

FIITJEE RET – 8

(2018 – 2020)(1ST YEAR_CHAMPIONS (20S))

IIT-2015 (P1)

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.

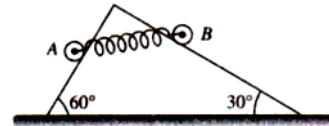
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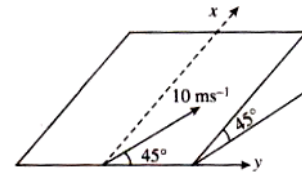
PAPER-I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 32)

- ◆ 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.

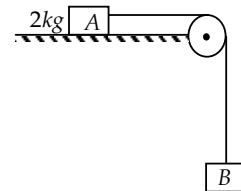
1. Two uniform solid cylinders A and B each of mass 1 kg are connected by a spring of constant 200 N m^{-1} at their axles and are placed on a fixed wedge as shown in the fig. There is no friction between cylinders and wedge. If the angle made by the line AB with the horizontal, in equilibrium, is 5α (in degree) then α is _____



2. The small marble is projected with a velocity of 10 ms^{-1} in a direction 45° from the horizontal y -direction on the smooth inclined plane. If the magnitude of its velocity after 2s is $\alpha \text{ m/s}$ then $(\alpha - 3)$ is _____



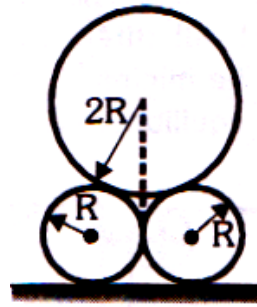
3. The coefficient of static friction, μ_s between block A of mass 2 kg and the table as shown in figure is 0.2. If 'M' (in kg) is maximum mass of the block B so that the two blocks do not move. Find the value of $10M$ (the string and the pulley are assumed to be smooth and massless $g = 10 \text{ m/s}^2$)



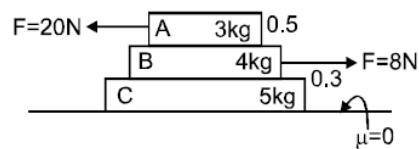
4. Two blocks of masses 3kg and 2kg are placed beside each other in contact with each other on a rough horizontal surface. A horizontal force of 20N is applied on 3kg. The coefficient of friction between blocks and the surface is 0.1 and $g = 10 \text{ ms}^{-2}$. The force of contact (in newton) between the two blocks is _____

Space for rough work

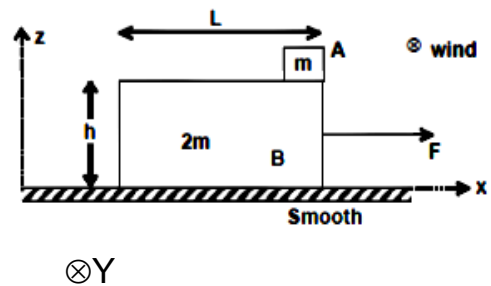
5. Two smooth solid cylinder each of radius R are placed on a rough horizontal surface and another smooth solid cylinder of same material but of radius $2R$ is placed lengthwise on two small cylinder. Side view of the arrangement is shown in figure. The minimum value of coefficient of friction between small cylinder and horizontal surface, so that the the system remains in equilibrium is $\frac{1}{\sqrt{2 \times n}}$. Find n



6. In the situation shown, coefficient of friction between A and B is 0.5 and between B and C is 0.3. Friction acting between B and C is x Newton then $\frac{7x}{9}$ is :

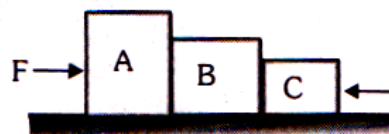


7. Two blocks A and B of masses m and $2m$ are initially at rest. Length of block B is L and the block A is placed at the right end corner of block B and the friction coefficient between them is $\mu = 1/2$. At $t = 0$ a constant force $F = \frac{5mg}{2}$ begins to act on block B towards right. Just when the block A leaves B, wind begins to blow along y - direction which exerts a constant force $\frac{mg}{2}$ on A. Assume the size of block A is small compared to B and neglect any rotational effects and toppling of block B. (Given $h = 1/2 m$, $L = 1\text{m}$ and $g = 10 \text{ m/s}^2$) Find ratio of the displacements of block A along x and y directions S_x/S_y after the time block A leaves the surface of B till the time it reaches ground



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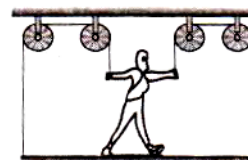
8. Three blocks A, B and C of masses 5 kg, 3 kg and 2 kg respectively are placed on a horizontal surface. The coefficient of friction between C and surface is 0.2 while between A and surface and between B and surface is zero. If a force $F = 10$ N is first applied on A as shown and then in 2nd case, F is applied on C (as shown), then the ratio of normal contact force between B and C in first to second case is $\alpha : \beta$ (Take $g = 10 \text{ m/s}^2$) Then find $\alpha - \beta$.



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

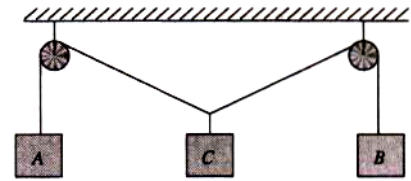
9. A painter of mass M stands on a platform of mass m and pulls himself up by two ropes which hang over pulley as shown in fig. He pulls each rope with force F and moves upward with a uniform acceleration a . Then



- (A) Normal reaction between painter and the platform is $\frac{2F(M-m)}{(M+m)}$
- (B) Normal reaction between painter and the platform is $\frac{2F(M-m)}{(2M+m)}$
- (C) $a = \frac{4F - (M+m)g}{M+m}$
- (D) $a = \frac{4F - (M+m)g}{2M+m}$

Space for rough work

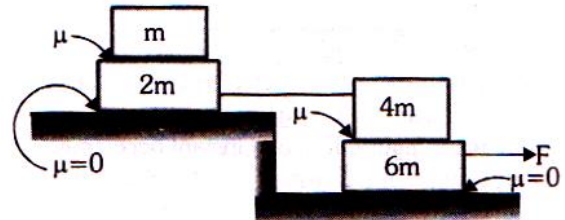
10. Three blocks A, B and C are suspended as shown in fig. Mass of each of blocks A and B is m . If the system is in equilibrium, and mass of C is M , then which of the following value/values of 'M' is possible (block C is hanging at the middle point of the string lying between the two pulleys)



- (A) $M = m$ (B) $M = 2m$
 (C) $M = 3m$ (D) $M = \frac{m}{10}$

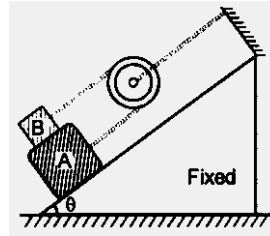
11. Find the minimum value of F so that all blocks move together with same acceleration

- (A) $\frac{91\mu mg}{7}$ (B) $7\mu mg$
 (C) $\frac{52\mu mg}{7}$ (D) $6\mu mg$

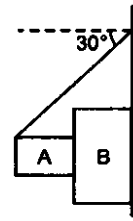


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12. In the arrangement shown in figure pulley is smooth and massless and string is light. Friction coefficient between A and B is μ . Friction is absent between A and plane. Select the correct alternative(s)



- (A) acceleration of the system is zero if $\mu \geq \frac{(m_B - m_A)}{2m_B} \tan \theta$ and $m_B > m_A$
- (B) force of friction between A and B is zero if $m_A = m_B$
- (C) B moves upwards if $m_B < m_A$
- (D) tension in the string is $mg(\sin \theta - \mu \cos \theta)$ if $m_A = m_B = m$
13. Two blocks A and B of mass 10 kg and 20 kg respectively are placed as shown in figure. Coefficient of friction between all the surfaces is 0.2 ($g = 10 \text{ m/s}^2$). Then:

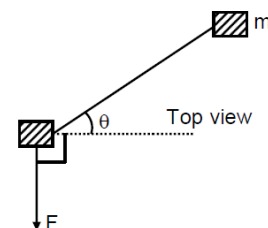


- (A) tension in the string is 306 N
- (B) tension in the string is 132 N
- (C) acceleration of block B is 2.6 m/s^2
- (D) acceleration of block B is 4.7 m/s^2

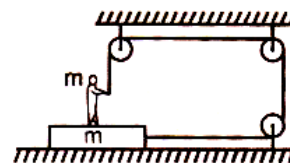
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14. A block is placed over a plank. The coefficient of friction between the block and the plank is $\mu = 0.2$. Initially both are at rest, suddenly the plank starts moving with acceleration $a_0 = 4 \text{ m/s}^2$. The displacement of the block in 1s is : ($g = 10 \text{ m/s}^2$)
- (A) 1 m relative to ground (B) 1 m relative to plank
(C) zero relative to plank (D) 2 m relative to ground

15. Figure shows top view of a horizontal surface. Two blocks each of mass m are placed on the surface and connected with a string. The friction coefficient is μ for each block. A horizontal force F is applied on one of the block as shown in the figure. F is maximum so that there is no sliding at any contact.



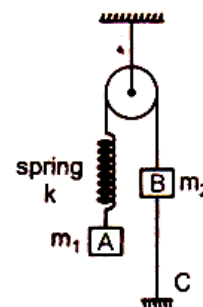
- (A) If $\theta = 30^\circ$ then $F = \frac{2\mu mg}{\sqrt{3}}$ & $T < \mu mg$ (B) If $\theta = 45^\circ$ then $F = \sqrt{2}\mu mg$ & $T = \mu mg$
(C) If $\theta = 60^\circ$ then $F = 2\mu mg$ & $T < \mu mg$ (D) If $\theta = 60^\circ$ then $F = \sqrt{3}\mu mg$ & $T = \mu mg$
16. The friction coefficient between plank and floor is μ . The man applies the maximum possible force on the string and the system remains at rest. Then



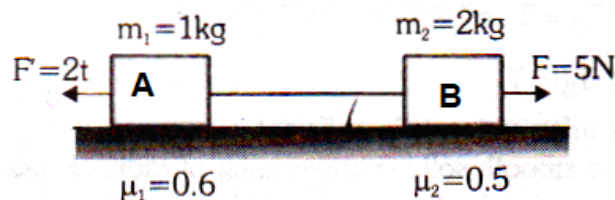
- (A) frictional force between plank and surface is $\frac{2\mu mg}{1+\mu}$
(B) frictional force on man is zero
(C) tension in the string is $\frac{2\mu mg}{1+\mu}$
(D) net force on man is zero

Space for rough work

17. In the system shown in the figure $m_1 > m_2$. System is held at rest by thread BC. Just after the thread BC is burnt.
- (A) initial acceleration of m_2 will be upwards
 (B) magnitude of initial acceleration both blocks will be equal to $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)g$
 (C) initial acceleration of m_1 will be equal to zero
 (D) magnitude of initial acceleration of two blocks will be non-zero and unequal.



18. Two block A and B are separated by some distance and tied by a string as shown in the figure. The force of friction acting on blocks A and B at $t = 2$ sec are respectively
- (A) $4N(\rightarrow), 5N(\leftarrow)$ (B) $2N(\rightarrow), 5N(\leftarrow)$
 (C) $0N(\rightarrow), 10N(\leftarrow)$ (D) $1N(\rightarrow), 5N(\leftarrow)$



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.

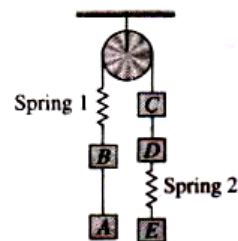
+2 If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.

0 If none of the bubbles is darkened.

-1 In all other cases.

Space for rough work

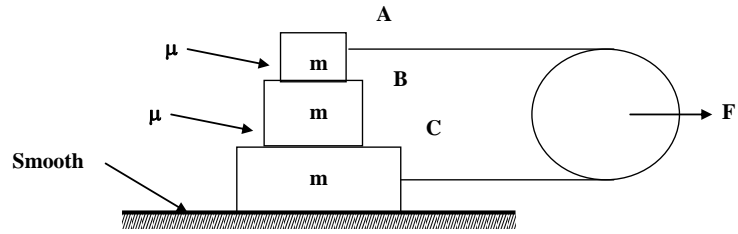
19. The system shown in fig is initially in equilibrium . Masses of the blocks A, B, C,D and E are respectively, 3kg, 3kg, 2kg, 2kg and 2 kg, Match the conditions in column I with the effect in column II.



	Column – I		Column – II
(A)	Just after cutting the spring 2, tension in string AB	(p)	20 Newton
(B)	Just after cutting the spring 2, tension in string CD	(q)	Decreases
(C)	Just after cutting the string between C and pulley, tension in string AB	(r)	Remains constant
(D)	Just after cutting the string between C and pulley, tension in string CD	(s)	Zero
		(t)	10 Newton

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)	$9 \mu mg$
(B)	Sliding between blocks A and B starts if F is more than	(q)	$6 \mu mg$
(C)	Sliding between blocks B and C starts if F is more than	(r)	$10 \mu mg$
(D)	Relative motion between all the three blocks will be observed when F is greater than	(s)	$12 \mu mg$
		(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. 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 $\frac{1}{2}$ 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 $-594.1 \text{ kJ mol}^{-1}$
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.
 - ◆ 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 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 electrovalent 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) 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) $\text{SO}_3^{2-} \rightarrow \text{SO}_4^{2-}$ (B) $\text{MnO}_2 \rightarrow \text{MnO}_4^-$
 (C) $[\text{Fe}(\text{CN})_6]^{4-} \rightarrow [\text{Fe}(\text{CN})_6]^{3-}$ (D) $\text{NO}_3^- \rightarrow \text{NH}_4^+$
-

Space for rough work

36. When a solution of KIO_3 is heated with oxalic acid according to following equation $\text{KIO}_3 + \text{H}_2\text{C}_2\text{O}_4 \rightarrow \text{K}_2\text{C}_2\text{O}_4 + \text{CO}_2 + \text{I}_2 + \text{H}_2\text{O}$ 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 $\text{Ba}(\text{OH})_2$ 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 $\text{Ba}(\text{OH})_2$
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.
- ◆ 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)	$\underline{P_2H_4} \rightarrow PH_3 + P_4H_2$	(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 $\triangle ABC$, $AB = 3$, $BC = 5$, $CA = 4$ 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 $\triangle ABC$, 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.
- ◆ 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. 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 $1 + \cos 3x = 2 \cos 2x$ ($n \in \mathbb{Z}$) ?
 (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) $\left(2n\pi - \frac{3\pi}{4}, 2n\pi + \frac{\pi}{4}\right), n \in \mathbb{Z}$ (B) $\left(2n\pi - \frac{\pi}{4}, 2n\pi + \frac{\pi}{6}\right), n \in \mathbb{Z}$
 (C) $\left(2n\pi - \frac{\pi}{3}, 2n\pi + \frac{\pi}{3}\right), n \in \mathbb{Z}$ (D) $\left(2n\pi - \frac{\pi}{4}, 2n\pi + \frac{3\pi}{4}\right), n \in \mathbb{Z}$

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) $a \leq 2k \sin \frac{A}{2}$ (B) $a \geq 2k \sin \frac{A}{2}$
 (C) $b^4 - (a^2 + 2k^2 \cos A)b^2 + k^4 = 0$ (D) $b^4 + (a^2 + 2k^2 \cos A)b^2 + k^4 = 0$
55. If in $\triangle ABC$, $a^4 + b^4 + c^4 = 2c^2(a^2 + b^2)$, 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 $\triangle ABC$, $\frac{\cos A + 2\cos C}{\cos A + 2\cos B} = \frac{\sin B}{\sin C}$, 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.	$\angle A = 30^\circ$
(B)	$a = 5, b = 6, \Delta = 15\sqrt{3}$ sq. units	q.	$\angle A = 45^\circ$
(C)	$a : b : c = 2 : \sqrt{6} : \sqrt{3} + 1$	r.	$\angle C = 60^\circ$
(D)	Perimeter of a triangle ABC is 6 times the arithmetic mean of the sines of its angles; $a = 1$	s.	$\angle B = 60^\circ$

60. Match the following

Column I		Column II	
(A)	The minimum value of $9^9 \cdot 27^{\cos 2x} \cdot 81^{\sin 2x}$	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

FITJEE RET – 8

(2018 – 2020)(1ST YEAR_CHAMPIONS (20S))

IIT-2015 (P1)

DATE: 13.08.2018

ANSWERS

PHYSICS

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