FIITJEE RET – 8

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2015 (P1)_SET–A

DATE: 13.08.2018

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.: ☐☐☐☐☐☐☐☐☐☐

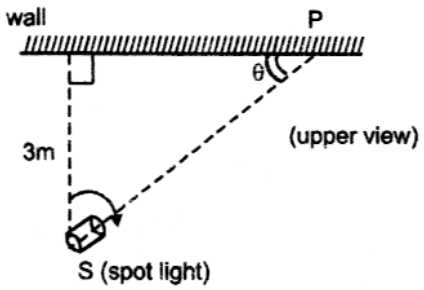
PAPER–I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 32)

- 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 coin placed on a rotating turntable just slips if it is placed at a distance of 16 cm from the centre. If the angular velocity of the turntable is doubled, it will just slip at a distance of n cm. Find **n**.

2. The disk in a CD player does not rotate at a constant angular speed, but spins at a rate which is decided by a control unit so that the linear speed of the track being read is constant. The laser beam used to read the data on the disk starts at an inner radius of 5 cm and continues to read until reaching an outer radius of 10 cm. If the disk rotates at 600 rev / min at the start, be its rotation rate at the end is 100 x n (rev / min). Find n.

3. A spot light S rotates in a horizontal plane with a constant angular velocity of 0.1 rad/s. The spot of light P moves along the wall at a distance 3m. The velocity of the spot P when $\theta = 45^0$ is $\frac{n}{10}$ m/s. Find **n**.

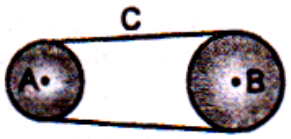


4. A particle moves clockwise in circle of radius 1 m with centre at (x,y) = (1m,0). It starts at rest from the origin at time t =0. Its speed increases at the constant rate of $\left(\frac{\pi}{2}\right)$ m/s^2. If the net acceleration at t =2 sec is $\frac{\pi}{2}\sqrt{\left(1+N\pi^2\right)}$ m/s^2 then what is the value of **N** ?

Space for rough work

5. A car is travelling along a flyover bridge which is a part of vertical circle of radius 10 m. At the highest point of it if the normal reaction on the car is half of its weight, the speed of car is N m/s. Find **N**.

6. Wheel A of radius r_A= 10 cm is coupled by a belt C to another wheel of radius r_B= 25 cm as in the figure. The belt does not slip. At time t =0 Wheel A increases it's angular speed from rest a uniform rate of $\pi/2$ rad/sec^2 . The time in which wheel B attains a speed of 120 rpm (wheel are fixed) is 5 x n(sec). Find n.



7. The blades of an aeroplane propeller are 2 m long and rotate at 300 rpm. If the Linear velocity of a point on the blades 0.5 m from the tip of the blades is $\left(\frac{5\pi}{2}\times n\right)$m/s . Find n.

8. A particle is moving in a circle of radius R with constant speed. The time period of particle is T = 1 second. In a time t = T / 6, if the difference between average speed and magnitude of average velocity of the particle is 2m/sec, if the radius of the circle (in metres) is $\frac{1}{\pi-n}$. Find n.

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. Let a_r and a_t represent radial and tangential accelerations. The motion of a particle may be circular if(assume that only momentary rest is allowed)
(A) $a_r = a_t = 0$ (B) $a_r = 0$ and $a_t \neq 0$ (C) $a_r \neq 0$ and $a_t = 0$ (D) $a_r \neq 0$ and $a_t \neq 0$

10. For a curved track of radius R, banked at angle θ:
(A) A vehicle moving with a speed $v_0 = \sqrt{Rg\tan\theta}$ is able to negotiate the curve without calling friction into play at all
(B) A vehicle is moving with any speed $v > v_0$ is able to negotiate the curve with calling friction into play.
(C) A vehicle is moving with any speed $v < v_0$ must also have the force of friction into play
(D) The minimum value of the angle of banking for a vehicle parked on the banked road can stay without slipping, is given by $\theta = \tan^{-1}\mu_s$ (μ_s = Coefficient of Static friction)

Space for rough work

11. Which of the following statements is/are incorrect?

(A) when a person walks on a rough surface the frictional force exerted by the surface on the person is opposite to the direction of his motion.

(B) we can predict the direction of motion of a body from the direction of the force acting on it.

(C) a body is said to be in translational equilibrium if no net force acting on the body

(D) in case of non-uniform circular motion angle between velocity and acceleration may be constant.

12. A heavy particle is tied to the end A of a string of length 1.6 m. Its other end O is fixed. It revolves as conical pendulum with the string making 60^0 with vertical. Then ($g=9.8\ m/s^2$)

(A) its period of revolution is $\frac{4\pi}{7}$sec

(B) the tension in the string is double the weight of the particle

(C) the speed of the particle = $= 2.8\sqrt{3}\ m/s$

(D) the centripetal acceleration the particle is $9.8\sqrt{3}\,m/s^2$

13. A car of mass M is traveling on a horizontal circular path of radius r. At an instant its speed is v and tangential acceleration is a

(A) The acceleration of the car is towards the centre of the path

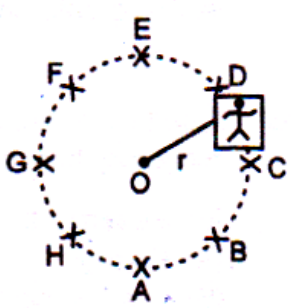
(B) The magnitude of the frictional force on the centre is greater than $\frac{mv^2}{r}$

(C) The friction coefficient between the ground and the car is not less than a / g.

(D) The friction coefficient between the ground and the car is $\mu = \tan^{-1}\frac{v^2}{g}$

Space for rough work

14. A machine in an amusement park, consists of a cage at the end of one arm, hinged at O. The cage revolves along a vertical circle of radius r (ABCDEFGH) about its hinge O, at constant linear speed $v = \sqrt{gr}$. The cage is so attached that the man of weight 'w' standing on a weighing machine, inside the cage, is always vertical. Then which of the following is / are correct



(A) the reading of his weight on the machine is the same at all positions

(B) the weight reading at A is greater then the weight reading at E by 2 w.

(C) the weight reading at G = w

(D) the ratio of the weight reading at E to that at A = 0

15. Assuming the motion of Earth around the sun as a circular orbit with a constant speed of 30 km/s.

(A) The average velocity of the earth during a period of 1 year is zero
(B) The average speed of the earth during a period of 1 year is zero
(C) The average acceleration during first 6 months of the year is zero
(D) The instantaneous acceleration of the earth points towards the sun.

16. A car of mass m attempts to go on the circular road of radius r, which is banked for a speed of 36 km/hr. The friction coefficient between the tyre and the road is negligible

(A) The car cannot make a turn without skidding

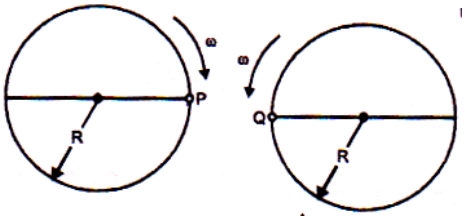
(B) If the car turns at a speed less than 36 km / hr , it will slip down

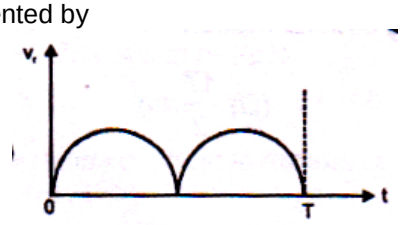
(C) If the car turns at the constant speed of 36 km/hr, the force by the road on the car is equal to $\frac{mv^2}{r}$

(D) If the car turns at the correct of 36 km/hr, the force by the road on the car is greater than mg as well as greater than $\frac{mv^2}{r}$

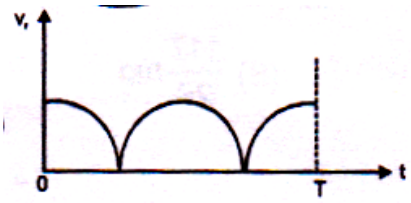
Space for rough work

17. Two identical discs of same radius R are rotating about their axes in opposite directions with the same constant angular speed ω. The disc are in the same horizontal plane. At time t =0, the point P and Q are facing each other as shown in the figure. The relative speed between the two points P and Q, V_r as function of time is best represented by

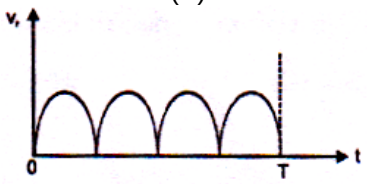




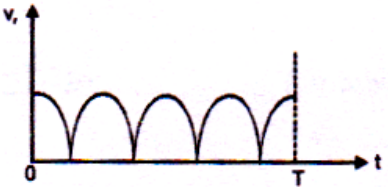
(A)



(B)

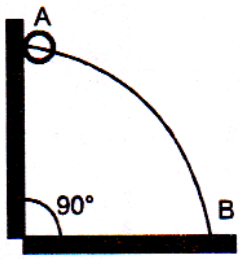


(C)



(D)

18. A wire, which passes through the hole is small bead, in the form of quarter of a circle. The wire is fixed vertically on ground as shown in the figure. The bead is released from the near the top of the wires and it slides along the wire without friction. As the bead moves from A to B, the force it applies on the wire is



(A) always radially outwards
(B) always radially inwards
(C) radially outwards initially and radially inwards later
(D) radially inwards initially and radially outwards later.

Space for rough work

SECTION 3 (Maximum Marks: 16)

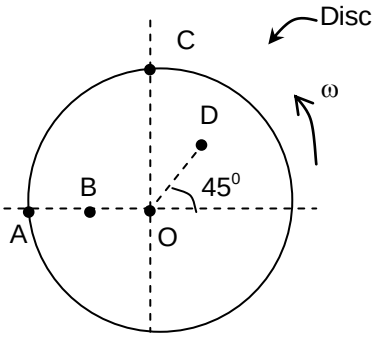
- This section contains **TWO** questions.
- Each question contains two columns, **Column I** and **Column II**
- **Column I** has **four** entries (A), (B), (C) and (D)
- **Column II** has **five** entries (P), (Q), (R), (S) and (T)
- Match the entries in **Column I** with the entries in **Column II**
- 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. A disc of radius R = 10m is rotating in horizontal plane with angular velocity ω = 1 rad /s about its center O. Points A,B,C,D are marked on the disc., then match the column I with column II (magnitude is given is SI units)

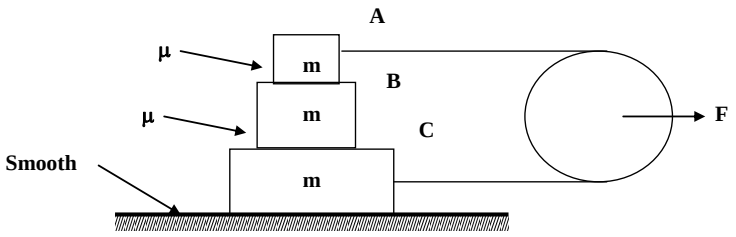
$$OB = OD = \frac{R}{2}$$



Column – I			Column – II	
(A)	V_{BO}	(speed of B w.r.t O)	(p)	1
(B)	ω_{CA}	(Angular velocity of C w.r.t A)	(q)	$\frac{1}{2}$
(C)	ω_{DA}	(Angular velocity of D w.r.t A)	(r)	$5\sqrt{5}$
(D)	V_{BC}	(speed of B w.r.t C)	(s)	5
			(t)	None

Space for rough work

20. Three blocks A,B and C of equal mass m are rest, as shown in fig. The ground is smooth and the coefficient of friction between blocks A and B and blocks B and C is μ. Block A and C are attached with a pulley by the help of a massless string. Now pulley is pulled with an external force F. Match the given situation (in column - I) with the magnitude of F (in column - II)



Column – I		Column – II	
(A)	F_{max} so that all the blocks move together	(p)	9 μmg
(B)	Sliding between blocks A and B starts if F is more than	(q)	6 μmg
(C)	Sliding between blocks B and C starts if F is more than	(r)	10 μmg
(D)	Relative motion between all the three blocks will be observed when F is greater than	(s)	12 μmg
		(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.
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  - **+4** If the bubble corresponding to the answer is darkened.
  - **0** In all other cases.

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21. The lattice energy of LiF is approximately -10^x kJ/mol find x.
Given that enthalpy of
(i) Sublimation is 155.2 kJ/mol
(ii) dissociation of ½ moles of F_2 is 75.3 kJ
(iii) Ionization is 520 kJ mol^{-1}
(iv) Electron gain enthalpy is –333 kJ mol^{-1}
(v) $\Delta_f H$ is –594.1 kJ mol^{-1}

22. How many of the following are ionic compounds ?
CO_2, H_2O, KCl, CsF, NH_3, HCl, AlF_3, HI

23. The coordination number of Na^+ ion in NaCl is

24. Equivalent mass of an element M is 3. Vapour density of its volatile chloride is 77. Atomic mass of the element is 4x. What is x ?

25. 2g of metallic chloride was quantitatively converted into corresponding oxide which weighed 0.8g. The equivalent weight of the element is approximately 2x. What is x.

26. An oxide of a metal M contains 20% of oxygen by weight. If the formula of its chloride is MCl_2, the atomic mass of M is 8x. What is x.

27. The n–factor of P_4 in $P_4 + 5O_2 \rightarrow P_4O_{10}$ is 5x. The x is

28. The volume in mL of 0.1 M $KMnO_4$ in acid medium needed to oxidize one gm of FeC_2O_4 is approximately 7x. The value of x is (Fe = 56)

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.
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  - **0** If none of the bubbles is darkened.
  - **–2** In all other cases

29. The favourable condition for the formation of ionic bond is
(A) High ionization energy of atom forming cation
(B) Low electron gain enthalpy of atom forming anion
(C) High electro negativity difference
(D) Low ionization energy of atom forming cation.

30. Which of the following has elelctrovalent bond.
(A) HCl (B) AlF_3 (C) CH_4 (D) $SrCl_2$

31. AgCl is insoluble in water, because of
(A) High Lattice energy (B) Low Lattice energy
(C) High Hydration energy (D) Low hydration energy

32. Lattice energy of an ionic compound depends on
(A) charge on the ion (B) size of the ion
(C) packing of the ion (D) coordination number of the ion

33. Which of the following ion(s)s is/are more hydrated than Ca^{2+} ion in water ?
(A) Al^{3+} (B) Be^{2+} (C) K^{+} (D) Mg^{2+}

34. The lattice energy of NaCl is smaller than
(A) KCl (B) RbCl (C) $MgCl_2$ (D) $AlCl_3$

35. Which among the following is/are oxidation process/es?
(A) $SO_3^{-2} \rightarrow SO_4^{2-}$ (B) $MnO_2 \rightarrow MnO_4^{-}$
(C) $[Fe(CN)_6]^{-4} \rightarrow [Fe(CN)_6]^{-3}$ (D) $NO_3^{-} \rightarrow NH_4^{+}$

Space for rough work

36. When a solution of KIO_3 is heated with oxalic acid according to following equation $KIO_3 + H_2C_2O_4 \rightarrow K_2C_2O_4 + CO_2 + I_2 + H_2O$ then [At. Wt. of I = 127).
(A) 3 moles of oxalic acid are consumed per mole of KIO_3
(B) The equivalent weight of KIO_3 is 42.8
(C) In the reaction KIO_3 is oxidized to I_2
(D) 6 moles of CO_2 are produced per mole of KIO_3.

37. A mixture of 20 mL of 0.2 M NaOH and 15 mL of 0.1 M $Ba(OH)_2$ has the same number of equivalents as
(A) 14 mL of 0.5 M HCl (B) 14 mL of 0.5 M H_2SO_4
(C) 56 mL of 0.125 M KOH (D) 28 mL of 0.25 M $Ba(OH)_2$

38. By redox reactions I^- ion may be converted into I_2 or I^+. The equivalent weights of iodide ion are. (At. Wt. of I = 127)
(A) 127 (B) 254 (C) 63.5 (D) 42.33

SECTION 3 (Maximum Marks: 16)

- This section contains **TWO** questions.
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- **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

39.

Column – I		Column – II	
(A)	$\underline{P_2H_4} \rightarrow PH_3 + P_4H_2$	(p)	$E = \frac{3M}{4}$
(B)	$\underline{I_2} \rightarrow I^- + IO_3^-$	(q)	$E = \frac{3M}{5}$
(C)	$MnO_4^- + Mn^{+2} + H_2O \rightarrow \underline{Mn_3O_4} + H^+$	(r)	$E = \frac{15M}{26}$
(D)	$\underline{H_3PO_2} \rightarrow PH_3 + H_3PO_3$	(s)	$E = \frac{5M}{6}$

E = Equivalent weight
M = Molecular weight

40.

Column – I		Column – II	
(A)	Lattice energy	(p)	LE > Hydration energy
(B)	NaCl in water	(q)	LE < hydration energy
(C)	Ionisation energy	(r)	Good conductor
(D)	AgCl in water	(s)	Increases with increase in charge on cation
		(t)	Decreases with increase in charge on cation.

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. Let PQR be a triangle of area Δ with a = 2, b = $\frac{7}{2}$ and c = $\frac{5}{2}$, where a, b and c are the lengths of the sides of the triangle opposite to the angles at P, Q and R respectively, then $\frac{2\sin P - \sin 2P}{2\sin P + \sin 2P} = \frac{k}{16\Delta^2}$, then the value of k is

42. If in ΔABC, AB = 3, BC = 5, CA = 4 and D, E are points on BC such that BD = DE = EC, then the value of tan $\angle$CAE = $\frac{3}{m}$, find the value of m.

43. In ΔABC, if $\angle A = \frac{\pi}{3}$, AD is a median then $b^2 + c^2 + bc = kAD^2$. The value of 'k' is

44. If in a triangle ABC, the median AD and perpendicular AE from vertex A to the side BC divides the angles A into three equal parts, then the value of $\frac{64bc}{3a^2}\cos\frac{A}{3}\sin^2\frac{A}{3}$ is

45. If the angle between the lines joining the origin to the points of intersection of the straight line y = 3x + 2 with the curve $x^2 + 2xy + 3y^2 + 4x + 8y - 11 = 0$ is $\tan^{-1}\left(\frac{k\sqrt{2}}{3}\right)$, then the value of 'k' is

46. In a triangle ABC, $2(a + b + c)(\cos A + \cos B + \cos C) = k\left(a\cos^2\frac{A}{2} + b\cos^2\frac{B}{2} + c\cos^2\frac{C}{2}\right)$, the value of 'k' is

47. The number of values of x in the interval $[0, 5\pi]$ satisfying the equation $3\sin^2 x - 7\sin x + 2 = 0$ is

48. The number of solutions of the equation $\tan x + \sec x = 2\cos x$ lying in the interval $[0, 2\pi]$ is

Space for rough work

SECTION 2 (Maximum Marks: 40)

- This section contains **TEN** questions.
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- 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. If number of solution of $3 \sin y + 12 \sin^3 x = a$ lies on the line $y = 3x$, then
(A) $a \in \{-9, 9\}$ (B) $a \in [-9, 9]$ (C) $a \in (-\infty, -9)$ (D) $a \in (9, \infty)$

50. For the smallest positive values of x and y, the equation $2(\sin x + \sin y) - 2\cos(x - y) = 3$ has a solution, then which of the following is/are true ?
(A) $\sin\left(\frac{x+y}{2}\right) = 1$ (B) $\cos\left(\frac{x-y}{2}\right) = \frac{1}{2}$
(C) number of ordered pairs (x, y) is 2 (D) number of ordered pairs (x, y) is 3

51. The equation $2\sin^3\theta + (2\lambda - 3)\sin^2\theta - (3\lambda + 2)\sin\theta - 2\lambda = 0$ has exactly three roots in $(0, 2\pi)$, then λ can be equal to
(A) 0 (B) 2 (C) 1 (D) –1

52. Which of the following sets can be the subset of the general solution of
$1 + \cos 3x = 2\cos 2x$ $(n \in Z)$?
(A) $n\pi + \frac{\pi}{3}$ (B) $n\pi + \frac{\pi}{6}$ (C) $n\pi - \frac{\pi}{6}$ (D) $2n\pi$

53. The expression $\cos 3\theta + \sin 3\theta + (2\sin 2\theta - 3)(\sin\theta - \cos\theta)$ is positive for all θ in
(A) $\left(2n\pi - \frac{3\pi}{4}, 2n\pi + \frac{\pi}{4}\right), n \in Z$ (B) $\left(2n\pi - \frac{\pi}{4}, 2n\pi + \frac{\pi}{6}\right), n \in Z$
(C) $\left(2n\pi - \frac{\pi}{3}, 2n\pi + \frac{\pi}{3}\right), n \in Z$ (D) $\left(2n\pi - \frac{\pi}{4}, 2n\pi + \frac{3\pi}{4}\right), n \in Z$

Space for rough work

54. Given the base BC = a, of a triangle ABC, the opposite angle A, and the product k^2 of the other two sides, which of the following is/are true

(A) $a \le 2k\sin\frac{A}{2}$ (B) $a \ge 2k\sin\frac{A}{2}$

(C) $b^4 - (a^2 + 2k^2 \cos A)b^2 + k^4 = 0$ (D) $b^4 + (a^2 + 2k^2 \cos A)b^2 + k^2 = 0$

55. If in ΔABC, $a^4 + b^4 + c^4 = 2c^2 (a^2 + b^2)$, then the value of $\angle C$ can be

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

56. If in a ΔABC, $\frac{\cos A + 2\cos C}{\cos A + 2\cos B} = \frac{\sin B}{\sin C}$, then the triangle is

(A) isosceles (B) equilateral (C) right angled (D) scalene

57. The equation of the lines joining the origin to the points of intersection of $3x - 2y = 1$ with $3x^2 + 5xy - 3y^2 + 2x + 3y = 0$ and the angle between them are given by

(A) $9x^2 + 10xy - 9y^2 = 0$ (B) $x^2 + 4xy + y^2 = 0$ (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{3}$

58. Equation $ax^3 - 9x^2y - xy^2 + 4y^3 = 0$ represents three straight lines. If the two of the lines are perpendicular, then a =

(A) –5 (B) 5 (C) 4 (D) –4

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. In ΔABC

Column I		Column II	
(A)	$(a + b + c)(a - b + c) = 3ca$	p.	$\angle A = 30°$
(B)	$a = 5, b = 6, \Delta = 15\sqrt{3}$ sq. units	q.	$\angle A = 45°$
(C)	$a : b : c = 2 : \sqrt{6} : \sqrt{3} + 1$	r.	$\angle C = 60°$
(D)	Perimeter of a triangle ABC is 6 times the arithmetic mean of the sines of its angles; $a = 1$	s.	$\angle B = 60°$

60. Match the following

Column I		Column II	
(A)	The minimum value of $9^9.27^{\cos 2x}.81^{\sin 2x}$	p.	1
(B)	Number of solutions of the equation $\cos^7 x + \sin^4 x = 1, x \in [0, 2\pi]$	q.	2
(C)	Value of a for which the equation $a^2 - 2a + \sec^2\pi(a + x) = 0$ has a solution	r.	3^{13}
(D)	If $\cos(p \sin x) = \sin(p \cos x)$, then the minimum positive value of $\frac{4\sqrt{2}}{\pi}$ p is	s.	4

Space for rough work

FIITJEE RET – 8

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2015 (P1)_SET–A

DATE: 13.08.2018

ANSWERS

PHYSICS

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

CHEMISTRY

21.	**3**	22.	**3**	23.	**6**	24.	**3**
25.	**5**	26.	**8**	27.	**4**	28.	**6**
29.	**C, D**	30.	**B, D**	31.	**A, D**	32.	**A, B**
33.	**A, B, D**	34.	**C, D**	35.	**A, B, C**	36.	**A, B**
37.	**A, C**	38.	**A, C**	39.	**A → s; B → q; C → r ; D → p**		
40.	**A → s; B → q, r; C → s; D → p**						

MATHEMATICS

41.	**9**	42.	**8**	43.	**4**	44.	**2**
45.	**2**	46.	**4**	47.	**6**	48.	**2**
49.	**Bonus**	50.	**ABC**	51.	**ACD**	52.	**BCD**
53.	**AB**	54.	**BC**	55.	**BD**	56.	**Bonus**
57.	**AC**	58.	**BD**	59.	**A → s; B → Bonus; C → q, s; D → p**		
60.	**A → r; B → s; C → p; D → q**						

FIITJEE RET – 8

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2015 (P1)_SET–B

DATE: 13.08.2018

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.: ☐☐☐☐☐☐☐☐☐☐

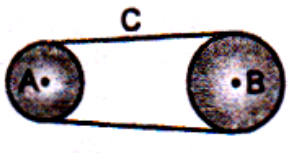
PAPER–I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 32)

- 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 car is travelling along a flyover bridge which is a part of vertical circle of radius 10 m. At the highest point of it if the normal reaction on the car is half of its weight, the speed of car is N m/s. Find **N**.

2. Wheel A of radius r_A= 10 cm is coupled by a belt C to another wheel of radius r_B= 25 cm as in the figure. The belt does not slip. At time t =0 Wheel A increases it's angular speed from rest a uniform rate of $\pi/2$ rad/sec^2 . The time in which wheel B attains a speed of 120 rpm (wheel are fixed) is 5 x n(sec). Find n.



3. The blades of an aeroplane propeller are 2 m long and rotate at 300 rpm. If the Linear velocity of a point on the blades 0.5 m from the tip of the blades is $\left(\frac{5\pi}{2}\times n\right)$m/s . Find n.

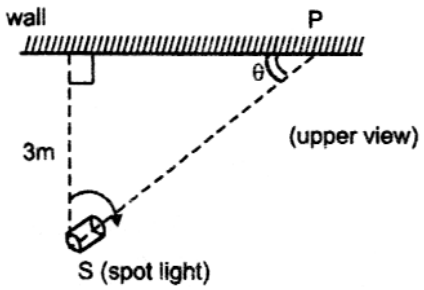
4. A particle is moving in a circle of radius R with constant speed. The time period of particle is T = 1 second. In a time t = T / 6, if the difference between average speed and magnitude of average velocity of the particle is 2m/sec, if the radius of the circle (in metres) is $\frac{1}{\pi - n}$. Find n.

5. A coin placed on a rotating turntable just slips if it is placed at a distance of 16 cm from the centre. If the angular velocity of the turntable is doubled, it will just slip at a distance of n cm. Find **n**.

6. The disk in a CD player does not rotate at a constant angular speed, but spins at a rate which is decided by a control unit so that the linear speed of the track being read is constant. The laser beam used to read the data on the disk starts at an inner radius of 5 cm and continues to read until reaching an outer radius of 10 cm. If the disk rotates at 600 rev / min at the start, be its rotation rate at the end is 100 x n (rev / min). Find n.

Space for rough work

7. A spot light S rotates in a horizontal plane with a constant angular velocity of 0.1 rad/s. The spot of light P moves along the wall at a distance 3m. The velocity of the spot P when $\theta = 45^0$ is $\frac{n}{10}$ m/s . Find **n**.

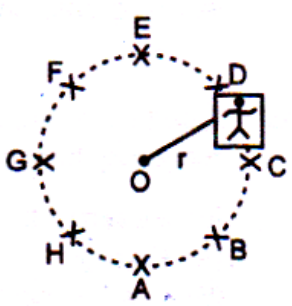


8. A particle moves clockwise in circle of radius 1 m with centre at (x,y) = (1m,0). It starts at rest from the origin at time t =0. Its speed increases at the constant rate of $\left(\frac{\pi}{2}\right)$ m/s^2. If the net acceleration at t =2 sec is $\frac{\pi}{2}\sqrt{\left(1+N\pi^2\right)}$ m/s^2 then what is the value of **N** ?

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. A machine in an amusement park, consists of a cage at the end of one arm, hinged at O. The cage revolves along a vertical circle of radius r (ABCDEFGH) about its hinge O, at constant linear speed $v = \sqrt{gr}$. The cage is so attached that the man of weight 'w' standing on a weighing machine, inside the cage, is always vertical. Then which of the following is / are correct



(A) the reading of his weight on the machine is the same at all positions

(B) the weight reading at A is greater then the weight reading at E by 2 w.

(C) the weight reading at G = w

(D) the ratio of the weight reading at E to that at A = 0

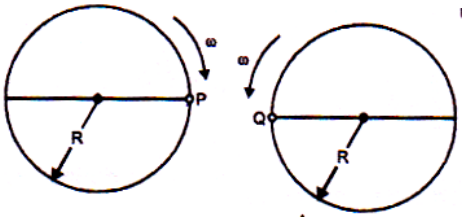
Space for rough work

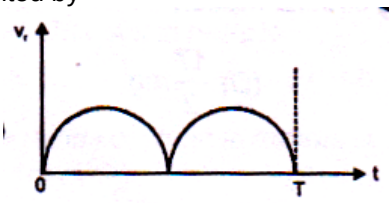
10. Assuming the motion of Earth around the sun as a circular orbit with a constant speed of 30 km/s.

(E) The average velocity of the earth during a period of 1 year is zero
(F) The average speed of the earth during a period of 1 year is zero
(G) The average acceleration during first 6 months of the year is zero
(H) The instantaneous acceleration of the earth points towards the sun.

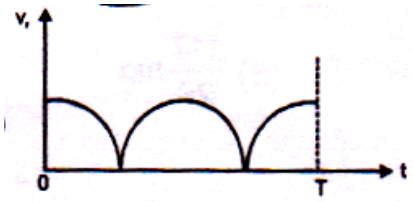
11. A car of mass m attempts to go on the circular road of radius r, which is banked for a speed of 36 km/hr. The friction coefficient between the tyre and the road is negligible
(A) The car cannot make a turn without skidding
(B) If the car turns at a speed less than 36 km / hr , it will slip down
(C) If the car turns at the constant speed of 36 km/hr, the force by the road on the car is equal to $\frac{mv^2}{r}$
(D) If the car turns at the correct of 36 km/hr, the force by the road on the car is greater than mg as well as greater than $\frac{mv^2}{r}$

12. Two identical discs of same radius R are rotating about their axes in opposite directions with the same constant angular speed ω. The disc are in the same horizontal plane. At time t =0, the point P and Q are facing each other as shown in the figure. The relative speed between the two points P and Q, V_r as function of time is best represented by

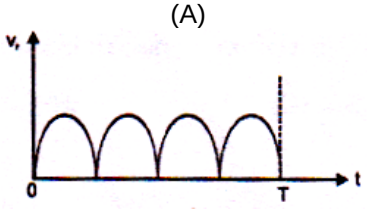




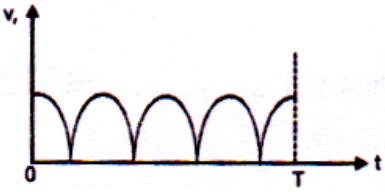
(A)



(B)



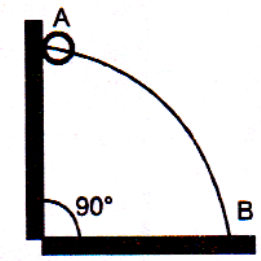
(C)



(D)

Space for rough work

13. A wire, which passes through the hole is small bead, in the form of quarter of a circle. The wire is fixed vertically on ground as shown in the figure. The bead is released from the near the top of the wires and it slides along the wire without friction. As the bead moves from A to B, the force it applies on the wire is



(A) always radially outwards
(B) always radially inwards
(C) radially outwards initially and radially inwards later
(D) radially inwards initially and radially outwards later.

14. Let a_r and a_t represent radial and tangential accelerations. The motion of a particle may be circular if(assume that only momentary rest is allowed)
(A) $a_r = a_t = 0$ (B) $a_r = 0 \text{ and } a_t \neq 0$ (C) $a_r \neq 0 \text{ and } a_t = 0$ (D) $a_r \neq 0 \text{ and } a_t \neq 0$

15. For a curved track of radius R, banked at angle θ:
(A) A vehicle moving with a speed $v_0 = \sqrt{Rg\tan\theta}$ is able to negotiate the curve without calling friction into play at all
(B) A vehicle is moving with any speed $v > v_0$ is able to negotiate the curve with calling friction into play.
(C) A vehicle is moving with any speed $v < v_0$ must also have the force of friction into play
(D) The minimum value of the angle of banking for a vehicle parked on the banked road can stay without slipping, is given by $\theta = \tan^{-1}\mu_s$ (μ_s = Coefficient of Static friction)

16. Which of the following statements is/are incorrect?
(A) when a person walks on a rough surface the frictional force exerted by the surface on the person is opposite to the direction of his motion.
(B) we can predict the direction of motion of a body from the direction of the force acting on it.
(C) a body is said to be in translational equilibrium if no net force acting on the body
(D) in case of non-uniform circular motion angle between velocity and acceleration may be constant.

Space for rough work

17. A heavy particle is tied to the end A of a string of length 1.6 m. Its other end O is fixed. It revolves as conical pendulum with the string making 60^0 with vertical. Then ($g=9.8\ m/s^2$)

(A) its period of revolution is $\frac{4\pi}{7}$sec

(B) the tension in the string is double the weight of the particle

(C) the speed of the particle = $= 2.8\sqrt{3}\ m/s$

(D) the centripetal acceleration the particle is $9.8\sqrt{3}\,m/s^2$

18. A car of mass M is traveling on a horizontal circular path of radius r. At an instant its speed is v and tangential acceleration is a

(A) The acceleration of the car is towards the centre of the path

(B) The magnitude of the frictional force on the centre is greater than $\frac{mv^2}{r}$

(C) The friction coefficient between the ground and the car is not less than a / g.

(D) The friction coefficient between the ground and the car is $\mu = \tan^{-1}\frac{v^2}{g}$

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:

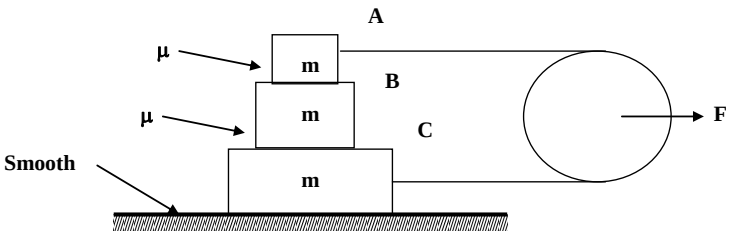
(A)	(P)	(Q)	(R)	(S)	(T)
(B)	(P)	(Q)	(R)	(S)	(T)
(C)	(P)	(Q)	(R)	(S)	(T)
(D)	(P)	(Q)	(R)	(S)	(T)

- 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. Three blocks A,B and C of equal mass m are rest, as shown in fig. The ground is smooth and the coefficient of friction between blocks A and B and blocks B and C is μ. Block A and C are attached with a pulley by the help of a massless string. Now pulley is pulled with an external force F. Match the given situation (in column - I) with the magnitude of F (in column - II)

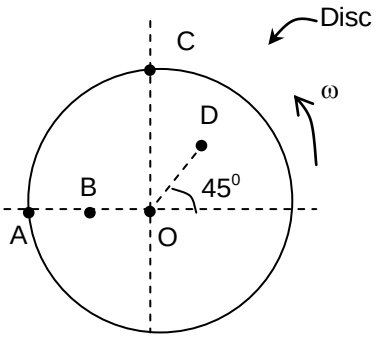


Column – I		Column – II	
(A)	F_{max} so that all the blocks move together	(p)	9 μmg
(B)	Sliding between blocks A and B starts if F is more than	(q)	6 μmg
(C)	Sliding between blocks B and C starts if F is more than	(r)	10 μmg
(D)	Relative motion between all the three blocks will be observed when F is greater than	(s)	12 μmg
		(t)	None

Space for rough work

20. A disc of radius R = 10m is rotating in horizontal plane with angular velocity ω = 1 rad /s about its center O. Points A,B,C,D are marked on the disc., then match the column I with column II (magnitude is given is SI units)

$OB = OD = \frac{R}{2}$



Column – I			Column – II	
(A)	V_{BO}	(speed of B w.r.t O)	(p)	1
(B)	ω_{CA}	(Angular velocity of C w.r.t A)	(q)	$\frac{1}{2}$
(C)	ω_{DA}	(Angular velocity of D w.r.t A)	(r)	$5\sqrt{5}$
(D)	V_{BC}	(speed of B w.r.t C)	(s)	5
			(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. 2g of metallic chloride was quantitatively converted into corresponding oxide which weighed 0.8g. The equivalent weight of the element is approximately 2x. What is x.

22. An oxide of a metal M contains 20% of oxygen by weight. If the formula of its chloride is MCl_2, the atomic mass of M is 8x. What is x.

23. The n–factor of P_4 in $P_4 + 5O_2 \rightarrow P_4O_{10}$ is 5x. The x is

24. The volume in mL of 0.1 M $KMnO_4$ in acid medium needed to oxidize one gm of FeC_2O_4 is approximately 7x. The value of x is (Fe = 56)

25. The lattice energy of LiF is approximately -10^x kJ/mol find x.
Given that enthalpy of
(i) Sublimation is 155.2 kJ/mol
(ii) dissociation of ½ moles of F_2 is 75.3 kJ
(iii) Ionization is 520 kJ mol^{-1}
(iv) Electron gain enthalpy is –333 kJ mol^{-1}
(v) $\Delta_f H$ is –594.1 kJ mol^{-1}

26. How many of the following are ionic compounds ?
CO_2, H_2O, KCl, CsF, NH_3, HCl, AlF_3, HI

27. The coordination number of Na^+ ion in NaCl is

28. Equivalent mass of an element M is 3. Vapour density of its volatile chloride is 77. Atomic mass of the element is 4x. What is x ?

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. The lattice energy of NaCl is smaller than
(A) KCl (B) RbCl (C) $MgCl_2$ (D) $AlCl_3$

30. Which among the following is/are oxidation process/es?
(A) $SO_3^{-2} \rightarrow SO_4^{2-}$ (B) $MnO_2 \rightarrow MnO_4^-$
(C) $[Fe(CN)_6]^{-4} \rightarrow [Fe(CN)_6]^{-3}$ (D) $NO_3^- \rightarrow NH_4^+$

31. When a solution of KIO_3 is heated with oxalic acid according to following equation $KIO_3 + H_2C_2O_4 \rightarrow K_2C_2O_4 + CO_2 + I_2 + H_2O$ then [At. Wt. of I = 127).
(A) 3 moles of oxalic acid are consumed per mole of KIO_3
(B) The equivalent weight of KIO_3 is 42.8
(C) In the reaction KIO_3 is oxidized to I_2
(D) 6 moles of CO_2 are produced per mole of KIO_3.

32. A mixture of 20 mL of 0.2 M NaOH and 15 mL of 0.1 M $Ba(OH)_2$ has the same number of equivalents as
(A) 14 mL of 0.5 M HCl (B) 14 mL of 0.5 M H_2SO_4
(C) 56 mL of 0.125 M KOH (D) 28 mL of 0.25 M $Ba(OH)_2$

33. By redox reactions I^- ion may be converted into I_2 or I^+. The equivalent weights of iodide ion are. (At. Wt. of I = 127)
(A) 127 (B) 254 (C) 63.5 (D) 42.33

34. The favourable condition for the formation of ionic bond is
(A) High ionization energy of atom forming cation
(B) Low electron gain enthalpy of atom forming anion
(C) High electro negativity difference
(D) Low ionization energy of atom forming cation.

Space for rough work

35. Which of the following has elelctrovalent bond.
(A) HCl (B) AlF_3 (C) CH_4 (D) $SrCl_2$

36. AgCl is insoluble in water, because of
(A) High Lattice energy (B) Low Lattice energy
(C) High Hydration energy (D) Low hydration energy

37. Lattice energy of an ionic compound depends on
(A) charge on the ion (B) size of the ion
(C) packing of the ion (D) coordination number of the ion

38. Which of the following ion(s)s is/are more hydrated than Ca^{2+} ion in water ?
(A) Al^{3+} (B) Be^{2+} (C) K^{+} (D) Mg^{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.

Space for rough work

39.

Column – I		Column – II	
(A)	Lattice energy	(p)	LE > Hydration energy
(B)	NaCl in water	(q)	LE < hydration energy
(C)	Ionisation energy	(r)	Good conductor
(D)	AgCl in water	(s)	Increases with increase in charge on cation
		(t)	Decreases with increase in charge on cation.

40.

Column – I		Column – II	
(A)	$\underline{P_2H_4} \rightarrow PH_3 + P_4H_2$	(p)	$E = \frac{3M}{4}$
(B)	$\underline{I_2} \rightarrow I^- + IO_3^-$	(q)	$E = \frac{3M}{5}$
(C)	$MnO_4^- + Mn^{+2} + H_2O \rightarrow \underline{Mn_3O_4} + H^+$	(r)	$E = \frac{15M}{26}$
(D)	$\underline{H_3PO_2} \rightarrow PH_3 + H_3PO_3$	(s)	$E = \frac{5M}{6}$

E = Equivalent weight
M = Molecular weight

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. If the angle between the lines joining the origin to the points of intersection of the straight line $y = 3x + 2$ with the curve $x^2 + 2xy + 3y^2 + 4x + 8y - 11 = 0$ is $\tan^{-1}\left(\frac{k\sqrt{2}}{3}\right)$, then the value of 'k' is

42. In a triangle ABC, $2(a + b + c)(\cos A + \cos B + \cos C) = k\left(a\cos^2\frac{A}{2} + b\cos^2\frac{B}{2} + c\cos^2\frac{C}{2}\right)$, the value of 'k' is

43. The number of values of x in the interval $[0, 5\pi]$ satisfying the equation $3\sin^2 x - 7\sin x + 2 = 0$ is

44. The number of solutions of the equation $\tan x + \sec x = 2\cos x$ lying in the interval $[0, 2\pi]$ is

45. Let PQR be a triangle of area Δ with $a = 2$, $b = \frac{7}{2}$ and $c = \frac{5}{2}$, where a, b and c are the lengths of the sides of the triangle opposite to the angles at P, Q and R respectively, then $\frac{2\sin P - \sin 2P}{2\sin P + \sin 2P} = \frac{k}{16\Delta^2}$, then the value of k is

46. If in ΔABC, AB = 3, BC = 5, CA = 4 and D, E are points on BC such that BD = DE = EC, then the value of $\tan\angle CAE = \frac{3}{m}$, find the value of m.

47. In ΔABC, if $\angle A = \frac{\pi}{3}$, AD is a median then $b^2 + c^2 + bc = kAD^2$. The value of 'k' is

48. If in a triangle ABC, the median AD and perpendicular AE from vertex A to the side BC divides the angles A into three equal parts, then the value of $\frac{64bc}{3a^2}\cos\frac{A}{3}\sin^2\frac{A}{3}$ is

Space for rough work

SECTION 2 (Maximum Marks: 40)

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- 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.
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  - **–2** In all other cases

49. Given the base BC = a, of a triangle ABC, the opposite angle A, and the product k^2 of the other two sides, which of the following is/are true

(A) $a \le 2k\sin\frac{A}{2}$ (B) $a \ge 2k\sin\frac{A}{2}$

(C) $b^4 - (a^2 + 2k^2\cos A)b^2 + k^4 = 0$ (D) $b^4 + (a^2 + 2k^2\cos A)b^2 + k^2 = 0$

50. If in ΔABC, $a^4 + b^4 + c^4 = 2c^2(a^2 + b^2)$, then the value of $\angle C$ can be

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

51. If in a ΔABC, $\frac{\cos A + 2\cos C}{\cos A + 2\cos B} = \frac{\sin B}{\sin C}$, then the triangle is

(A) isosceles (B) equilateral (C) right angled (D) scalene

52. The equation of the lines joining the origin to the points of intersection of $3x - 2y = 1$ with $3x^2 + 5xy - 3y^2 + 2x + 3y = 0$ and the angle between them are given by

(A) $9x^2 + 10xy - 9y^2 = 0$ (B) $x^2 + 4xy + y^2 = 0$ (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{3}$

53. Equation $ax^3 - 9x^2y - xy^2 + 4y^3 = 0$ represents three straight lines. If the two of the lines are perpendicular, then a =

(A) –5 (B) 5 (C) 4 (D) –4

54. If number of solution of $3\sin y + 12\sin^3 x = a$ lies on the line $y = 3x$, then

(A) $a \in \{-9, 9\}$ (B) $a \in [-9, 9]$ (C) $a \in (-\infty, -9)$ (D) $a \in (9, \infty)$

Space for rough work

55. For the smallest positive values of x and y, the equation 2 (sin x + sin y) – 2 cos (x – y) = 3 has a solution, then which of the following is/are true ?

(A) $\sin\left(\frac{x+y}{2}\right)=1$ (B) $\cos\left(\frac{x-y}{2}\right)=\frac{1}{2}$

(C) number of ordered pairs (x, y) is 2 (D) number of ordered pairs (x, y) is 3

56. The equation $2\sin^3\theta + (2\lambda - 3)\sin^2\theta - (3\lambda + 2)\sin\theta - 2\lambda = 0$ has exactly three roots in $(0, 2\pi)$, then λ can be equal to

(A) 0 (B) 2 (C) 1 (D) –1

57. Which of the following sets can be the subset of the general solution of $1 + \cos 3x = 2\cos 2x$ $(n \in Z)$?

(A) $n\pi+\frac{\pi}{3}$ (B) $n\pi+\frac{\pi}{6}$ (C) $n\pi-\frac{\pi}{6}$ (D) $2n\pi$

58. The expression $\cos 3\theta + \sin 3\theta + (2\sin 2\theta - 3)(\sin\theta - \cos\theta)$ is positive for all θ in

(A) $\left(2n\pi-\frac{3\pi}{4},2n\pi+\frac{\pi}{4}\right),n\in Z$ (B) $\left(2n\pi-\frac{\pi}{4},2n\pi+\frac{\pi}{6}\right),n\in Z$

(C) $\left(2n\pi-\frac{\pi}{3},2n\pi+\frac{\pi}{3}\right),n\in Z$ (D) $\left(2n\pi-\frac{\pi}{4},2n\pi+\frac{3\pi}{4}\right),n\in Z$

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)
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- Match the entries in **Column I** with the entries in **Column II**
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- 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.

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0 If none of the bubbles is darkened.
–1 In all other cases.

Space for rough work

59. Match the following

Column I		Column II	
(A)	The minimum value of $9^9.27^{\cos 2x}.81^{\sin 2x}$	p.	1
(B)	Number of solutions of the equation $\cos^7 x + \sin^4 x = 1$, $x \in [0, 2\pi]$	q.	2
(C)	Value of a for which the equation $a^2 - 2a + \sec^2\pi(a + x) = 0$ has a solution	r.	3^{13}
(D)	If cos (p sin x) = sin (p cos x), then the minimum positive value of $\frac{4\sqrt{2}}{\pi}$ p is	s.	4

60. In ΔABC

Column I		Column II	
(A)	$(a + b + c)(a - b + c) = 3ca$	p.	$\angle A = 30°$
(B)	$a = 5, b = 6, \Delta = 15\sqrt{3}$ sq. units	q.	$\angle A = 45°$
(C)	$a : b : c = 2 : \sqrt{6} : \sqrt{3} + 1$	r.	$\angle C = 60°$
(D)	Perimeter of a triangle ABC is 6 times the arithmetic mean of the sines of its angles; a = 1	s.	$\angle B = 60°$

Space for rough work

FIITJEE RET – 8

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2015 (P1)_SET–B

DATE: 13.08.2018

ANSWERS

PHYSICS

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

CHEMISTRY

21.	**5**	22.	**8**	23.	**4**	24.	**6**
25.	**3**	26.	**3**	27.	**6**	28.	**3**
29.	**C, D**	30.	**A, B, C**	31.	**A, B**	32.	**A, C**
33.	**A, C**	34.	**C, D**	35.	**B, D**	36.	**A, D**
37.	**A, B**	38.	**A, B, D**	39.	**A → s ; B → q, r ; C → s; D → p**		
40.	**A →s ; B → q; C → r ; D → p**						

MATHEMATICS

41.	**2**	42.	**4**	43.	**6**	44.	**2**
45.	**9**	46.	**8**	47.	**4**	48.	**2**
49.	**BC**	50.	**BD**	51.	**Bonus**	52.	**AC**
53.	**BD**	54.	**Bonus**	55.	**ABC**	56.	**ACD**
57.	**BCD**	58.	**AB**	59.	**A → r; B → s; C → p; D → q**		
60.	**A → s; B → Bonus; C → q, s; D → p**						