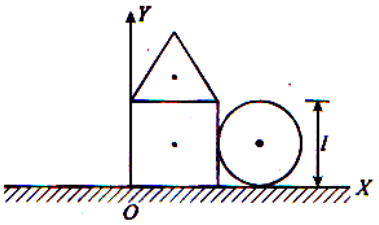
(A) $\left(\frac{a}{2}, 2a\right)$ (B) $\left(\frac{a}{2}, a\right)$

(C) $\left(\frac{a}{2}, \frac{2a}{3}\right)$ (D) $\left(a, \frac{a}{3}\right)$



Space for rough work

16. Three laminar objects of uniform density a square, a disc and an equilateral triangle are placed as shown in the figure. If centre of mass of the system of three objects is given by (x_{cm}, y_{cm}) then



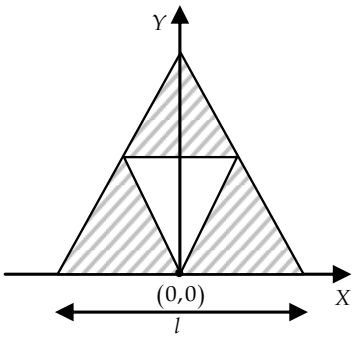
(A) $x_{cm} = \dfrac{\left(3\pi+\sqrt{3}+4\right)\ell}{2\left(4+\pi+\sqrt{3}\right)}$

(B) $x_{cm} = \dfrac{\left(2\pi+\sqrt{3}+4\right)\ell}{2\left(2+\pi+\sqrt{3}\right)}$

(C) $y_{cm} = \dfrac{\left(\pi+2\sqrt{3}+5\right)\ell}{2\left(4+\pi+\sqrt{3}\right)}$

(D) $y_{cm} = \dfrac{\left(2\pi+\sqrt{3}+4\right)\ell}{2\left(2+\pi+\sqrt{3}\right)}$

17. From a equilateral triangular lamina of length l, another lamina whose vertices are midpoints of the bigger lamina is removed. Then COM of the remaining sheet is at



(A) a distance of $\dfrac{l}{2}$ from origin

(B) a distance of $\dfrac{\sqrt{3}}{4}l$ from origin

(C) a distance of $\dfrac{\sqrt{3}}{4}l$ from vertex

(D) a distance of $\dfrac{l}{2\sqrt{3}}$ from origin

Space for rough work

18. Two particles of equal mass are projected simultaneously from the roof of a tower of height 20m with same speed 20 m/s, one horizontally and the other vertically upwards. Choose the correct alternative(s)

(A) the acceleration of centre of mass is g/2 downward

(B) the acceleration of centre of mass is 2g downward

(C) maximum height of centre of mass from the ground is 25 m

(D) maximum height of centre of mass from the ground is 40 m

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

19. In all the following cases, a person inside a cabin is holding a small ball of mass 'm' connected with a rope of length 'ℓ' to a nail fixed to the cabin. Initially the ball is exactly vertically below the nail(in all the cases) . In each of the following cases, find out what minimum velocity should man impart the ball so that it completes a circular motion in vertical plane

Column – I		Column – II	
(A)	Cabin is accelerating downwards at a rate $\frac{g}{5}$	(p)	$\sqrt{6g\ell}$
(B)	Cabin is accelerating horizontally at a rate $\sqrt{3}g$	(q)	$\sqrt{2g\ell}$
(C)	Cabin is accelerating down on a smooth plane of inclination 60^0	(r)	$\sqrt{\sqrt{3}g\ell}$
(D)	Cabin is stationary but completely filled with a liquid whose density is $\frac{1}{5}$th of density of ball	(s)	$\sqrt{4g\ell}$
Note:	(Liquid exerts buoyant force in the vertically upward direction and its magnitude is given by F= W $\frac{\sigma}{\rho}$, where W is weight of the object immersed, σ is the density of liquid and ρ is the density of the object) Note: (In case B and C , cabin acceleration vector lies in the plane of circle)	(t)	None of these

Space for rough work

20. A small object of mass 0.5 kg is attached to an end of a massless 2 m long rope. It is rotated under gravity in a vertical circle with the other end of the rope being at the centre of the circle. The motion is started from the lowest point. **Match column I and II**

COLUMN – I		**COLUMN - II**	
(A)	If the speed of the object at lowest point is 3.5 m/s	(p)	there will be some point on the circle at which speed of the object is zero but tension in the rope is not zero.
(B)	If the speed of the object at lowest point is 8 m/s	(q)	there will be some point on the circle at which tension in the rope is zero but speed of the object is not zero.
(C)	If the maximum tension in the rope is 15 N	(r)	the object will be able to reach the highest point
(D)	If the maximum tension in the rope is 30 N	(s)	none of these

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. Solid ammonia carbamate dissociates to give ammonia and CO_2 as follows

$$NH_2COONH_4(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$$

At equilibrium, ammonia is added such that partial pressure of NH_3 now equals the original total pressure. Calculate the ratio of the total pressure to the original total pressure is $\frac{x}{y}$. Then x – y.

22. For the reaction $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$, the value of K_c at 800°C is 2. When the equilibrium concentrations of both the reactants is 0.5 mol., What is the value of K_p at the same temperature

Space for rough work

23. For the equilibrium $AB\ g \rightleftharpoons A\ g + B\ g$, at a given temperature $\frac{1}{3}rd$ of AB is dissociated, then $\frac{P}{K_p}$ will be numerically equal to.....

24. In the dissociation of AB_2 as $AB_2(g) \rightleftharpoons AB(g) + B(g)$, the equilibrium concentration of AB_2 is 400 mm and equilibrium constant is 100 mm. The initial concentration of AB_2 was

25. Consider the following constant is

$A + B \rightleftharpoons E$, $K_c = 6$

$2B + C \rightleftharpoons 2D$ $K_c = 4$

What will be the equilibrium constant (K_c) for the following reaction

$A + D \rightleftharpoons E + C$

26. The radius of Ag^+ ion is 126 pm and that of I^- ion is 216 pm. The co-ordination number of Ag^+ ion is

27. Number of octahedral voids in HCP unit cell is _____

28. In a face centered cubic arrangement of A and B atoms, whose B atoms are at the corner of the unit cell and A-atoms at the face centers. One of the A-atoms is missing from one of the faces in the unit cell. The simplest formula of the compound is A_xB_y then x+y is?

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. For the gas phase reaction

$C_2H_4 + H_2 \rightleftharpoons C_2H_6,\ \Delta H^0 = -136.8\ kJ\ mol^{-1}$

Carried out in a vessel , the equilibrium concentration of C_2H_4 can be increased by
(A) increasing temperature
(B) decreasing the pressure
(C) removing some H_2
(D) adding some C_2H_6

30. In the three step endothermic reaction

$X_2(g) + Y_2(g) \overset{\text{Step-I}}{\rightleftharpoons} 4Z(g) \overset{\text{Step-II}}{\rightleftharpoons} 3P(g) \overset{\text{Step-III}}{\rightleftharpoons} 2Q(g)$

then which of the following statement(s) is/are correct?
(A) Step-I is favoured by high temperature and low pressure
(B) Step-II is favoured by high temperature and high pressure
(C) Step-III is favoured by high pressure and high temperature
(D) None of these

31. $N_2 + O_2 \rightleftharpoons 2NO, K_1; \left(\frac{1}{2}\right)N_2 + \left(\frac{1}{2}\right)O_2 \rightleftharpoons NO, K_2;$

$2NO \rightleftharpoons N_2 + O_2, K_3; NO \rightleftharpoons \left(\frac{1}{2}\right)N_2 + \left(\frac{1}{2}\right)O_2, K_4$

Correct relation(s) between K_1, K_2, K_3 and K_4 is/are :
(A) $K_1 \times K_3 = 1$
(B) $\sqrt{K_1} \times K_4 = 1$
(C) $\sqrt{K_3} \times K_2 = 1$
(D) None of these

Space for rough work

32. For the reaction, $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$, the forward reaction at constant temperature is favoured by :
(A) introducing an inert gas at constant volume
(B) introducing chlorine gas at constant volume
(C) introducing an inert gas at constant pressure
(D) increasing the volume of the container .

33. Which of the following statements are true?
(A) antiferromagnetism is due to the alignment of individual magnetic moments in opposite direction in a compensatory way
(B) Fe, Co and Ni are ferromagnetic
(C) Frenkel defect is dislocation defect.
(D) on heating the coordination number of a crystal will increase

34. Tetrahedral voids are present in
(A) hexagonal close packing (B) cubic close packing
(C) body centred cubic (D) simple cubic

35. A solid is made of two elements x and z. The atoms 'z' are in CCP arrangement while the atoms 'x' occupy all the tetrahedral sites. What is the formula of the compound.
(A) xz (B) xz_2 (C) x_2z (D) x_2z_3

36. Which of the following statements are true?
(A) In Na_2O structure, the coordination number of O^{2-} is 8.
(B) the % void space in ccp is 26%
(C) Frenkel defect is dislocation defect.
(D) HCP unit cell has 6 tetrahedral voids

37. Select correct statements.
(A) the coordination number (C.N.) of cation occupying a tetrahedral void is 4
(B) the C.N. of cation occupying a octahedral void is 6
(C) in Frenkel defect, density of the lattice decreases
(D) in Frenkel defect, density of the lattice increases

38. Which is/are amorphous solid(s) ?
(A) Rubber (B) Graphite (C) Glass (D) Plastic

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)	$H_2(g)+I_2(g)\rightleftharpoons 2HI(g)$	(p)	Unaffected by inert gas addition
(B)	$CaCO_3(s)\rightleftharpoons CaO(s)+CO_2(g)$	(q)	Forward shift by rise in pressure and backward shift by inert gas addition
(C)	$N_2(g)+3H_2(g)\rightleftharpoons 2NH_3(g)$	(r)	Unaffected by increase in pressure
(D)	$PCl_3(g)\rightleftharpoons PCl_3(g)+Cl_2(g)$	(s)	Backward shift by rise in pressure and forward shift by inert gas addition

40.

Column – I		Column – II	
(A)	CsCl	(p)	Anion occupies HCP
(B)	CaF_2	(q)	Cation occupies body centre
(C)	ZnS (wurtzite)	(r)	2 : 1 stoichiometry
(D)	Na_2O	(s)	Fluorite structure

Space for rough work

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. A secant OPQ is drawn through the centre O(0, 0) of 2 concentric circles of radii 'a' and 'b' (a < b) to meet the circles in P and Q. Lines through P parallel to y-axis and through O parallel to x-axis meet at point R. The locus of 'R' is an ellipse with eccentricity 'e' whose foci lie on the inner circle. Then the value of $2\left(\sqrt{3}e\right)^2$ is

42. If e be the eccentricity of the ellipse $4(x - 2y + 1)^2 + 9(2x + y + 2)^2 = 25$, then the value of $\frac{6}{\sqrt{5}}e$ must be

43. The orbit of the earth is an ellipse with eccentricity $\frac{1}{60}$ with the sun at one focus the major axis being approximately 186×10^6 miles in length. If the shortest and longest distances of the earth from the sum are $\lambda \times 10^5$ miles and $\mu \times 10^5$ miles, then the value of $\frac{\lambda + \mu}{620}$ must be

44. The equation of the ellipse referred to its centre whose minor axis is equal to the distance between the foci and whose latusrectum is 10 is $mx^2 + ny^2 = 100$, when $m, n \in N$, then the value of $m^2 + n^2$ must be

45. If $\int (x^9 + x^6 + x^3)(2x^6 + 3x^3 + 6)^{1/3}\,dx = \frac{1}{a}(2x^9 + 3x^6 + 6x^3)^{4/3} + c$, then the value of $\frac{a}{12}$ must be

46. If $\int\left(\sqrt{\tan x} + \sqrt{\cos x}\right)dx = a\tan^{-1}\left(\frac{\tan x - 1}{\sqrt{b\tan x}}\right) + c$, then the value of $a^4 + b$ must be

47. If $\int\left(\frac{\cos 8x - \cos 7x}{1 + 2\cos 5x}\right)dx = \frac{\sin 3x}{a} - \frac{\sin 2x}{b} + c$, then the value of $(a^b)^4$ must be

48. If $\int \sin 4x \cdot e^{\tan^2 x} = a\cos^b x \cdot e^{\tan^2 x} + c$, then the value of $a^{\sqrt{b}}$ must be

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

49. Let $\int \frac{x^{1/2}}{\sqrt{(1-x^3)}}\,dx = \frac{2}{3}$ gof (x) + c, then

(A) f(x) = $\sqrt{x}$ (B) f(x) = $x^{3/2}$ (C) f(x) = $x^{2/3}$ (D) g(x) = $\sin^{-1}x$

50. If $\int$ cosec 2x dx = f{g(x)} + c, then

(A) range of g(x) = $(-\infty, \infty)$ (B) domain of f(x) = $(-\infty, \infty) - \{0\}$

(C) $g'(x) = \sec^2 x$ (D) $f'(x) = \frac{1}{x}$ for all $x \in (0, \infty)$

51. A primitive of sin 6x is

(A) $\frac{1}{3}(\sin^6 x - \sin^3 x) + c$ (B) $-\frac{1}{3}\cos^2 3x + c$

(C) $\frac{1}{3}\sin^2 3x + c$ (D) $\frac{1}{3}\sin\left(3x+\frac{\pi}{7}\right)\sin\left(3x-\frac{\pi}{7}\right)+c$

52. If $f(x) = \lim_{n\to\infty} e^{x\tan\left(\frac{1}{n}\right)\ln\left(\frac{1}{n}\right)}$ and $\int \frac{f(x)}{\sqrt[3]{(\sin^{11} x\cos x)}}\,dx = g(x) + c$, then

(A) $g\left(\frac{\pi}{4}\right) = \frac{3}{2}$ (B) g(x) is continuous for all x

(C) $g\left(\frac{\pi}{4}\right) = -\frac{15}{8}$ (D) g(x) is non differentiable at infinitely many points

Space for rough work

53. If $\int\left(\cos^{-1}x+\cos^{-1}\sqrt{(1-x^2)}\right)dx = Ax + f(x)\sin^{-1}x - 2\sqrt{(1-x^2)} + c \ \forall\ x \in [-1, 0)$, then

(A) f(x) = x (B) f(x) = –2x (C) A = $\frac{\pi}{4}$ (D) A = $\frac{\pi}{2}$

54. If latus rectum of the ellipse $x^2\tan^2\alpha + y^2\sec^2\alpha = 1$ is $\frac{1}{2}$, then α $(0 < \alpha < \pi)$ is equal to

(A) $\frac{\pi}{12}$ (B) $\frac{\pi}{6}$ (C) $\frac{5\pi}{12}$ (D) none of these

55. If the tangent at the point $\left(4\cos\theta, \frac{16}{\sqrt{11}}\sin\theta\right)$ to the ellipse $16x^2 + 11y^2 = 256$ is also a tangent to the circle $x^2 + y^2 – 2x = 15$, then θ equals

(A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$ (C) $-\frac{\pi}{3}$ (D) $\frac{5\pi}{3}$

56. If the tangent to the ellipse $x^2 + 4y^2 = 16$ at the point P(θ) is a normal to the circle $x^2 + y^2 – 8x – 4y = 0$, then θ equals

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$ (C) 0 (D) $-\frac{\pi}{4}$

57. Let F_1, F_2 be two foci of the ellipse and PT and PN be the tangent and the normal respectively to the ellipse at point P, Then

(A) PN bisects $\angle F_1PF_2$ (B) PT bisects $\angle F_1PF_2$
(C) PT bisects angle $(180° – \angle F_1PF_2)$ (D) none of these

58. A tangent to the ellipse $4x^2 + 9y^2 = 36$ is cut by the tangent at the extremities of the major axis at T and T′. The circle on TT′ as diameter passes through the point

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

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.

59. Consider the ellipse $x^2 + 2y^2 = 2$. Let L be the end of the latusrectum in the first quadrant. The tangent at L to the ellipse meets the right side directrix at T. The normal at L meets the major axis at N and the left side directrix at M

Column I		Column II	
(A)	The area of ΔLNT	p.	$\frac{1}{5}$
(B)	The circumradius of ΔLNT	q.	$\frac{1}{\sqrt{2}}$
(C)	The ratio LN : LT	r.	$\frac{3}{4}$
(D)	The ratio LN : NM	s.	$\frac{3}{4\sqrt{2}}$

Space for rough work

60. Match the following

	Column – I		Column – II
a)	If $\int x^2 d(\tan^{-1} x)dx = x - f(x) + c$ then $f(1)$ is equal to	p)	$\frac{1}{8}$
b)	If $\int \sqrt{1+2\tan x(\tan x+\sec x)}\,dx = a\log\left\lvert\cos\frac{x}{2}-\sin\frac{x}{2}\right\rvert + c$ then a is equal to $(0 < x < \pi/2)$	q)	–2
c)	If $\int x^2 e^{2x} dx = e^{2x} f(x) + c$, then the minimum value of $f(x)$ is	r)	0
d)	If $\int \frac{(x^4+1)}{x(x^2+1)^2}dx = a\log\lvert x\rvert + \frac{b}{x^2+1} + c$ then $a-b$ is equal to	s)	$\frac{\pi}{4}$

Space for rough work

FIITJEE RET – 8

EXTENDED_2019

IIT-2015 (P1)

DATE: 17.09.2018

ANSWERS

PHYSICS

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

CHEMISTRY

21.	**4**	22.	**2**	23.	**8**	24.	**6 (BONUS)**
25.	**3**	26.	**6**	27.	**6**	28.	**7**
29.	**A, B, C, D**	30.	**A, B, C**	31.	**A, B, C**	32.	**C, D**
33.	**A, B, C**	34.	**A, B**	35.	**C**	36.	**A, B, C**
37.	**A, B**	38.	**A, C, D**				
39.	**A → p, r ; B → s ; C → q ; D → s**						
40.	**A → q ; B → s ; C → p ; D → r**						

MATHEMATICS

41.	**3 (BONUS)**	42.	**2**	43.	**3**	44.	**5**
45.	**2**	46.	**6 (BONUS)**	47.	**9 (BONUS)**	48.	**4**
49.	**BD**	50.	**ABC (BONUS)**	51.	**BCD**	52.	**CD**
53.	**BD**	54.	**AC**	55.	**ACD**	56.	**AC**
57.	**AC**	58.	**ABD**	59.	**A → s; B → r; C → q; D → p**		
60.	**A → s; B → q; C → p; D → r**						