

FIITJEE RET – 3

(2017 – 2019)(2ND YEAR_CHAMPIONS)

IIT-2015 (P2)

DATE: 02.07.2018

Time: 3 hours

Maximum Marks: 240

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 **8 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 paragraphs** type questions. Each paragraph describes an experiment, a situation or a problem. Two multiple choice questions will be asked based on this paragraph. One or more than one option can be correct.

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 **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.

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.

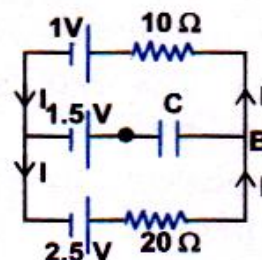
NAME:

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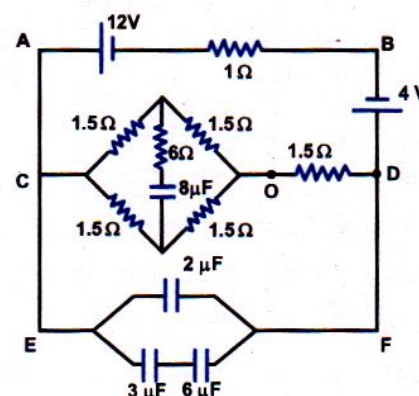
PAPER – II
PART I: PHYSICS
SECTION 1 (Maximum Marks: 32)

- ◆ 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. In the circuit shown in figure, find the potential difference across the plates of the capacitor.



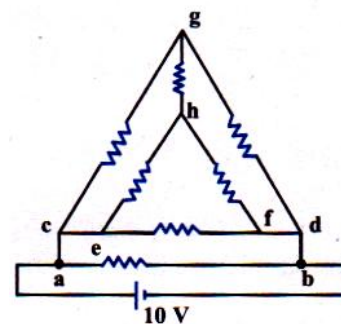
2. In the given circuit, the potential difference across the $6\mu\text{F}$ capacitor in steady state is K Volt. Find the value of K.



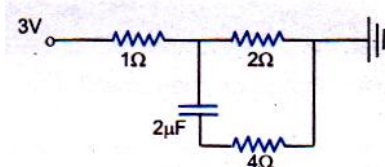
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3. Three resistors of resistances $2\ \Omega$, $3\ \Omega$ and $6\ \Omega$ are available to be connected across a battery of internal resistance $1\ \Omega$ and emf, 4V by means of conducting wires. Find the maximum current (in Ampere) that can be drawn through the cell by using all the given resistances.

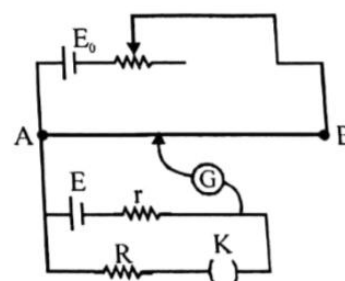
4. Consider the network shown in the figure. All resistance are equal to $2\ \Omega$. Find the potential difference between (in Volt) points e and h.



5. Figure show a network of capacitor and resistance. Potentials of some of the points are given. Find the charge (in μC) on capacitor at steady state



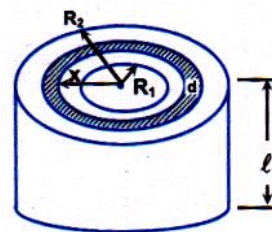
6. The given figure represents an arrangement of potentiometer for the calculation of internal resistance (r) of the unknown battery (E). The balance length is 70.0 cm with the key opened and 60.0 cm with the key closed. R is $132.40\ \Omega$. The internal resistance (r) of the unknown cell to a correct number of significant figures ($E_0 > E$) is 11 K . Find K . (Nearest integer)



7. An unknown cell balances 300 cm of wire in a potentiometer circuit, but the balance length reduces to 280 cm when a resistance of $280\ \Omega$ is added in parallel with the cell. A standard cell of emf 1.1 V balances 220 cm on the same potentiometer. The balance length (in cm) when $48\ \Omega$ resistance is connected across the unknown cell is 72 K . Find K

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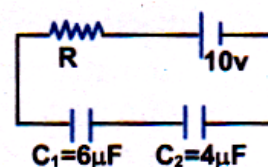
8. A cylindrical conductor of length ℓ and inner and outer radii radius R_1 and R_2 has specific resistance. ρ A cell of emf $\varepsilon = 3.5$ V is connected across the two lateral faces (inner and outer) of the conductor. The current drawn from the cell is $I = \frac{N\pi\ell}{\rho \ln(R_2/R_1)}$. Find N.



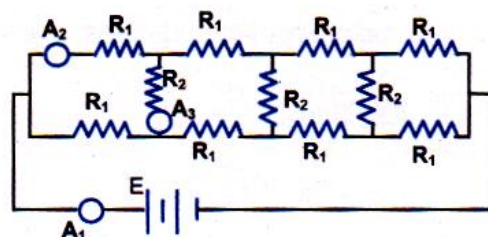
SECTION 2 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** 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:**
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 - 0** If none of the bubbles is darkened
 - 2** In all other cases

9. In the given circuit, in steady state
- (A) the potential difference across the capacitor C_1 is 4V
- (B) the potential difference across the capacitor C_2 is 6 V
- (C) the charge on capacitor C_1 is $24 \mu\text{C}$
- (D) the charge on capacitor C_2 is $16 \mu\text{C}$

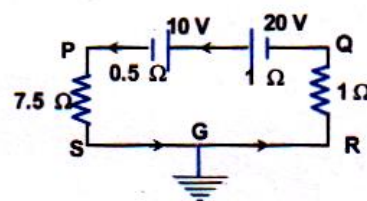


10. In the given circuit, $R_1 = 10\Omega$, $R_2 = 6\Omega$ and $E = 10\text{V}$. Then, the correct statement(s) is /are.
- (A) Effective resistance of the circuit is 20Ω
- (B) Reading of A_1 is $1/2$ amp
- (C) Reading of A_2 is $1/4$ amp
- (D) Reading of A_3 is $1/8$ amp

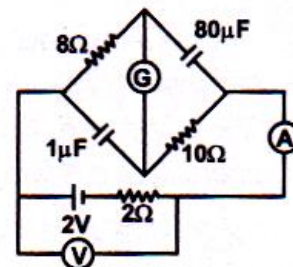


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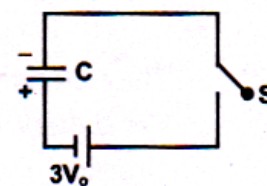
11. In the circuit shown
 (A) the potential at P is -7.5 V
 (B) the potential at Q is -1 V
 (C) the potential at R is zero
 (D) the potential at S is zero



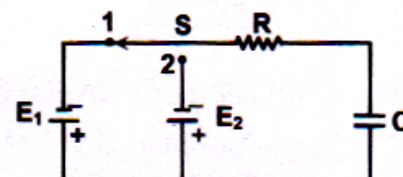
12. The ammeter (A) and voltmeter (V) in the given circuit are ideal but the galvanometer has a resistance of 2Ω . In steady state
 (A) no current flows in (G)
 (B) 0.1 A current flows in (G)
 (C) charge on $1\mu\text{F}$ capacitor is $1\mu\text{C}$
 (D) terminal potential difference across battery is 1.8 V .



13. In the circuit shown in the figure, the capacitor C is charged to a potential V_0 . The heat generated and charge flown, in the circuit when the switch S is closed, is
 (A) $\Delta q = 2CV_0$ (B) $\Delta H = 4CV_0^2$
 (C) $\Delta q = 4CV_0$ (D) $\Delta H = 8CV_0^2$

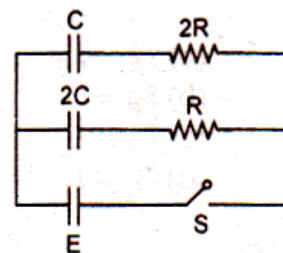


14. Two batteries of emf E_1 and E_2 , a capacitor of capacitance 'C' and a resistor R are connected in a circuit as shown. When the switch S is shifted from position (1) to (2), then the charge flow and work done by battery E_2 are
 (A) $\Delta q = C(E_2 - E_1)$ (B) $\Delta W = C(E_2 - E_1)E_2$
 (C) $\Delta q = C(E_2 + E_1)$ (D) $\Delta W = \frac{q_2^2}{2c} - \frac{q_1^2}{2c}$



Space for rough work

15. Voltmeter reads the potential difference across the terminals of an old battery as 1.40 V while a potentiometer reads its voltage to be 1.55 V. The voltmeter resistance is 280Ω . Then:
 (A) the emf of the battery is 1.4 V
 (B) the emf of the battery is 1.55 V
 (C) the internal resistance r of the battery is 30Ω
 (D) the internal resistance r of the battery is 5Ω
16. In the circuit shown in figure, switch S is closed at time $t = 0$. Select the correct statement(s)
 (A) Rate of increase of charge is same in both the capacitors
 (B) Ratio of charge stored in capacitors C and $2C$ at any time t would be 1 : 2
 (C) Time constant of both the capacitors are equal
 (D) Steady state charge in capacitors C and $2C$ are in the ratio of 1 : 2

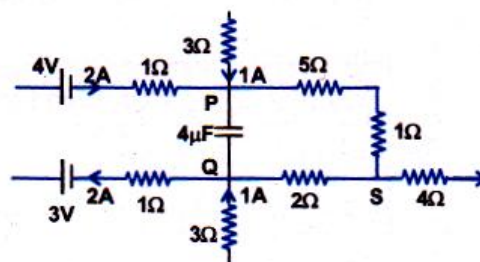


SECTION 3 (Maximum Marks: 16)

- ◆ This section contains **TWO** paragraphs
- ◆ Based on each paragraph, there will be **TWO** questions
- ◆ Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
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 - 2 In all other cases

Paragraph-1

A part of a circuit in steady state along with the currents flowing in the branches, the value of resistances etc is shown in the figure.



Now, answer the following questions:

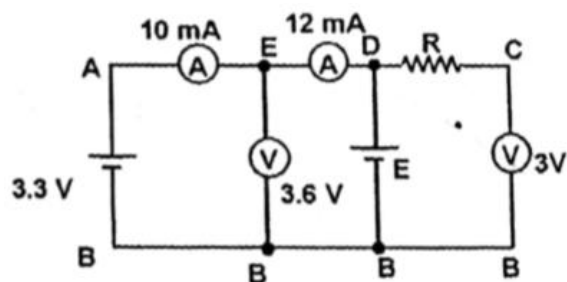
17. Potential difference between points P and Q is
 (A) 10 V (B) 20 V (C) 30 V (D) 35 V
18. Charge on the capacitor is
 (A) $10\mu\text{C}$ (B) $80\mu\text{C}$ (C) $20\mu\text{C}$ (D) $40\mu\text{C}$

Space for rough work

Paragraph-2

Read the passage carefully and answer the following questions.

A circuit contains two identical ammeters (not ideal) and two identical voltmeters (not ideal) as shown in the figure. The readings of ammeters and voltmeters are shown in the figure. There is an unknown resistor of resistance $R \Omega$ and unknown ideal battery of emf E volt in the circuit.



19. The current supplied by unknown ideal battery of emf E volt is
 (A) $\frac{41}{3}$ mA (B) $\frac{35}{3}$ mA (C) $\frac{39}{3}$ mA (D) $\frac{5}{3}$ mA
20. The value of R is
 (A) 2.304 $k\Omega$ (B) 1.152 $k\Omega$ (C) 0.576 $k\Omega$ (D) 0.288 $k\Omega$

PART II: CHEMISTRY

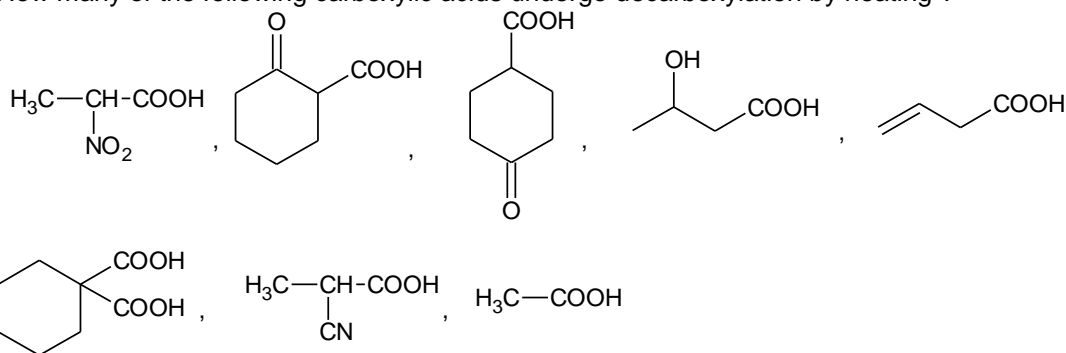
SECTION 1 (Maximum Marks: 32)

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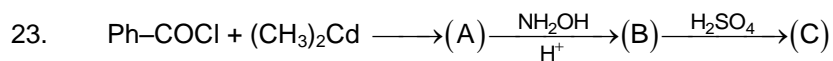
- +4** If the bubble corresponding to the answer is darkened
0 In all other cases

21. How many of the following carboxylic acids undergo decarboxylation by heating ?



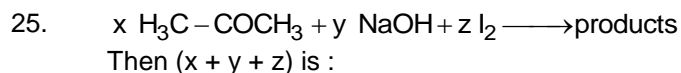
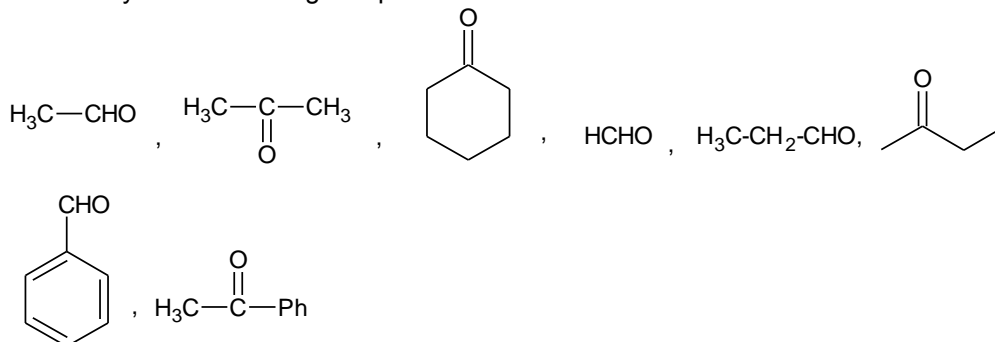
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22. How many of the following are more acidic than benzoic acid ?
acetic acid, formic acid, propanoic acid, o-nitro benzoic acid, oxalic acid, phenol, o-hydroxy benzoic acid, ethanol.

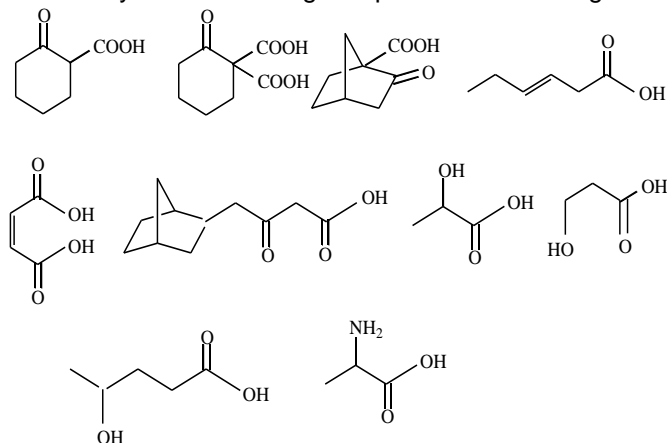


The no. of π - bonds present in product 'C'.

24. How many of the following compounds shows both +ve tollen's test and +ve iodoform test ?

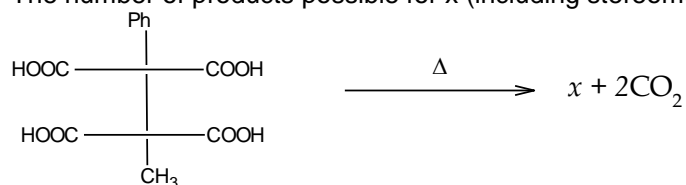


26. How many of the following compounds can undergo decarboxylation on strong heating.



Space for rough work

27. The number of products possible for x (including stereoisomers) in the following reaction is:

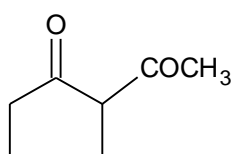
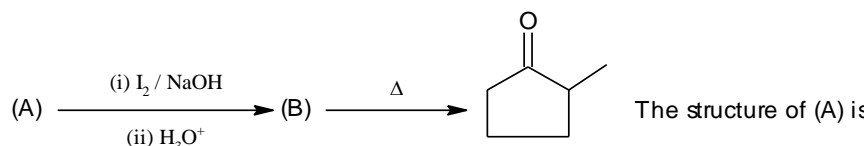


28. A compound with molecular formula $\text{C}_8\text{H}_{16}\text{O}_4$ does not give litmus test and does not give colour with 2,4-DNP. It reacts with excess $\text{Me}-\overset{\text{O}}{\parallel}{\text{C}}-\text{Cl}$ to give a compound whose vapour density is 152. Compound (A) contains how many hydroxyl groups?

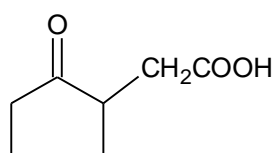
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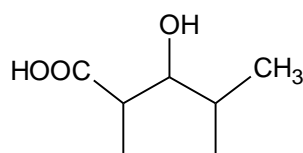
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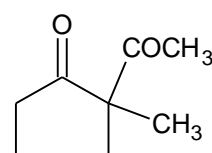
(A)



(B)

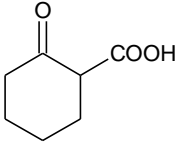


(C)



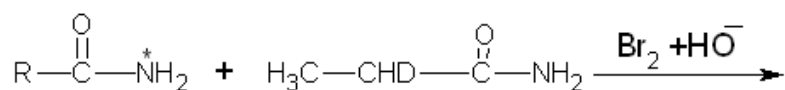
(D)

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30. Which of the following products is/are correctly mentioned in the following reactions
 (A) $\text{HCHO} \xrightarrow{\text{NaOD}} \text{HCOONa} + \text{CH}_3\text{OD}$ (B) $\text{HCDO} \xrightarrow{\text{NaOH}} \text{DCOONa} + \text{CH}_2\text{DOH}$
 (C) $\text{HCDO} \xrightarrow{\text{NaOEt}} \text{DCOOEt} + \text{DCH}_2\text{ONa}$ (D) $\text{D}_2\text{CO} \xrightarrow{\text{NaOD}} \text{DCOONa} + \text{CD}_3\text{OD}$
31. $3\text{HCHO} + \text{CH}_3\text{CHO} \xrightarrow{\text{NaOH}}$ A. A formed can
 (A) reduce Tollen's reagent (B) give Cannizzaro reaction
 (C) react with Na (D) give green colour with $\text{Cr}_2\text{O}_7^{2-} / \text{H}^+$
32. Ammonium acetate on heating followed by basic hydrolysis gives
 (A) N_2 gas (B) CO_2 (C) Acetamide (D) NH_3 gas
33. Which of the following compound is decarboxylated on heating ?
 (A) $\begin{array}{c} \text{CH}_2\text{COOH} \\ | \\ \text{CH}_2\text{COOH} \end{array}$ (B) $\text{C}_2\text{H}_5\text{CH}(\text{COOH})_2$
 (C) $\text{CH}_3\text{COCH}_2\text{COOH}$ (D) 
34. Citric acid, which causes the sharp taste of lemon juice, has the following formula:
 $\begin{array}{c} \text{CH}_2\text{COOH} \\ | \\ \text{HO}-\text{C}-\text{COOH} \\ | \\ \text{CH}_2\text{COOH} \end{array}$
 Which react/s completely with 1 mole of citric acid?
 (A) 4 moles of $\text{PCl}_5(\text{s})$ (B) 4 moles of $\text{HCl}(\text{g})$ (C) 4 moles of $\text{Na}(\text{s})$ (D) 4 moles of $\text{NaOH}(\text{aq})$

Space for rough work

35.



Mixture of 1^o amines.

Which of the following statements are true for above reaction.

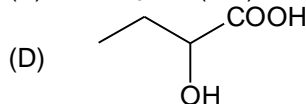
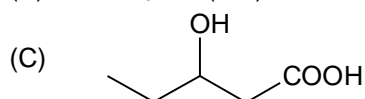
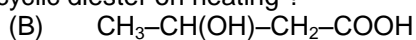
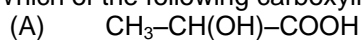
(A) A mixture of four different amines are formed confirming that a free carbonylnitrene intermediate might have been formed.

(B) A mixture of two amines are formed confirming that rearrangement is strictly intramolecular.

(C) If R is Chiral, it migrates with retention of configuration.

(D) A free carbonylnitrene $\text{R}_1-\overset{\text{O}}{\parallel}{\text{C}}-\ddot{\text{N}}:$ might be formed as an intermediate is formed and only two amines are formed.

36. Which of the following carboxylic acid forms cyclic diester on heating ?



SECTION 3 (Maximum Marks: 16)

◆ This section contains **TWO** paragraphs

◆ Based on each paragraph, there will be **TWO** 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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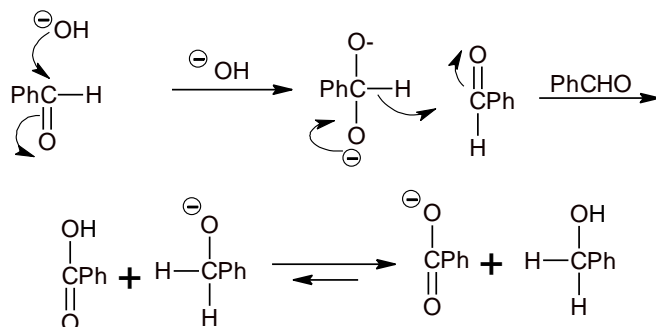
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-2 In all other cases

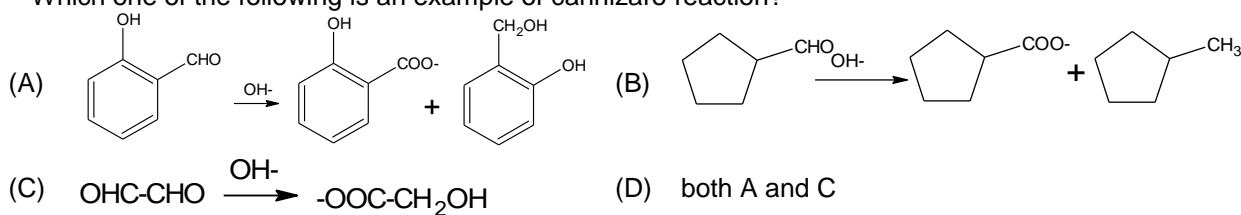
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Paragraph-1

Cannizzaro reaction involves hydride transfer directly from an aldehyde molecule lacking alpha hydrogen to a second molecule of either the same aldehyde (disproportionation) or sometimes to a molecule of a different aldehyde having no alpha hydrogen (crossed cannizzaro). Suitable dialdehydes can undergo intramolecular hydride transfer. The reaction requires the presence of base. The reaction is believed to follow the pathway as shown below:



37. Which one of the following is an example of cannizzaro reaction?



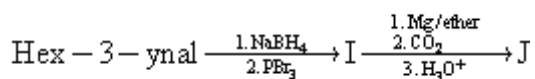
38. When $\text{C}_6\text{H}_5\text{CDO}$ is made to react with hydroxide ion in the presence of D_2O which of the following compounds are produced (after acidification)?

(A) $\text{PhCH(D)OD} + \text{PhCOOD}$ (B) $\text{PhCH}_2\text{OD} + \text{PhCOOD}$
 (C) $\text{PhCD}_2\text{OD} + \text{PhCOOD}$ (D) $\text{PhCH(D)OH} + \text{PhCOOD}$

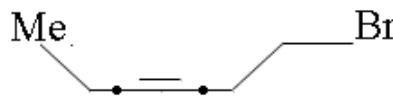
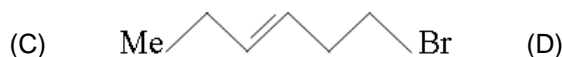
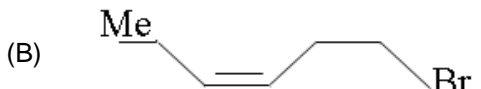
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Paragraph-2

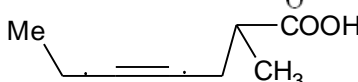
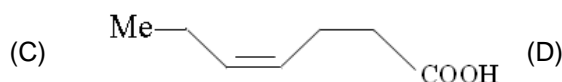
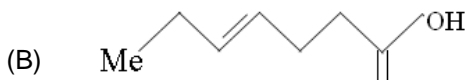
In the following reaction sequence products I, J are formed



39. The structure of the product I is



40. The structure of compound J is



PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
- ◆ The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0** to **9**, both inclusive
- ◆ For each question, darken the bubble corresponding to the correct integer in the ORS
- ◆ **Marking scheme:**

+4 If the bubble corresponding to the answer is darkened

0 In all other cases

41. The equation to the parabola whose axis parallel to the y-axis and which passes through the points (0, 4), (1, 9) and (4, 5). If latus rectum of parabola is λ , then the value of $38\lambda - 15$ is
42. The locus of a point that divides a chord of slope 2 of the parabola $y^2 = 4x$ internally in the ratio 1 : 2 is a parabola. If the vertex of parabola is (λ, μ) , then the value of $\frac{\lambda}{\mu}$ is

Space for rough work

43. PN is an ordinate of the parabola $y^2 = 4ax$. A straight line is drawn through the middle point M of PN parallel to the axis meeting the parabola at Q. NQ meets the tangent at the vertex A, at a point T, then $9\left(\frac{AT}{NP}\right) =$
44. The Harmonic mean of the segments of a focal chord of the parabola $y^2 = 4ax$ is ka , where k is equal to
45. The shortest distance between the parabola $y^2 = 4x$ and $y^2 = 2x - 6$ is \sqrt{k} , then k is equal to
46. Radius of the largest circle which passes through the focus of the parabola $y^2 = 4x$ and contained in it, is
47. The equation $ax^2 + 4xy + y^2 + ax + 3y + 2 = 0$ represents a parabola if a is
48. The straight line $x + y = k$, touches the parabola $y = x - x^2$, if k is

SECTION 2 (Maximum Marks: 32)

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

49. The x-coordinate of points on the axis of the parabola $4y^2 - 32x + 4y + 65 = 0$ from which all the three normals to the parabola are real is
(A) 4 (B) 5 (C) 6 (D) 7
50. The length of latus-rectum of the parabola whose parametric equation is $x = t^2 + t + 1$, $y = t^2 - t + 1$, where $t \in \mathbb{R}$ is equal to
(A) 2 (B) 4 (C) 8 (D) none of these
51. Let PQ be a chord of the parabola $y^2 = 4x$. A circle drawn with PQ as a diameter passes through the vertex V of the parabola. If area of $\Delta PVQ = 20$ sq. unit, then coordinates of P are
(A) (-16, -8) (B) (-16, 8) (C) (16, -8) (D) (16, 8)

Space for rough work

52. The normal $y = mx - 2am - am^3$ to the parabola $y^2 = 4ax$ subtends a right angle at the vertex if
 (A) $m = 1$ (B) $m = \sqrt{2}$ (C) $m = -\sqrt{2}$ (D) $m = \frac{1}{\sqrt{2}}$
53. The equation of a tangent to the parabola $y^2 = 8x$ which makes an angle 45° with the line $y = 3x + 5$ is
 (A) $2x + y + 1 = 0$ (B) $y = 2x + 1$ (C) $x - 2y + 8 = 0$ (D) $x + 2y - 8 = 0$
54. If equation of directrix of the parabola $x^2 + 4y - 6x + k = 0$ is $y + 1 = 0$, then
 (A) $k = 17$ (B) $k = -17$ (C) focus is $(3, -3)$ (D) vertex is $(2, -2)$
55. The following line(s) is(are) tangent to the curve $y = x^2 - x$
 (A) $x - y = 0$ (B) $x + y = 0$ (C) $x - y = 1$ (D) $x + y = 1$
56. The locus of point of intersection of tangents to the parabola $y^2 = 4(x + 1)$ and $y^2 = 8(x + 2)$ which are perpendicular to each other is
 (A) $x + 7 = 0$ (B) $x - y = 4$ (C) $x + 3 = 0$ (D) $y - x = 12$

SECTION 3 (Maximum Marks: 16)

- ◆ This section contains **TWO** paragraphs
- ◆ Based on each paragraph, there will be **TWO** 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

Paragraph-1

Three normals AA_1 , BB_1 and CC_1 are drawn from a point $P(h, k)$ to the parabola $y^2 = 4ax$, at A, B and C points. The following conditions are satisfied by the three normals:

- (I) Any two of three normals coincide
- (II) $S(a, 0)$ be the focus of the parabola
- (III) Three normals be real, then $h > 2a$
- (IV) Slopes of the normals are m_1 , m_2 and m_3 . If $m_1 m_2 = \lambda$, then the locus of P is a parabola.
- (V) P lies on the line $y = \mu$, then the sides of the triangle ABC touch the parabola $S' = 0$

57. $SA \cdot SB \cdot SC$ is equal to
 (A) $a(SP)^2$ (B) $2a(SP)^2$ (C) $(aSP)^2$ (D) $4a(SP)^2$

Space for rough work

58. If $a = -1$ and $k = 2$ and (III) is satisfied, then
(A) $h > 2$ (B) $h > -2$ (C) $h < -2$ (D) $-2 < h < 2$

Paragraph-2

If a source of light is placed at the fixed point of a parabola and if the parabola is a reflecting surface, then the ray will bounce back in a line parallel to the axis of the parabola.

59. A ray of light is coming along the line $y = 2$ from the positive direction of x-axis and strikes a concave mirror whose intersection with the x - y plane is a parabola $y^2 = 8x$, then the equation of the reflected ray is
(A) $2x + 5y = 4$ (B) $3x + 2y = 6$ (C) $4x + 3y = 8$ (D) $5x + 4y = 10$
60. A ray of light moving parallel to the x-axis gets reflected from a parabolic mirror whose equation is $y^2 + 10y - 4x + 17 = 0$. After reflection, the ray must pass through the point
(A) $(-2, -5)$ (B) $(-1, -5)$ (C) $(-3, -5)$ (D) $(-4, -5)$

Space for rough work

FITJEE RET – 3

(2017 – 2019)(2ND YEAR_CHAMPIONS)

IIT-2015 (P2)

DATE: 02.07.2018

ANSWERS

PHYSICS

1.	0	2.	2	3.	2	4.	5
5.	4	6.	2	7.	3	8.	7
9.	A,B,C	10.	A,B,C	11.	BC,D	12.	B,C,D
13.	C,D	14.	A,B	15.	B,C	16.	B,C,D
17.	B	18.	B	19.	A	20.	C

CHEMISTRY

21.	5	22.	4	23.	4	24.	1
25.	8	26.	4	27.	4	28.	3
29.	D	30.	A, B, C, D	31.	A, B, C, D	32.	D
33.	B, C, D	34.	A, C	35.	B, C, D	36.	A, D
37.	BONUS	38.	BONUS	39.	D	40.	A

MATHEMATICS

41.	9	42.	Bonus	43.	6	44.	2
45.	5	46.	4	47.	4	48.	1
49.	CD	50.	D	51.	CD	52.	BC
53.	AC	54.	AC	55.	BC	56.	C
57.	A	58.	C	59.	C	60.	B