

FIITJEE RET – 1

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2014 (P1)_SET-A

DATE: 11.06.2018

Time: 3 hours

Maximum Marks: 180

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 **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** are correct.
9. **Section II** contains **10 questions**. The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).

D. Marking Scheme

10. For each question in **Section I**, you will be awarded **3 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.
11. For each question in **Section II**, you will be awarded **3 marks** if you darken the bubble corresponding to the correct answer **ONLY**. In all other cases **zero (0) marks** will be awarded. **No negative 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:

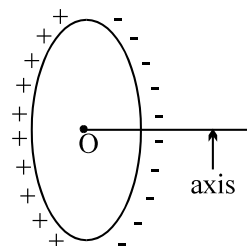
ENROLLMENT NO.:

PAPER-I
PART I: PHYSICS

SECTION – I: (One or more than one options are correct)

This section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE THAN ONE** are correct.

- The electric potential in the region of space is given by $V(x) = A + Bx + Cx^2$, where V is in volts, x is in meters and A, B, C are constants. Then,
 - \vec{E} varies linearly with x
 - the unit of \vec{E} is newton coulomb⁻¹
 - \vec{E} is in the negative x -direction
 - the electric field \vec{E} in this region is constant
- The electric potential decreases uniformly from x volt to $-x$ volt as one moves along y -axis from $y = +1$ m to $y = -1$ m. The electric field at the origin:
 - is equal to $\frac{x}{2}$ volt/m
 - may be equal to x volt/m
 - may be greater than x volt/m
 - may be less than x volt/m
- A particle A of mass m and charge Q moves directly towards a fixed particle B, which has charge Q . The speed of A is v when it is far away from B. The minimum separation between the particles is proportional to
 - Q^2
 - $\frac{1}{v^2}$
 - $\frac{1}{v}$
 - $\frac{1}{m}$
- A ring of radius R is made out of a thin metallic wire of area of cross section A . The ring has a uniform charge Q distributed on it. A charge q_0 is placed at the centre of the ring. IF Y is the young's modulus for the material of the ring and ΔR is the change in the radius of the ring then.
 - $\Delta R = \frac{q_0 Q}{4\pi\epsilon_0 RAY}$
 - $\Delta R = \frac{q_0 Q}{4\pi^2\epsilon_0 RAY}$
 - $\Delta R = \frac{q_0 Q}{8\pi^2\epsilon_0^2 RAY}$
 - $\Delta R = \frac{q_0 Q}{8\pi\epsilon_0 RAY}$
- The figure shows a non conducting ring which has positive and negative charge non-uniformly distributed on it such that the total charge is zero. Which of the following statement is true?
 - The potential at all the points on the axis will be zero.
 - The electric field at all the points on the axis will be zero.
 - The direction of electric field at all points on the axis will be along the axis.
 - If the ring is placed inside a uniform external electric field then net force acting on it will be zero



Space for rough work

6. Charge Q is distributed non-uniformly over a ring of radius R , P is a point on the axis of ring at a distance $\sqrt{3}R$ from its centre. Which of the following is a correct statement.

(A) Potential at P is $\frac{KQ}{2R}$

(B) Magnitude of electric field at P may be greater than $\frac{\sqrt{3}KQ}{8R^2}$

(C) Magnitude of electric field at P must be equal to $\frac{\sqrt{3}KQ}{8R^2}$

(D) Magnitude of electric field at P cannot be less than $\frac{\sqrt{3}KQ}{8R^2}$

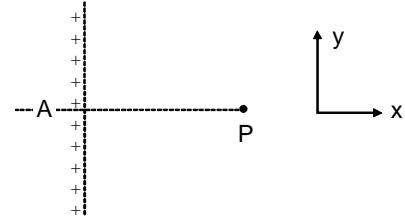
7. Electric field, due to infinite line of charge, as shown in figure, at P has magnitude E . If half of the line of charge i.e. below A , is removed then

(A) Electric field at P will have magnitude $E/2$.

(B) Electric field's x component at P will be $E/2$.

(C) Electric field's y component at P will be $E/2$.

(D) electric field at P will have a magnitude more than $E/2$



8. Choose the correct statements from the following

(A) if the electric field is zero at a point, the electric potential must also be zero at that point

(B) if the electric field is constant in a given region of space, the electric field must be zero in that region

(C) two different equipotential surfaces can never intersect

(D) electrons move from region of lower potential to a region of higher potential

9. Four point charges $+q$, $+q$, $-q$ and $-q$ are placed respectively at corners A , B , C , D respectively of a square. Then

(A) the potential at the center O of the square is zero

(B) the electric field at the center O of the square is zero

(C) if E is the mid-point of side BC , the work done in carrying an electron from O to E is zero

(D) if F is the mid-point of side CD , the work done in carrying an electron from O to F is zero

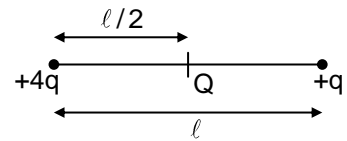
10. Three point charges $+4q$, Q and $+q$ are placed in a straight line of length ℓ at points as shown in figure.

(A) if net force on charge $+q$ is zero then Q must be a negative charge whose value is q

(B) if net force on $+4q$ is zero, then Q must be a negative charge whose value is $q/2$

(C) if net force on charge $+q$ were zero, then potential energy of the system is $\frac{7q^2}{2\pi\epsilon_0\ell}$

(D) if net force on $+4q$ is zero, then Q must be a negative charge whose value is $\frac{q}{4}$

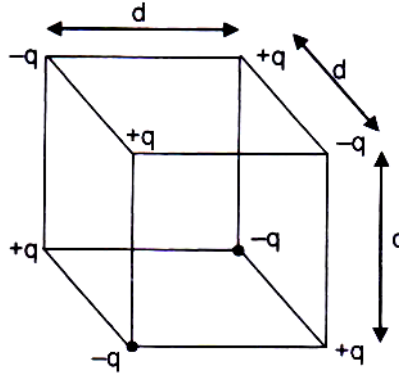


Space for rough work

SECTION – II: (Integer value type)

This section contains **10 questions**. The answer to each of the questions is a **single digit integer**, ranging from 0 to 9 (both inclusive).

11. The potential energy of the configuration is given as $\frac{-Aq^2}{\pi\epsilon_0 d} \left[B - \frac{1}{\sqrt{C}} + \frac{1}{3\sqrt{D}} \right]$. Then find $\frac{CD}{AB}$.

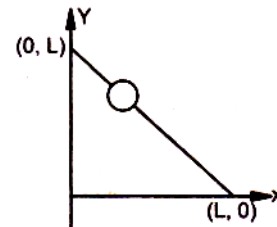


12. A charge Q is uniformly distributed on the surface of an angular disc of inner radius R and outer radius ηR . A charged particle of mass m and charge $-q$ is released from rest at a point on the axis of the disc far from the centre of the ring?

The velocity it will reach the centre of the ring is equal to $\frac{AKQ}{(\eta+1)R}$. Then find A .

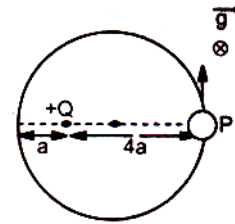
13. Electric field given by the vector $E = x\hat{i} + y\hat{j}$ is present in the XY plane. A small ring carrying charge $+Q$, which can freely slide on a smooth non conducting rod, is projected along the rod from the point $(0, L)$ such that it can reach the other end of the rod. What minimum velocity should be given to the ring? (Assume zero gravity)?

$(QL^2/k_1 m)^{1/n}$. Then $k_1 + n = ?$.



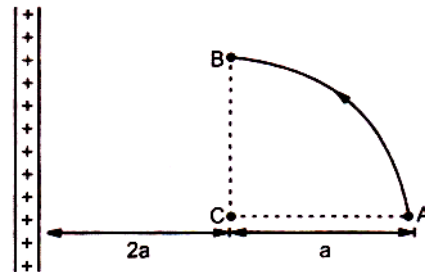
Space for rough work

14. The diagram shows a small bead of mass m carrying charge q . The bead can freely move on the smooth horizontal plane. In the same plane a charge $+Q$ has also been fixed as shown. The potential at the point P due to $+Q$ is V . The velocity with which the bead should be projected from the point P so that it can



complete a circle be greater than. $\sqrt{\frac{aqV}{m}}$. Find $\frac{a}{2}$.

15. The arc AB with the centre C and the infinitely long wire having linear charge density λ are lying in same plane. The minimum amount of work to be done to move a point charge q_0 from point A to B through a circular path AB of radius a is equal

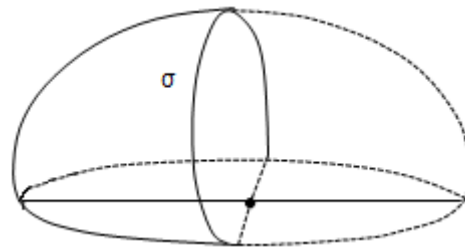


to $\frac{q_0 \lambda}{4\pi \epsilon_0} \ln\left(\frac{s}{r}\right)$. Then $s+r+t = ?$

16. A ring of radius R has charge $-Q$ distributed uniformly over it. A charge q is placed at the centre of the ring such that the electric field becomes zero at a point on the axis of the ring at a distance R from the centre of the ring. The value of $q = \frac{Q}{4} \sqrt{W}$. Find W .

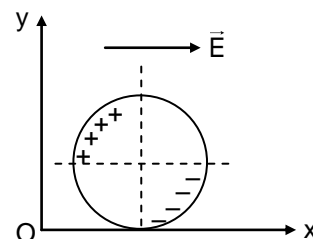
17. The electric potential V at any point x, y, z (all in meter) in space is given by $v = 4x^2$ volt. The electric field E at the point $(1m, 0, 2m)$ is V/m.

18. The electric field strength at the centre of a hemisphere of radius R charged uniformly with surface charge density σ is $\frac{\sigma}{4\epsilon_0}$. Now half part of the hemisphere is removed as shown. The field strength at the centre due to the removing part is $\frac{\sigma}{2\epsilon_0 \sqrt{n}}$, then find n ?

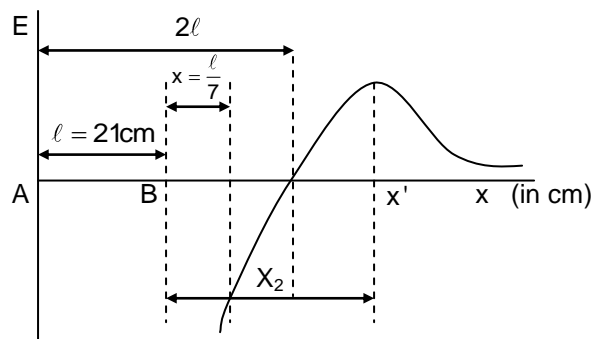


Space for rough work

19. A nonconducting ring of mass m and radius R with charge per unit length λ , is shown in figure. It is then placed on a rough nonconducting horizontal plane. At time $t = 0$, a uniform electric field $\vec{E} = E_0 \hat{i}$ is switched on and the ring starts rolling without sliding. The friction force (magnitude) acting on the ring is $f = \frac{\beta}{6}(\lambda R E_0)$, then β is



20. Two point charges Q_a and Q_b are positioned at points A and B. The field strength to the right of charge Q_b on the line that passes through the two charges varies according to a law represented schematically in figure (without employing a definite scale). The field strength is assumed to be positive if its direction coincides with the positive direction of the x -axis. The distance between the charges is $\ell = 21$ cm. Find the ratio between the absolute values of charges Q_a and Q_b .



PART II: CHEMISTRY

SECTION – I: (One or more than one options are correct)

This section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE THAN ONE** are correct.

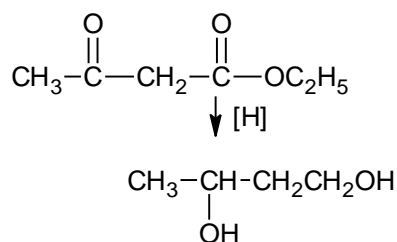
21. Grignard reagents give alkane, on reaction with :
 (A) phenol (B) ether (C) alcohol (D) water
22. Isobutyl alcohol cannot be obtained by the reaction between :
 (A) C_2H_5MgBr and CH_3CHO (B) CH_3MgBr and CH_3CH_2CHO
 (C) $(CH_3)_2CHMgBr$ and $HCHO$ (D) CH_3MgBr and CH_3COCH_3
23. Alcohol can be prepared by which of the following methods ?
 (A) By hydration of alkene (B) By reduction of carbonyl compounds
 (C) By reaction of primary aliphatic amines with nitrous acid
 (D) By hydrolysis of esters

Space for rough work

24. $\text{CH}_3 - \text{CH}(\text{CH}_3) - \text{CH} = \text{CH}_2 \xrightarrow{\text{Reagent R}}$ alcohol
Which is/are true about alcohol and R ?
- | Alcohol | Reagent |
|--|--|
| (A) $\text{CH}_3 - \text{CH}(\text{CH}_3) - \text{CH}_2 - \text{CH}_2\text{OH}$ | $\text{BH}_3/\text{THF} \text{ H}_2\text{O}_2/\text{OH}^-$ |
| (B) $\text{CH}_3 - \text{CH}(\text{CH}_3) - \text{CH}(\text{OH}) - \text{CH}_3$ | $\text{Hg}(\text{OAc})_2/\text{NaBH}_4 - \text{H}_2\text{O}$ |
| (C) $\text{CH}_3 - \text{C}(\text{OH})(\text{CH}_3) - \text{CH}_2 - \text{CH}_3$ | H_3O^+ |
| (D) None of the above | |
25. $\text{Ph} - \text{CH}(\text{OH}) - \text{CH}_3$ can be prepared by
- | | |
|--|--|
| (A) $\text{Ph} - \text{CHO} + \text{CH}_3\text{MgCl}$ | (B) $\text{CH}_3\text{CH}_2\text{CHO} + \text{PhMgBr}$ |
| (C) $\text{Ph} - \text{CH}(\text{CH}_3)\text{MgCl} + \text{O}_2$ | (D) None |
26. When neopentyl alcohol is treated with H_2SO_4 , a mixture of two alkenes (85 : 15) is formed. Which statement(s) is/are correct about these alkenes ?
- (A) Both give same major products on treatment with HBr
 (B) Both give different major products on treatment with HBr in presence of peroxide
 (C) The alkene which is formed in 85% concentration has higher heat of hydrogenation than other alkene
 (D) Both alkenes, on ozonolysis give same product
27. Which of the following alcohol(s) can be prepared by the action of Grignard reagents with aldehydes ?
- | | |
|-----------------------|--|
| (A) Primary alcohols | (B) secondary alcohols |
| (C) tertiary alcohols | (D) Both primary and tertiary alcohols |
28. Which of the following reactions will yield propan-2-ol ?
- (A) $\text{H}_2\text{C} = \text{CH} - \text{CH}_3 + \text{HOH} \xrightarrow{\text{H}^+}$
 (B) $\text{CH}_3 - \text{CHO} \xrightarrow[\text{HOH}]{\text{CH}_3\text{MgBr}}$
 (C) $\text{CH}_2\text{O} \xrightarrow[\text{(ii)HOH}]{\text{(i)C}_2\text{H}_5\text{MgI}}$
 (D) $\text{H}_2\text{C} = \text{CH} - \text{CH}_3 \xrightarrow{\text{neutral KMnO}_4}$
29. The correct combination of names for isomeric alcohols with molecular formula $\text{C}_4\text{H}_{10}\text{O}$ are :
- (A) tert-butanol and 2-methylpropan-2-ol
 (B) tert-butanol and 1, 1-dimethylethan-1-ol
 (C) n-butanol and butan-1-ol
 (D) iso-butyl alcohol and 2-methylpropan-1-ol

Space for rough work

30.



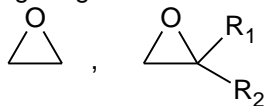
The reducing agent suitable for above transformation is

- (A) NaBH_4 (B) LiAlH_4 (C) $\text{H}_2/\text{Ni}, \Delta$ (D) none of these

SECTION – II: (Integer value type)

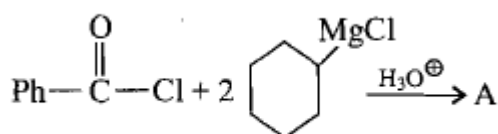
This section contains **10 questions**. The answer to each of the questions is a **single digit integer**, ranging from 0 to 9 (both inclusive).

31. How many number of structural and stereoisomeric alcohols are possible having the molecular formula $\text{C}_5\text{H}_{12}\text{O}$?
32. If 4-methyl-2-pentene is refluxed with dilute sulphuric acid, hydration reaction takes place. On principle, how many different alcohols would be formed ?
33. How many different ketones on treatment with Grignard's reagent followed by hydrolysis can give 2-cyclopentyl butanol ?
34. How many of the following reagents can be used for the preparation of 3° alcohol with Grignard reagents ?



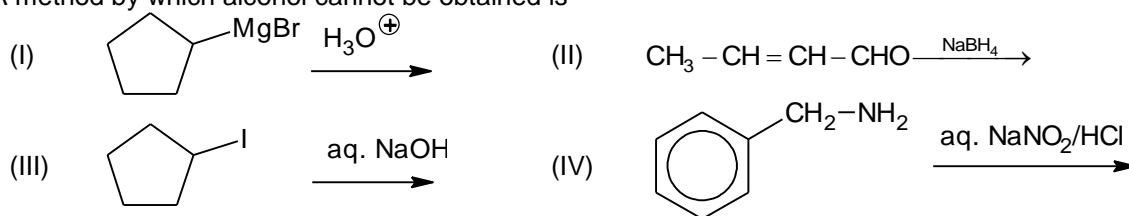
HCOOC_2H_5 , $\text{CH}_3\text{COOC}_2\text{H}_5$, CH_3CHO , CH_3COCH_3 , $\text{C}_2\text{H}_5\text{COC}_6\text{H}_5$.

35. The degree of unsaturation of the product of the following reaction is.....

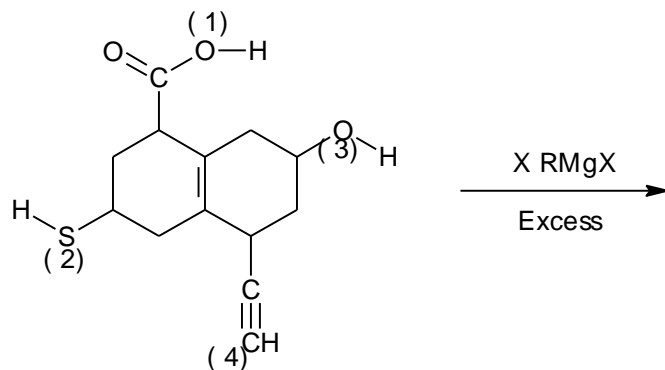


Space for rough work

36. A method by which alcohol cannot be obtained is

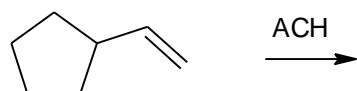


37.



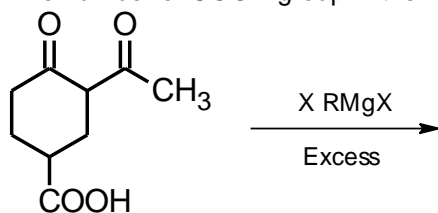
The value of x is

38.

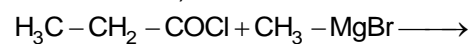


Total no. of possible products of alcohols.

39. The number of COOH group in the final product of the following reaction is



40. Total number of enol possible for the compound formed during given reaction will be (including stereoisomers)



Space for rough work

PART III: MATHEMATICS

SECTION – I: (One or more than one options are correct)

This section contains 10 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE or MORE THAN ONE are correct.

41. Given that the 4th term in the expansion of $\left(2 + \frac{3x}{8}\right)^{10}$ has the maximum numerical value, then x can lie in the interval(s)
 (A) $\left(2, \frac{64}{21}\right)$ (B) $\left(-\frac{60}{23}, -2\right)$ (C) $\left(-\frac{64}{21}, -2\right)$ (D) $\left(2, -\frac{60}{23}\right)$
42. If in the expansion of $\left(\frac{1}{x} + x \tan x\right)^5$ the ratio of 4th term to the 2nd term is $\frac{2}{27}\pi^4$, then value of x can be
 (A) $-\frac{\pi}{6}$ (B) $-\frac{\pi}{3}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{12}$
43. If in the expansion of $(a + b)^n$, $n \in \mathbb{N}$, sum of odd and even terms be α and β respectively, then
 (A) $(a^2 - b^2)^n = \alpha^2 - \beta^2$ (B) $(a^2 - b^2)^n = (\alpha - \beta)^n$
 (C) $(a + b)^n - (a - b)^n = 4\alpha\beta$ (D) $(a + b)^{2n} - (a - b)^{2n} = 4\alpha\beta$
44. If in the expansion of $(1 + x)^m (1 - x)^n$, the coefficient of x and x^2 are 3 and -6 respectively, then
 (A) $m = 9$ (B) $n = 12$ (C) $m = 12$ (D) $n = 9$
45. In the expansion of $(1 + x^2)^{12} (1 + x^{12})$
 (A) coefficient of $x^{24} = {}^{12}C_6 + 1$ (B) coefficient of $x^{12} = {}^{12}C_6 + 1$
 (C) coefficient of $x^{18} = {}^{12}C_6 + {}^{12}C_6$ (D) coefficient of $x^6 = {}^{12}C_3$

Space for rough work

46. For the expansion $(1+2\sqrt{x})^{40}$, sum of the coefficient of the
- (A) integral powers of x is $\frac{1}{2}(3^{40} + 1)$ (B) non-integral powers of x is $\frac{1}{2}(3^{40} - 1)$
 (C) integral powers of x is $\frac{1}{2}(3^{40} - 1)$ (D) non-integral powers of x is $\frac{1}{2}(3^{40} + 1)$
47. The value/values of x in the expression $(x + x^{\log_{10} x})^5$ if the third term in the expansion is 10,00,000 is /are
- (A) 10 (B) 100 (C) $10^{-5/2}$ (D) $10^{-3/2}$
48. In the expansion $(7^{1/3} + 11^{1/9})^{6561}$
- (A) there are exactly 730 rational terms
 (B) there are exactly 5831 irrational terms
 (C) the term which involves greatest binomial coefficients is irrational
 (D) the term which involves greatest binomial coefficients is rational
49. In the expansion of $(x^2 + 1 + \frac{1}{x^2})^n$, $n \in \mathbb{N}$,
- (A) number of terms is $2n + 1$ (B) coefficient of constant terms is 2^{n-1}
 (C) coefficient of x^{2n-2} is n (D) coefficient of x^2 in n
50. 10th term of $(3 - \sqrt{\frac{17}{4}} + 3\sqrt{2})^{20}$
- (A) an irrational number (B) a rational number
 (C) a positive integer (D) a negative integer

Space for rough work

SECTION – II: (Integer value type)

This section contains **10 questions**. The answer to each of the questions is a **single digit integer**, ranging from 0 to 9 (both inclusive).

51. If A and B are coefficients of x^n in the expansion of $(1+x)^{2n}$ and $(1+x)^{2n-1}$ respectively, then $\frac{A}{B}$ is equal to
52. If the coefficients of 2nd, 3rd and the 4th terms in the expansion of $(1+x)^n$ are in A.P., then value of n is
53. If the three consecutive coefficient in the expansion of $(1+x)^n$ are 28, 56 and 70, then the value of n is
54. Least positive integer just greater than $(1+0.00002)^{50000}$ is
55. If the middle term in the expansion of $\left(\frac{x}{2}+2\right)^8$ is 1120, then the sum of possible real values of x is
56. If the constant term in the binomial expansion of $\left(x^2-\frac{1}{x}\right)^n$, $n \in \mathbb{N}$ is 15, then the value of n is equal to
57. The expression $\left(\sqrt{2x^2+1}+\sqrt{2x^2-1}\right)^6 + \left(\frac{2}{\sqrt{2x^2+1}+\sqrt{2x^2-1}}\right)^6$ is a polynomial of degree
58. Find the coefficient of x^{2009} in the expansion of $(1-x)^{2008} (1+x+x^2)^{2007}$
59. In the coefficients x^7 in $\left(ax^2+\frac{1}{bx}\right)^{11}$ and coefficient of x^{-7} in $\left(ax-\frac{1}{bx^2}\right)^{11}$ are equal, then the value of ab is
60. If the second term of the expansion $\left[a^{1/13}+\frac{a}{\sqrt{a^{-1}}}\right]^n$ is $14a^{5/2}$, then the value of $\frac{{}^nC_3}{{}^nC_2}$ is

Space for rough work

FITJEE RET – 9

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2014 (P1)_SET-A

DATE: 11.06.2018

ANSWERS

PHYSICS

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

CHEMISTRY

21. A, C, D	22. A, B, D	23. A, B, C, D	24. A, B, C
25. A, C	26. A, B	27. A, B	28. A, B
29. A, C, D	30. B, C	31. Bonus	32. 5 or 3
33. 3	34. 4	35. 6	36. 1
37. 4	38. Bonus	39. 0	40. 3

MATHEMATICS

41. ABC	42. BC	43. AD	44. CD
45. ABD	46. AB	47. AC	48. AC
49. AC	50. A	51. 2	52. 7
53. 8	54. 3	55. 0	56. 6
57. 6	58. 0	59. 1	60. 4

FIITJEE RET – 1

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2014 (P1)_SET-B

DATE: 11.06.2018

Time: 3 hours

Maximum Marks: 180

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:

12. The question paper consists of **3 parts (Physics, Chemistry and Mathematics)**. Each part consists of **two sections**.
13. **Section I** contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** are correct.
14. **Section II** contains **10 questions**. The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).

D. Marking Scheme

15. For each question in **Section I**, you will be awarded **3 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.
16. For each question in **Section II**, you will be awarded **3 marks** if you darken the bubble corresponding to the correct answer **ONLY**. In all other cases **zero (0) marks** will be awarded. **No negative 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.

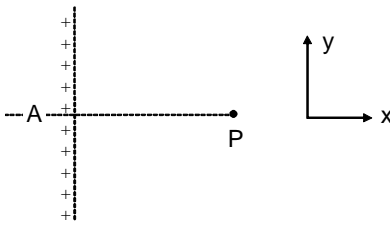
NAME:

ENROLLMENT NO.:

PAPER-I
PART I: PHYSICS

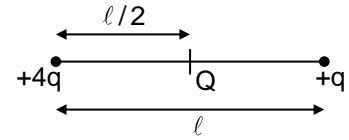
SECTION – I: (One or more than one options are correct)

This section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE THAN ONE** are correct.

1. Charge Q is distributed non-uniformly over a ring of radius R , P is a point on the axis of ring at a distance $\sqrt{3}R$ from its centre. Which of the following is a correct statement.
- (A) Potential at P is $\frac{KQ}{2R}$
- (B) Magnitude of electric field at P may be greater than $\frac{\sqrt{3}KQ}{8R^2}$
- (C) Magnitude of electric field at P must be equal to $\frac{\sqrt{3}KQ}{8R^2}$
- (D) Magnitude of electric field at P cannot be less than $\frac{\sqrt{3}KQ}{8R^2}$
2. Electric field, due to infinite line of charge, as shown in figure, at P has magnitude E . If half of the line of charge i.e. below A , is removed then
- (A) Electric field at P will have magnitude $E/2$.
- (B) Electric field's x component at P will be $E/2$.
- (C) Electric field's y component at P will be $E/2$.
- (D) electric field at P will have a magnitude more than $E/2$
- 
3. Choose the correct statements from the following
- (A) if the electric field is zero at a point, the electric potential must also be zero at that point
- (B) if the electric field is constant in a given region of space, the electric field must be zero in that region
- (C) two different equipotential surfaces can never intersect
- (D) electrons move from region of lower potential to a region of higher potential
4. Four point charges $+q$, $+q$, $-q$ and $-q$ are placed respectively at corners A , B , C , D respectively of a square. Then
- (A) the potential at the center O of the square is zero
- (B) the electric field at the center O of the square is zero
- (C) if E is the mid-point of side BC , the work done in carrying an electron from O to E is zero
- (D) if F is the mid-point of side CD , the work done in carrying an electron from O to F is zero

Space for rough work

5. Three point charges $+4q$, Q and $+q$ are placed in a straight line of length ℓ at points as shown in figure.



- (A) if net force on charge $+q$ is zero then Q must be a negative charge whose value is q
 (B) if net force on $+4q$ is zero, then Q must be a negative charge whose value is $q/2$
 (C) if net force on charge $+q$ were zero, then potential energy of the system is $\frac{7q^2}{2\pi\epsilon_0\ell}$
 (D) if net force on $+4q$ is zero, then Q must be a negative charge whose value is $\frac{q}{4}$

6. The electric potential in the region of space is given by $V(x) = A + Bx + Cx^2$, where V is in volts, x is in meters and A, B, C are constants. Then,

- (A) \vec{E} varies linearly with x
 (B) the unit of \vec{E} is newton coulomb $^{-1}$
 (C) \vec{E} is in the negative x -direction
 (D) the electric field \vec{E} in this region is constant

7. The electric potential decreases uniformly from x volt to $-x$ volt as one moves along y -axis from $y = +1$ m to $y = -1$ m. The electric field at the origin:

- (A) is equal to $\frac{x}{2}$ volt/m
 (B) may be equal to x volt/m
 (C) may be greater than x volt/m
 (D) may be less than x volt/m

8. A particle A of mass m and charge Q moves directly towards a fixed particle B, which has charge Q . The speed of A is v when it is far away from B. The minimum separation between the particles is proportional to

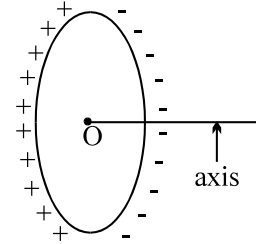
- (A) Q^2 (B) $\frac{1}{v^2}$ (C) $\frac{1}{v}$ (D) $\frac{1}{m}$

9. A ring of radius R is made out of a thin metallic wire of area of cross section A . The ring has a uniform charge Q distributed on it. A charge q_0 is placed at the centre of the ring. If Y is the young's modulus for the material of the ring and ΔR is the change in the radius of the ring then.

- (A) $\Delta R = \frac{q_0 Q}{4\pi\epsilon_0 RAY}$ (B) $\Delta R = \frac{q_0 Q}{4\pi^2\epsilon_0 RAY}$
 (C) $\Delta R = \frac{q_0 Q}{8\pi^2\epsilon_0^2 RAY}$ (D) $\Delta R = \frac{q_0 Q}{8\pi\epsilon_0 RAY}$

Space for rough work

10. The figure shows a non conducting ring which has positive and negative charge non-uniformly distributed on it such that the total charge is zero. Which of the following statement is true?
 (A) The potential at all the points on the axis will be zero.
 (B) The electric field at all the points on the axis will be zero.
 (C) The direction of electric field at all points on the axis will be along the axis.
 (D) If the ring is placed inside a uniform external electric field then net force acting on it will be zero

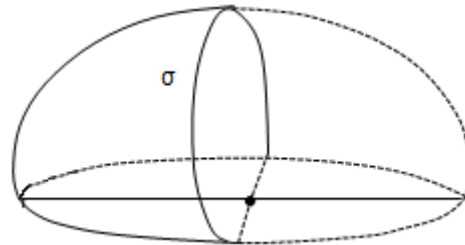


SECTION – II: (Integer value type)

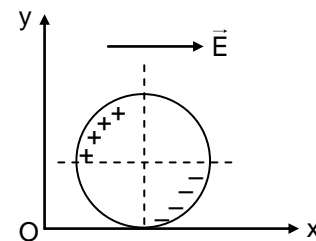
This section contains **10 questions**. The answer to each of the questions is a **single digit integer**, ranging from 0 to 9 (both inclusive).

11. A ring of radius R has charge $-Q$ distributed uniformly over it. A charge q is placed at the centre of the ring such that the electric field becomes zero at a point on the axis of the ring at a distance R from the centre of the ring. The value of $q = \frac{Q}{4} \sqrt{W}$. Find W.
12. The electric potential V at any point x,y,z (all in meter) in space is given by $v = 4x^2$ volt. The electric field E at the point (1m, 0, 2m) is V/m.

13. The electric field strength at the centre of a hemisphere of radius R charged uniformly with surface charge density σ is $\frac{\sigma}{4\epsilon_0}$. Now half part of the hemisphere is removed as shown. The field strength at the centre due to the removing part is $\frac{\sigma}{2\epsilon_0 \sqrt{n}}$, then find n?

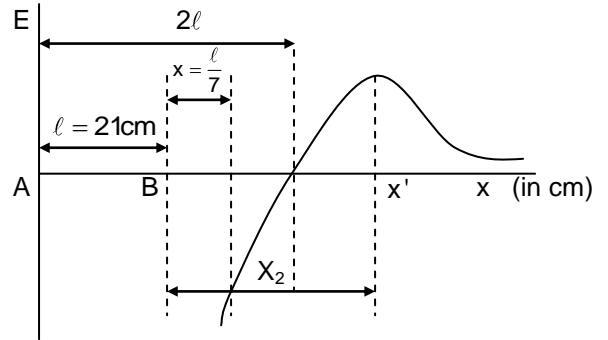


14. A nonconducting ring of mass m and radius R with charge per unit length λ , is shown in figure. It is then placed on a rough nonconducting horizontal plane. At time $t = 0$, a uniform electric field $\vec{E} = E_0 \hat{i}$ is switched on and the ring starts rolling without sliding. The friction force (magnitude) acting on the ring is $f = \frac{\beta}{6} (\lambda R E_0)$, then β is

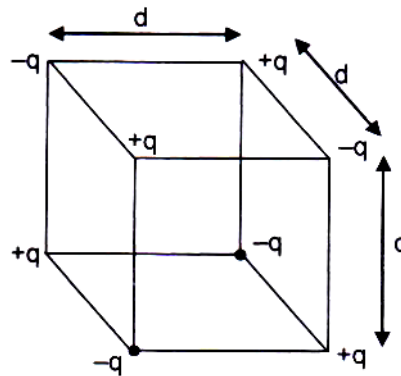


Space for rough work

15. Two point charges Q_a and Q_b are positioned at points A and B. The field strength to the right of charge Q_b on the line that passes through the two charges varies according to a law represented schematically in figure (without employing a definite scale). The field strength is assumed to be positive if its direction coincides with the positive direction of the x-axis. The distance between the charges is $\ell = 21$ cm. Find the ratio between the absolute values of charges Q_a and Q_b .



16. The potential energy of the configuration is given as $\frac{-Aq^2}{\pi\epsilon_0 d} \left[B - \frac{1}{\sqrt{C}} + \frac{1}{3\sqrt{D}} \right]$. Then find $\frac{CD}{AB}$.

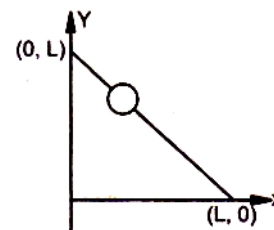


17. A charge Q is uniformly distributed on the surface of an angular disc of inner radius R and outer radius ηR . A charged particle of mass m and charge $-q$ is released from rest at a point on the axis of the disc far from the centre of the ring?

The velocity it will reach the centre of the ring is equal to $\frac{AKQ}{(\eta+1)R}$. Then find A .

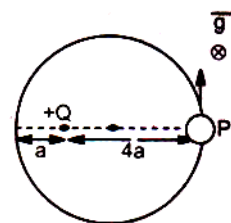
18. Electric field given by the vector $E = x\hat{i} + y\hat{j}$ is present in the XY plane. A small ring carrying charge $+Q$, which can freely slide on a smooth non conducting rod, is projected along the rod from the point $(0, L)$ such that it can reach the other end of the rod. What minimum velocity should be given to the ring? (Assume zero gravity)?

$(QL^2/k_1 m)^{1/n}$. Then $k_1 + n = ?$.



Space for rough work

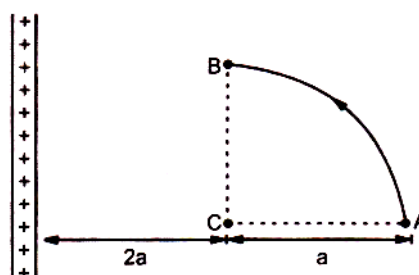
19. The diagram shows a small bead of mass m carrying charge q . The bead can freely move on the smooth horizontal plane. In the same plane a charge $+Q$ has also been fixed as shown. The potential at the point P due to $+Q$ is V . The velocity with which the bead should be projected from the point P so that it can



complete a circle be greater than. $\sqrt{\frac{aqV}{m}}$. Find $\frac{a}{2}$.

20. The arc AB with the centre C and the infinitely long wire having linear charge density λ are lying in same plane. The minimum amount of work to be done to move a point charge q_0 from point A to B through a circular path AB of radius a is equal

to $\frac{q_0\lambda}{4\pi\epsilon_0} \ln\left(\frac{s}{r}\right)$. Then $s+r+t = ?$



PART II: CHEMISTRY

SECTION – I: (One or more than one options are correct)

This section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE THAN ONE** are correct.

21. When neopentyl alcohol is treated with H_2SO_4 , a mixture of two alkenes (85 : 15) is formed. Which statement(s) is/are correct about these alkenes ?
- (A) Both give same major products on treatment with HBr
 - (B) Both give different major products on treatment with HBr in presence of peroxide
 - (C) The alkene which is formed in 85% concentration has higher heat of hydrogenation than other alkene
 - (D) Both alkenes, on ozonolysis give same product

Space for rough work

22. Which of the following alcohol(s) can be prepared by the action of Grignard reagents with aldehydes ?
 (A) Primary alcohols (B) secondary alcohols
 (C) tertiary alcohols (D) Both primary and tertiary alcohols
23. Which of the following reactions will yield propan-2-ol ?
 (A) $\text{H}_2\text{C} = \text{CH} - \text{CH}_3 + \text{HOH} \xrightarrow{\text{H}^+}$
 (B) $\text{CH}_3 - \text{CHO} \xrightarrow[\text{HOH}]{\text{CH}_3\text{MgBr}}$
 (C) $\text{CH}_2\text{O} \xrightarrow[\text{(ii)HOH}]{\text{(i)C}_2\text{H}_5\text{MgI}}$
 (D) $\text{H}_2\text{C} = \text{CH} - \text{CH}_3 \xrightarrow{\text{neutral KMnO}_4}$
24. The correct combination of names for isomeric alcohols with molecular formula $\text{C}_4\text{H}_{10}\text{O}$ are :
 (A) tert-butanol and 2-methylpropan-2-ol
 (B) tert-butanol and 1, 1-dimethylethan-1-ol
 (C) n-butanol and butan-1-ol
 (D) iso-butyl alcohol and 2-methylpropan-1-ol
25.
$$\begin{array}{c} \text{O} \qquad \qquad \text{O} \\ \parallel \qquad \qquad \parallel \\ \text{CH}_3 - \text{C} - \text{CH}_2 - \text{C} - \text{OC}_2\text{H}_5 \\ \downarrow [\text{H}] \\ \text{CH}_3 - \text{CH} - \text{CH}_2\text{CH}_2\text{OH} \\ | \\ \text{OH} \end{array}$$

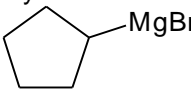
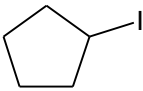
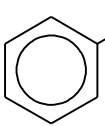
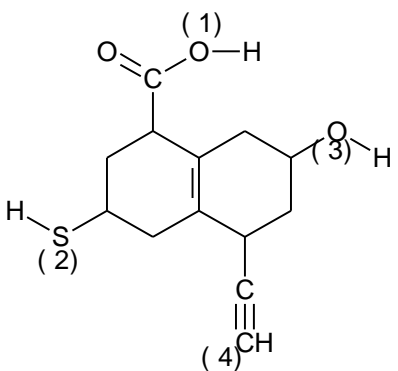
 The reducing agent suitable for above transformation is
 (A) NaBH_4 (B) LiAlH_4 (C) $\text{H}_2/\text{Ni}, \Delta$ (D) none of these
26. Grignard reagents give alkane, on reaction with :
 (A) phenol (B) ether (C) alcohol (D) water
27. Isobutyl alcohol cannot be obtained by the reaction between :
 (A) $\text{C}_2\text{H}_5\text{MgBr}$ and CH_3CHO (B) CH_3MgBr and $\text{CH}_3\text{CH}_2\text{CHO}$
 (C) $(\text{CH}_3)_2\text{CHMgBr}$ and HCHO (D) CH_3MgBr and CH_3COCH_3
28. Alcohol can be prepared by which of the following methods ?
 (A) By hydration of alkene (B) By reduction of carbonyl compounds
 (C) By reaction of primary aliphatic amines with nitrous acid
 (D) By hydrolysis of esters

Space for rough work

29. $\text{CH}_3 - \text{CH}(\text{CH}_3) - \text{CH} = \text{CH}_2 \xrightarrow{\text{Reagent R}} \text{alcohol}$
Which is/are true about alcohol and R ?
- | Alcohol | Reagent |
|--|--|
| (A) $\text{CH}_3 - \text{CH}(\text{CH}_3) - \text{CH}_2 - \text{CH}_2\text{OH}$ | $\text{BH}_3/\text{THF} \text{ H}_2\text{O}_2/\text{OH}^-$ |
| (B) $\text{CH}_3 - \text{CH}(\text{CH}_3) - \text{CH}(\text{OH}) - \text{CH}_3$ | $\text{Hg}(\text{OAc})_2/\text{NaBH}_4 - \text{H}_2\text{O}$ |
| (C) $\text{CH}_3 - \text{C}(\text{OH})(\text{CH}_3) - \text{CH}_2 - \text{CH}_3$ | H_3O^+ |
| (D) None of the above | |
30. $\text{Ph} - \text{CH}(\text{OH}) - \text{CH}_3$ can be prepared by
- | | |
|--|--|
| (A) $\text{Ph} - \text{CHO} + \text{CH}_3\text{MgCl}$ | (B) $\text{CH}_3\text{CH}_2\text{CHO} + \text{PhMgBr}$ |
| (C) $\text{Ph} - \text{CH}(\text{CH}_3)\text{MgCl} + \text{O}_2$ | (D) None |

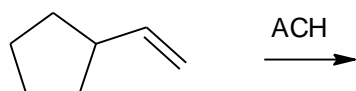
SECTION – II: (Integer value type)

This section contains **10 questions**. The answer to each of the questions is a **single digit integer**, ranging from 0 to 9 (both inclusive).

31. A method by which alcohol cannot be obtained is
- | | |
|--|--|
| (I)  $\xrightarrow{\text{H}_3\text{O}^+}$ | (II) $\text{CH}_3 - \text{CH} = \text{CH} - \text{CHO} \xrightarrow{\text{NaBH}_4}$ |
| (III)  $\xrightarrow{\text{aq. NaOH}}$ | (IV)  $\xrightarrow{\text{aq. NaNO}_2/\text{HCl}}$ |
32.  $\xrightarrow[\text{Excess}]{\text{X RMgX}}$
- The value of x is

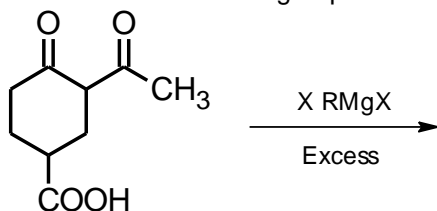
Space for rough work

33.

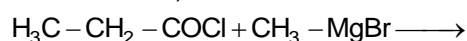


Total no. of possible products of alcohols.

34. The number of COOH group in the final product of the following reaction is



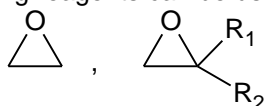
35. Total number of enol possible for the compound formed during given reaction will be (including stereoisomers)

36. How many number of structural and stereoisomeric alcohols are possible having the molecular formula $\text{C}_5\text{H}_{12}\text{O}$?

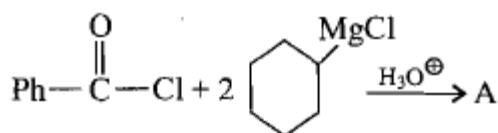
37. If 4-methyl-2-pentene is refluxed with dilute sulphuric acid, hydration reaction takes place. On principle, how many different alcohols would be formed ?

38. How many different ketones on treatment with Grignard's reagent followed by hydrolysis can give 2-cyclopentyl butanol ?

39. How many of the following reagents can be used for the preparation of 3° alcohol with Grignard reagents ?


 $\text{HCOOC}_2\text{H}_5, \text{CH}_3\text{COOC}_2\text{H}_5, \text{CH}_3\text{CHO}, \text{CH}_3\text{COCH}_3, \text{C}_2\text{H}_5\text{COC}_6\text{H}_5.$

40. The degree of unsaturation of the product of the following reaction is.....



Space for rough work

PART III: MATHEMATICS

SECTION – I: (One or more than one options are correct)

This section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE THAN ONE** are correct.

41. For the expansion $(1+2\sqrt{x})^{40}$, sum of the coefficient of the
- (A) integral powers of x is $\frac{1}{2}(3^{40} + 1)$ (B) non-integral powers of x is $\frac{1}{2}(3^{40} - 1)$
 (C) integral powers of x is $\frac{1}{2}(3^{40} - 1)$ (D) non-integral powers of x is $\frac{1}{2}(3^{40} + 1)$
42. The value/values of x in the expression $(x + x^{\log_{10} x})^5$ if the third term in the expansion is 10,00,000 is /are
 (A) 10 (B) 100 (C) $10^{-5/2}$ (D) $10^{-3/2}$
43. In the expansion $(7^{1/3} + 11^{1/9})^{6561}$
 (A) there are exactly 730 rational terms
 (B) there are exactly 5831 irrational terms
 (C) the term which involves greatest binomial coefficients is irrational
 (D) the term which involves greatest binomial coefficients is rational
44. In the expansion of $(x^2 + 1 + \frac{1}{x^2})^n$, $n \in \mathbb{N}$,
 (A) number of terms is $2n + 1$ (B) coefficient of constant terms is 2^{n-1}
 (C) coefficient of x^{2n-2} is n (D) coefficient of x^2 in n
45. 10th term of $(3 - \sqrt{\frac{17}{4}} + 3\sqrt{2})^{20}$
 (A) an irrational number (B) a rational number
 (C) a positive integer (D) a negative integer

Space for rough work

46. Given that the 4th term in the expansion of $\left(2 + \frac{3x}{8}\right)^{10}$ has the maximum numerical value, then x can lie in the interval(s)
- (A) $\left(2, \frac{64}{21}\right)$ (B) $\left(-\frac{60}{23}, -2\right)$ (C) $\left(-\frac{64}{21}, -2\right)$ (D) $\left(2, -\frac{60}{23}\right)$
47. If in the expansion of $\left(\frac{1}{x} + x \tan x\right)^5$ the ratio of 4th term to the 2nd term is $\frac{2}{27}\pi^4$, then value of x can be
- (A) $-\frac{\pi}{6}$ (B) $-\frac{\pi}{3}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{12}$
48. If in the expansion of $(a + b)^n$, $n \in \mathbb{N}$, sum of odd and even terms be α and β respectively, then
- (A) $(a^2 - b^2)^n = \alpha^2 - \beta^2$ (B) $(a^2 - b^2)^n = (\alpha - \beta)^n$
 (C) $(a + b)^n - (a - b)^n = 4\alpha\beta$ (D) $(a + b)^{2n} - (a - b)^{2n} = 4\alpha\beta$
49. If in the expansion of $(1 + x)^m (1 - x)^n$, the coefficient of x and x^2 are 3 and -6 respectively, then
- (A) $m = 9$ (B) $n = 12$ (C) $m = 12$ (D) $n = 9$
50. In the expansion of $(1 + x^2)^{12} (1 + x^{12})$
- (A) coefficient of $x^{24} = {}^{12}C_6 + 1$ (B) coefficient of $x^{12} = {}^{12}C_6 + 1$
 (C) coefficient of $x^{18} = {}^{12}C_6 + {}^{12}C_6$ (D) coefficient of $x^6 = {}^{12}C_3$

SECTION – II: (Integer value type)

This section contains **10 questions**. The answer to each of the questions is a **single digit integer**, ranging from 0 to 9 (both inclusive).

51. If the constant term in the binomial expansion of $\left(x^2 - \frac{1}{x}\right)^n$, $n \in \mathbb{N}$ is 15, then the value of n is equal to
52. The expression $\left(\sqrt{2x^2 + 1} + \sqrt{2x^2 - 1}\right)^6 + \left(\frac{2}{\sqrt{2x^2 + 1} + \sqrt{2x^2 - 1}}\right)^6$ is a polynomial of degree

Space for rough work

53. Find the coefficient of x^{2009} in the expansion of $(1-x)^{2008} (1+x+x^2)^{2007}$
54. In the coefficients x^7 in $\left(ax^2 + \frac{1}{bx}\right)^{11}$ and coefficient of x^{-7} in $\left(ax - \frac{1}{bx^2}\right)^{11}$ are equal, then the value of ab is
55. If the second term of the expansion $\left[a^{1/13} + \frac{a}{\sqrt{a^{-1}}}\right]^n$ is $14a^{5/2}$, then the value of $\frac{{}^n C_3}{{}^n C_2}$ is
56. If A and B are coefficients of x^n in the expansion of $(1+x)^{2n}$ and $(1+x)^{2n-1}$ respectively, then $\frac{A}{B}$ is equal to
57. If the coefficients of 2nd, 3rd and the 4th terms in the expansion of $(1+x)^n$ are in A.P., then value of n is
58. If the three consecutive coefficient in the expansion of $(1+x)^n$ are 28, 56 and 70, then the value of n is
59. Least positive integer just greater than $(1+0.00002)^{50000}$ is
60. If the middle term in the expansion of $\left(\frac{x}{2} + 2\right)^8$ is 1120, then the sum of possible real values of x is

Space for rough work

FITJEE RET – 9

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2014 (P1)_SET-B

DATE: 11.06.2018

ANSWERS

PHYSICS

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

CHEMISTRY

21. A, B	22. A, B	23. A, B	24. A, C, D
25. B, C	26. A, C, D	27. A, B, D	28. A, B, C, D
29. A, B, C	30. A, C	31. 1	32. 4
33. Bonus	34. 0	35. 3	36. Bonus
37. 5 or 3	38. 3	39. 4	40. 6

MATHEMATICS

41. AB	42. AC	43. AC	44. AC
45. A	46. ABC	47. BC	48. AD
49. CD	50. ABD	51. 6	52. 6
53. 0	54. 1	55. 4	56. 2
57. 7	58. 8	59. 3	60. 0