

IIT JEE ADVANCED
TEST- 03 (26-04-2018)

Time: 3 Hours

SRGP

Maximum Marks: 270

LEADER/INTHUSE/TOAS/TAAS

PAPER-1

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

A. General:

1. This booklet is your Question Paper. Do not break the seal of this booklet before being instructed to do so by the invigilator.
2. Blank spaces and blank pages are provided in the question paper for your rough work. No additional sheets will be provided for rough work.
3. Blank papers, clipboards, log tables, slide rules, calculators, cameras cellular phones, pagers and electronic gadgets of any are NOT allowed inside the examination hall.
4. Write your name and Form number in the space provided on the back cover of this booklet.
5. The answer sheet, a machine-readable Optical Response Sheet (ORS), is provided separately.
6. DO NOT TAMPER WITH/MULTILATE THIS ORS OR THIS BOOKLET.
7. On breaking the seal of the booklet check that it contains 17 pages and all the 63 questions in each subject and corresponding answer choices are legible. Read carefully the instructions printed at the beginning of each section.

B. Filling the ORS:

8. A candidate has to write his/her answer in the ORS sheet by darkening the appropriate bubble with the help of black ball point pen as the correct answer (s) of the question attempted.
9. Write all information and sign in the box provided on part of the ORS.

Name of the Candidate

I have read all the instructions and shall abide by them.

Signature of the Candidate

Form Number

--	--	--	--	--	--	--	--

I have verified all the information filled in by the Candidate

Signature of the invigilator

Some Useful Data

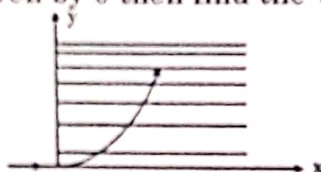
Quantity	Values
Constant of gravitation	$6.67259 \times 10^{-11} \text{ N-m}^2 \text{ kg}^{-2}$
Speed of light in vacuum	$2.99792458 \times 10^8 \text{ m s}^{-1}$
Avogadro constant	$6.0221367 \times 10^{23} \text{ mol}^{-1}$
Gas constant	$8.314510 \text{ JK}^{-1}\text{-mol}^{-1}$
Boltzmann constant	$1.380658 \times 10^{-23} \text{ JK}^{-1}$
	$8.617385 \times 10^{-5} \text{ eV K}^{-1}$
Stefan-Boltzmann constant	$5.67051 \times 10^{-8} \text{ W m}^{-2} \cdot \text{K}^{-4}$
Wien's displacement law constant	$2.897756 \times 10^{-3} \text{ m} \cdot \text{K}$
Charge of proton	$1.60217733 \times 10^{-19} \text{ C}$
Mass of electron	$9.1093897 \times 10^{-31} \text{ kg}$
	$5.48579903 \times 10^{-4} \text{ u}$
Mass of proton	$1.6726231 \times 10^{-27} \text{ kg}$
	1.007276470 u
Permeability of vacuum	$4\pi \times 10^{-7} \text{ NA}^{-2}$
Permittivity of vacuum	$8.854187817 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$
Faraday constant	$96485.3029 \text{ C mol}^{-1}$
Planck constant	$6.6260755 \times 10^{-34} \text{ J-s}$
	$4.1356692 \times 10^{-15} \text{ eV-s}$

PART-I : PHYSICS

SECTION-1 : Integer Value Correct Type

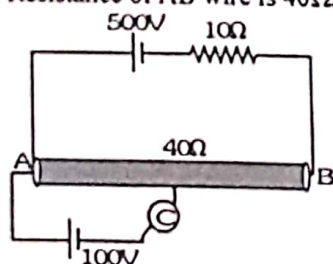
This section contains 7 questions. The answer to each question is a three digit integer (000). If your answer is 3, then fill it as 003 and If answer is 12, then fill it as 012. You will be awarded 4 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. No negative marks will be awarded for incorrect answers in this section.

1. The refractive index of the medium within a certain region, $x > 0$, $y > 0$, changes with y . A thin light ray travelling in the x -direction strikes the medium at right angles and moves through the medium along a circular arc. The maximum angular size of the arc is (The material having greatest refractive index is diamond with refractive index $n = 2.5$) given by θ then find the value of $10 \times \cos \theta$.

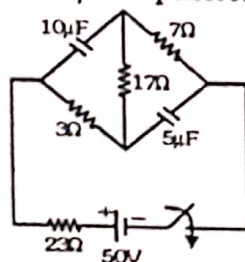


2. A positive charge $+q_1$ is located to the left of a negative charge $-q_2$. On a line passing through the two charges, there are two places where the total potential is zero. The reference is assumed to be at infinity. The first place is between the charges and is 4.00 cm to the left of the negative charge. The second place is 7.00 cm to the right of the negative charge. If $q_2 = -12 \mu\text{C}$, what is the value of charge q_1 in μC .

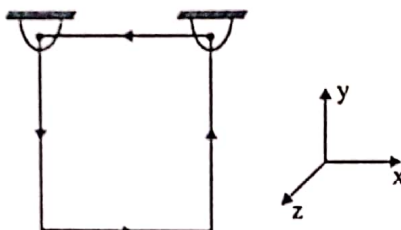
3. In a uniform shape potentiometer wire AB (100 cm long) has specific resistance $\rho = kx$ where x is position of point from starting end A. Then at which position (in cm) null point of wire will come from left end A for a given circuit? Resistance of AB wire is 40Ω .



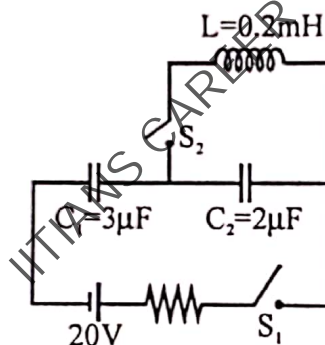
4. Write down the charge in μC on $10\mu\text{F}$ capacitor in steady state.



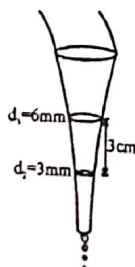
5. A current carrying uniform square frame is suspended from hinged supports as shown in the figure such that it can freely rotate about its upper side. The length and mass of each side of the frame is 2m and 4kg respectively. A uniform magnetic field $\vec{B} = (3\hat{i} + 4\hat{j})$ is applied. When the wire frame is rotated to 45° from vertical and released it remains in equilibrium. Find the magnitude of current (in A) in the wire frame.



6. The circuit shown in figure is in the steady state with switch S_1 closed and S_2 open. At $t = 0$, S_1 is opened and S_2 is closed. The first instant t , when the energy in the inductor becomes one-third of that in the capacitor C_2 is $\frac{\pi}{\alpha}$ millisecond. Find the value of α .



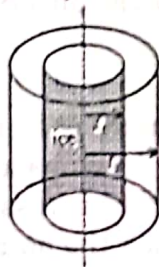
7. The tap in the garden was closed in appropriately resulting in the water flowing freely out of it which forms a downward narrowing beam. The beam of water has a circular cross-section, the diameter of the circle is 6 mm at one point and 3 mm below it is only 3 mm as shown in figure. If the rate of water wasted is $(x \times \pi)$ mL/minute then find the value of x . (Neglect the effect of viscosity and surface tension of the flowing water.)



SECTION -2 : One or More Options Correct Type

This section contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE THAN ONE** may correct. You will be awarded 4 marks if you darken all the bubble(s) corresponding to the correct answer(s) and zero mark if no bubbles are darkened. In all other cases minus Two. (-2) mark will be awarded.

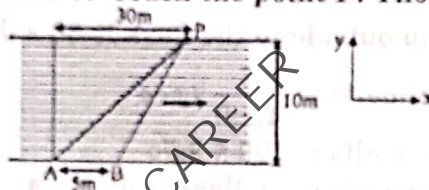
8. A 100 cm long cylindrical flask with inner and outer diameter 2 cm and 4 cm respectively is completely filled with ice as shown in the figure. The constant temperature outside the flask is 40°C . (Thermal conductivity of the flask is $0.693 \text{ W/m}^\circ\text{C}$, $L_{\text{ice}} = 80 \text{ cal/gm}$ & $\ln 2 = 0.693$).



- (A) Rate of heat flow from outside to the flask is $80\pi \text{ J/s}$
 (B) The rate at which ice melts is $\frac{\pi}{4200} \text{ kg/s}$
 (C) The rate at which ice melts is $100\pi \text{ kg/s}$
 (D) Rate of heat flow from outside to flask is $40\pi \text{ J/s}$
9. The energy of a particle executing simple harmonic motion is given by $E = Ax^2 + Bv^2$ where x is the displacement from mean position $x=0$ and v is the velocity of the particle at x then choose the **CORRECT** statement(s).
 (A) Amplitude of SHM is $\sqrt{\frac{2E}{A}}$
 (B) Maximum velocity of the particle during SHM is $\sqrt{\frac{E}{B}}$
 (C) Time period of motion is $2\pi\sqrt{\frac{B}{A}}$
 (D) Displacement of the particle is directly proportional to the velocity of the particle.
10. A waveform: $y_1 = A \sin \left(2x - 4t + \frac{\pi}{3} \right)$ is superposed with a second waveform, to produce a standing wave with a node at $x = 0$. The equation of the second waveform can be:
 (A) $y_2 = A \sin \left(2x + 4t + \frac{5\pi}{3} \right)$ (B) $y_2 = A \sin \left(2x - 4t + \frac{\pi}{3} \right)$
 (C) $y_2 = A \sin \left(2x + 4t - \frac{\pi}{3} \right)$ (D) $y_2 = A \sin \left(2x + 4t + \frac{\pi}{3} \right)$

11. A car moves towards a hill with speed v_c . It blows a horn of frequency f which is heard by an observer following the car with speed v_o . The speed of sound in air is v .
- (A) The wavelength of sound reaching the hill is $\frac{v}{f}$
- (B) The wavelength of sound reaching the hill is $\frac{v - v_c}{f}$
- (C) The beat frequency observed by the observer is $\left(\frac{v + v_o}{v - v_c}\right)f$
- (D) The beat frequency observed by the observer is $\frac{2v_c(v + v_o)f}{v^2 - v_c^2}$

12. Two swimmers A and B start swimming from different positions on the same bank as shown in figure. The swimmer A swims at angle 90° with respect to the river to reach point P. He takes 120 seconds to cross the river of width 10 m. The swimmer B also takes the same time to reach the point P. Then

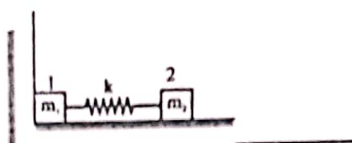


- (A) Velocity of A with respect to river is $\left(\frac{1}{12}\right) \text{ m/s}$
- (B) River flow velocity is $\left(\frac{1}{4}\right) \text{ m/s}$
- (C) Velocity of B along y-axis with respect to earth is $\left(\frac{1}{12}\right) \text{ m/s}$
- (D) Velocity of B along x-axis with respect to earth is $\left(\frac{5}{24}\right) \text{ m/s}$
13. A particle of mass 5 kg moving in the X-Y plane has its potential energy given by $U = (-7x + 24y) \text{ J}$. The particle is initially at origin and has a velocity $\vec{u} = (14.4\hat{i} + 4.2\hat{j}) \text{ m/s}$.
- (A) The particle has speed 25 m/s at $t = 4 \text{ sec}$
- (B) The particle has an acceleration 25 m/s^2
- (C) The acceleration of particle is normal to its initial velocity
- (D) All above are correct

SECTION-3 : Single Correct Type

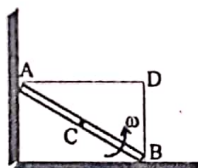
This section contains 5 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct. You will be awarded 4 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. In all other cases minus one (-1) mark will be awarded.

14. Two bars connected by a weightless spring of stiffness k rest on a smooth horizontal plane as shown in figure. Bar 2 is shifted a small distance x to the left and then released. The velocity of the centre of mass of the system after bar 1 breaks off the wall is



- (A) $\frac{x\sqrt{m_2 k}}{m_1 + m_2}$ (B) $x\sqrt{\frac{k}{m_1 + m_2}}$
(C) zero (D) $\frac{\sqrt{m_1 k}}{m_1 + m_2}$

15. A thin rod AB is sliding between two fixed right angled surfaces. At some instant its angular velocity is ω . If I_x represent moment of inertia of the rod about an axis perpendicular to the plane and passing through the point X (A, B, C or D), the kinetic energy of the rod is



- (A) $\frac{1}{2} I_A \omega^2$ (B) $\frac{1}{2} I_B \omega^2$
(C) $\frac{1}{2} I_C \omega^2$ (D) $\frac{1}{2} I_D \omega^2$

16. A particle is projected vertically upwards from the surface of the earth (radius R_e) with a speed equal to one fourth of escape velocity. What is the maximum height attained by it from the surface of the earth?

- (A) $\frac{16}{15} R_e$ (B) $\frac{R_e}{15}$
(C) $\frac{4}{15} R_e$ (D) None of these

17. Two particles A and B separated by a distance $2R$ are moving counter clockwise along the same circular path of radius R each with uniform speed v . At time $t = 0$, A is given a tangential acceleration of magnitude $a = \frac{72 v^2}{25 \pi R}$.
- (A) The time lapse for the two bodies to collide is $\frac{6 \pi R}{5v}$
- (B) The angle covered by A after $t = 0$ and before collision is $\frac{11 \pi}{6}$
- (C) Angular velocity of A just before collision is $\frac{11v}{5R}$
- (D) Radial acceleration of A is $\frac{289 v^2}{5R}$
18. Figure shows the variation of the internal energy U with density r of one mole of an ideal monatomic gas for thermodynamic cycle ABCA. Here process AB is a part of rectangular hyperbola:



- (A) Process AB is isothermal & net work in cycle is done by gas.
- (B) Process AB is isobaric & net work in cycle is done by gas.
- (C) Process AB is isobaric & net work in cycle is done on the gas.
- (D) Process AB is adiabatic & net work in cycle is done by gas.

SECTION-4 : Matrix Match Type

This section contain 3 questions. Question has three statements (A, B, and C) given in **Column-I** and three statements (P, Q, and R) in **Column II**. Any given statement in Column-I can have correct matching with **ONE OR MORE THAN ONE** statement given in Column-II. For example, if for a given question, statement B matches with the statements given in Q, then for the particular question, against statement B, darken the bubbles corresponding to Q in the ORS. You will be awarded 6 marks if you darken all the bubble(s) corresponding to the correct answer(s) and zero mark if no bubbles are darkened. For each correct answer +2 mark will be awarded. No negative marks will be awarded for incorrect answers in this section.

19. Certain radioactive processes are listed in column I and some properties and processes related to them are listed in column II.

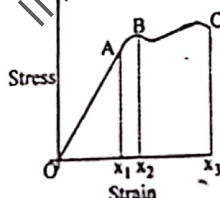
Column I

- (A) α -decay
(B) β -decay
(C) γ -emission

Column II

- (P) Increase in atomic number
(Q) Decrease in atomic number
(R) No change in atomic number

20. A metal wire is pulled by equal forces at the ends. The stress-strain (x) relationship of the wire is given. Point B of graph is the elastic limit



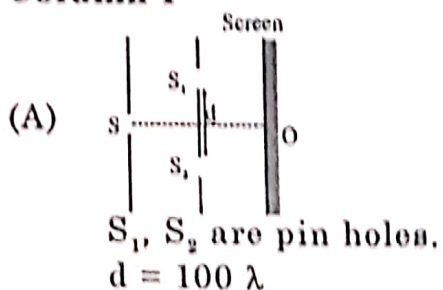
Column I

- (A) $x < x_1$
(B) $x_1 < x < x_2$
(C) $x_2 < x < x_3$

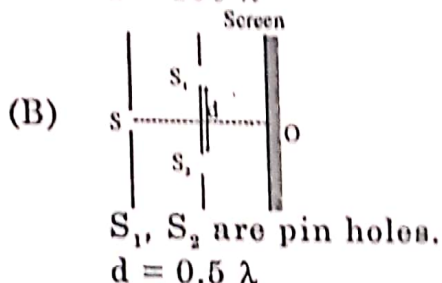
Column II

- (P) There is permanent deformation
(Q) Hook's law is valid
(R) There is no permanent deformation

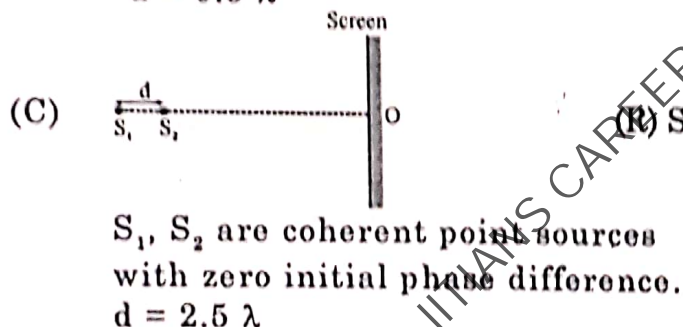
21. Column-I describes various arrangements to obtain interference pattern on screen.
Column I



(P) Centre of screen 'O' is dark.



(Q) First order maxima will not be seen.



(R) Shape of fringes is hyperbolic

ANSWER KEY 26-04-2018

PAPER-1

PHYSICS

- | | | | | |
|----------------------------|------------|----------|-----------------------|----------|
| 1. (004) | 2. (044) | 3. (050) | 4. (200) | 5. 010 |
| 6. (300) | 7. (108) | 8. (AB) | 9. (BC) | 10. (AC) |
| 11. (BD) | 12. (ABCD) | 13. (AC) | 14. (A) | 15. (D) |
| 16. (B) | 17. (B) | 18. (B) | 19. (A) Q (B) P (C) R | |
| 20. (A) Q, R; (B) R; (C) P | | | | |
| 21. (A) R (B) QR (C) P | | | | |

PART-II : MATHEMATICS

SECTION-1 : Integer Value Correct Type

This section contains 7 questions. The answer to each question is a three digit integer (000). If your answer is 3, then fill it as 003 and If answer is 12, then fill it as 012. You will be awarded 4 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. No negative marks will be awarded for incorrect answers in this section.

22. If A.M. G.M & H.M. of the first and last terms of the series $100, 101, 102, \dots, n-1, n$ ($100 < n \leq 500$) are the terms of the series itself. Then the value of $\frac{n}{100}$ is ($n \in \mathbb{N}$)
23.
$$f(x) = \begin{cases} 7 - x^2 + \log_{1/2}(b^2 - 4b + 3) & ; 0 \leq x < 2 \\ x^2 - x + 2 & ; x \geq 2 \end{cases}$$

find the integral value of b, for which f(x) has least value at $x = 2$.
24. Let M(1, 2, 3) be a point in space and N be a point on the line L_1 , then find the value of $a + b$, (where $\lambda = \frac{a}{b}$, a and b are co-prime number), for which \overline{MN} is parallel to the plane $\vec{r} \cdot (\hat{i} - 4\hat{j} + 3\hat{k}) = 1$ is equal to
25. Let f and g be two real - valued differentiable functions on R. If $f'(x) = g(x)$ and $g'(x) = f(x)$ for all $x \in \mathbb{R}$ and $f(3) = 5$, $f'(3) = 4$, then $\sqrt{\int_0^1 (f^2(x) - g^2(x)) dx}$ is equal to
26. The number of real values of α satisfying the equation
$$\int_{-1}^{\alpha} \left(8x^2 + \frac{28}{3}x + 4 \right) dx = \frac{1 + \frac{3}{2}\alpha}{\log_{\alpha+1} \sqrt{\alpha+1}},$$
 is
27. Number of integral value of c satisfying $\log_{\frac{25-c}{16}} \left(\frac{24 - 2c - c^2}{14} \right) > \cot(\cot^{-1})$ is
28. In $\triangle ABC$, $AC > AB$, the internal angle bisector of angle A meets BC at D and E (E is inside the triangle) is the foot of the perpendicular from B on AD. Suppose $AB = 5$ and $BE = 4$, the value of the expression $\left(\frac{AC + AB}{AC - AB} \right) (ED)$ is

SECTION -2 : One or More Options Correct Type

This section contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE THAN ONE** may correct. You will be awarded 4 marks if you darken all the bubble(s) corresponding to the correct answer(s) and zero mark if no bubbles are darkened. In all other cases minus Two (-2) mark will be awarded.

29. If $y(x)$ satisfies the differential equation $\frac{dy}{dx} = \sin(2x) + 3y \cot x$ and $y\left(\frac{\pi}{2}\right) = 2$, then

Which of the following statement(s) is (are) correct ?

- (A) $y\left(\frac{\pi}{6}\right) = 0$ (B) $y'\left(\frac{\pi}{3}\right) = \frac{9-3\sqrt{2}}{2}$
(C*) $y(x)$ increases in $\left(\frac{\pi}{6}, \frac{\pi}{3}\right)$ (D) $\int_0^{\frac{\pi}{3}} y(x) dx = \pi$

30. Let C_1 and C_2 are two conics whose respective eccentricities are roots of equation $x^2 - 3ax + 2a^2 = 0$. Identify the correct option(s) -

- (A) Both C_1 and C_2 will represent hyperbolas if $a \in (1, \infty)$
(B) Both C_1 and C_2 will represent ellipses if $a \in \left(0, \frac{1}{2}\right)$
(C) C_1 and C_2 will represent a hyperbola and an ellipse if $a \in \left(\frac{1}{2}, 1\right)$
(D) C_1 and C_2 will represent a hyperbola and an ellipse if $a = 1$

31. Events A and B satisfy $P(\bar{A}) = 7/10$, $P(B) = 4/10$ and $P(A \cap B) = 1/10$. Which of following is/are correct.

- (A) $15P(A \cap \bar{B}) = 7P\left(\frac{B}{A}\right)$ (B) $P\left(\frac{(A \cap \bar{B})}{(A \cup B)}\right) = \frac{1}{2}$
(C) $P\left(\frac{A}{B}\right) < P\left(\frac{B}{A}\right)$ (D) $P(\text{neither A nor B occurs}) = \frac{2}{5}$

32. Let B is an invertible square matrix and B is the adjoint of matrix A such that $AB = B^T$, then -

- (A) A is an identity matrix.
(B) B is a symmetric matrix.
(C) A is not an identity matrix
(D) B is skew symmetric matrix.

33. A tangent is drawn at any point $P(t)$ on the parabola $y^2 = 8x$ and a point $Q(\alpha, \beta)$ is taken on it from which pair of tangents QA and QB are drawn to the circle $x^2 + y^2 = 4$, where A & B are points of contact. Now if point $P(t)$ varies on the parabola then the locus of all such point of concurrency of the chord of contact AB is denoted by $S = 0$, then-
- (A) Equation of $S = 0$ is $2x + y^2 = 0$
 (B) Equation of $S = 0$ is $x + y^2 = 0$
 (C) Area bounded by $S = 0$ and the line $2x + 1 = 0$ is $\frac{2}{3}$ sq. units
 (D) Tangents drawn at the extremities of intersection of $S = 0$ and the line $2x - y + 1 = 0$ to the curve $S = 0$ includes an angle 75° .
34. Let $f(x)$ be an even periodic function with period 4 defined partially as

$$f(x) = \begin{cases} e^x & x \in [0, 1] \\ e(2-x) & x \in [1, 2] \end{cases}$$
 In the interval $[-10, 10]$ identify the correct statement(s)
- (A) $f(x)$ is non-derivable at exactly 14 points
 (B) $f(x)$ is non-derivable at exactly 19 points
 (C) Range of $f(x)$ is $[0, e]$
 (D) $f(x)$ is discontinuous at exactly 8 points

SECTION-3 : Single Correct Type

This section contains 5 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct. You will be awarded 4 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. In all other cases minus one (-1) mark will be awarded.

35. Given the inequality $\frac{1}{3} \leq \frac{x^2 - \alpha x + \alpha^2}{x^2 + \beta x + \beta^2} \leq 3$ holds true $\forall x \in \mathbb{R}$ and $\beta \neq 0$, and for this inequality maximum value of $\left| \frac{\alpha}{\beta} \right|$ is equal to
- (A) $\frac{5}{3}$ (B) $\frac{3}{5}$ (C) 1 (D) 2
36. Let $F(z) = \frac{z+i}{z-i}$ for all complex numbers $z \neq i$ and consider $z_n = F(z_{n-1})$ for all positive integers n . Given that $z_0 = 2 + i$ and $z_{2015} = a + ib$, where a & b are real numbers, then $(a + b)$ is
- (A) 3 (B) 8 (C) 10 (D) 12
37. If total number of alpha-numeral linear arrangements of all letters and digits used in the word "T20 WORLD CUP 2016" such that between each pair of digits there is exactly one letter and no three letters are together is $m(6!)^2$, then sum of digits in number m is
- (A) 3 (B) 4 (C) 5 (D) 9

38. If $\frac{\sin 25^\circ \cot 55^\circ (\tan 60^\circ + \tan 35^\circ)}{(1 + \tan^2 35^\circ)} = \frac{\sqrt{a} + 1}{2\sqrt{b}}$ where $a, b \in \mathbb{N}$, then $(2a - b)$ equals -
(A) 2 (B) -2 (C) 4 (D) -4
39. If $f(x) = ({}^8C_1x + 1)({}^8C_2x + 1) \dots ({}^8C_8x + 1)$, then $f'(0)$ is divisible by -
(A) 19 (B) 17 (C) 5 (D) 11

SECTION-4 : Matrix Match Type

This section contains 3 questions. Question has three statements (A, B, and C) given in Column-I and three statements (P, Q, and R) in Column II. Any given statement in Column-I can have correct matching with ONE OR MORE THAN ONE statement given in Column-II. For example, if for a given question, statement B matches with the statements given in Q, then for the particular question, against statement B, darken the bubbles corresponding to Q in the ORS. You will be awarded 6 marks if you darken all the bubble(s) corresponding to the correct answer(s) and zero mark if no bubbles are darkened. For each correct answer +2 mark will be awarded. No negative marks will be awarded for incorrect answers in this section.

40. **Column-I** **Column -II**
- (A) $|z - 3| + |z - 4i| = 6$, then locus of z is (P) square
- (B) $\frac{|z+1-2i|}{|z-3i|} = 2$, then locus of z is (Q) circle
- (C) $|z + \bar{z}| + |z - \bar{z}| = 4$, then locus of z is (R) ellipse
41. **Column - I** **Column-II**
- (A) The value $\left[\sum_{n=0}^{\infty} \tan^{-1} \left(\frac{2}{\sqrt{n+2} + \sqrt{n} + (n+2)\sqrt{n} + n(\sqrt{n+2})} \right) \right]$ (P) 5
([.] represents greatest integer function)
- (B) Number of solutions of equation $\tan^{-1}(2 \sin x) = \cot^{-1}(\cos x)$ in $[0, 10\pi]$ is (Q) 2
- (C) If the sum of roots of the quadratic equation $(-a+1)x^2 + (a^2 - a + 4)x - 2a + 3 = 0$ is minimum, then the value of a ($a > 1$) is (R) 6

42. Column-I

Column-II

(A) If $x = \tan \frac{\pi}{12}$, then the value of $x^4 - 3x^3 + 19x^2 - 12x + 5$ is (P) 1

(B) Number of integers in the range of $\frac{x^4 - x + 3}{x^4 - x + 1}$ is (Q) 2

(C) The value of $\sum_{p=1}^{\infty} \sum_{q=1}^{\infty} \delta_{pq} \frac{2^p}{3^q}$, (where $\delta_{pq} = \begin{cases} 0 & p \neq q \\ 1 & p = q \end{cases}$) is equal to (R) 3

ANSWER KEY 26-04-2018

PAPER-1

MATHEMATICS

- | | | | | |
|---------------------------|-----------|-----------|-----------------------|-----------|
| 22. (004) | 23. (000) | 24. (019) | 25. (003) | 26. (001) |
| 27. (003) | 28. (003) | 29. (AC) | 30. (ABC) | 31. (ACD) |
| 32. (AB) | 33. (AC) | 34. (BC) | 35. (A) | 36. (A) |
| 37. (D) | 38. (B) | 39. (C) | 40. (A) R (B) Q (C) P | |
| 41. (A) Q ; (B) P ; (C) P | | | | |
| 42. (A) R ; (B) Q ; (C) Q | | | | |

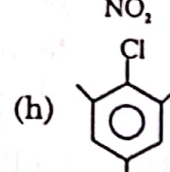
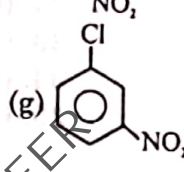
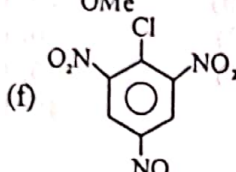
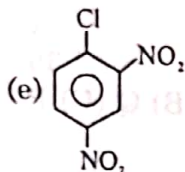
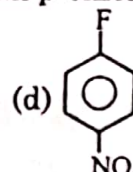
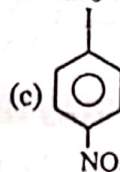
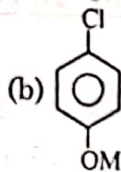
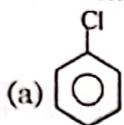
IITIAN'S CAREER

PART-III : CHEMISTRY

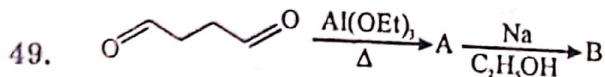
SECTION-1 : Integer Value Correct Type

This section contains 7 questions. The answer to each question is a three digit integer (000). If your answer is 3, then fill it as 003 and If answer is 12, then fill it as 012. You will be awarded 4 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. No negative marks will be awarded for incorrect answers in this section.

43. How many bonding molecular orbitals are used in the formation of NO?
44. How many of the following will react with NH_3 at faster than p-chloronitrobenzene?



45. $\Delta H^\circ_{\text{comb}}$ of methane and ethane are -218 kJ/mole and -368 kJ/mole respectively. Calculate the $\Delta H^\circ_{\text{comb}}$ (in kJ/mole) of hexane.
46. Numbers of elements from given below which are commercially refined by vapour phase refining :
Ni, Zr, B, Zn, Sn, Ti, Bi, Hg
47. How many carbonyl compounds of molecular mass 86 will give optically active product/product mixture on treatment with LiAlH_4 ?
48. A solid AB has $\frac{r^+}{r^-} = 0.5$. Calculate the packing fraction of a face of cubic unit cell
[Use : $\pi = 3.15$]
[Fill your answer by multiplying it through 1000]



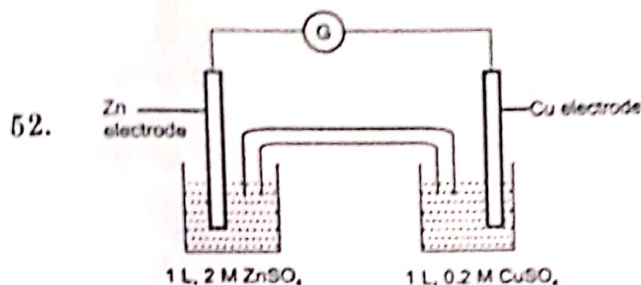
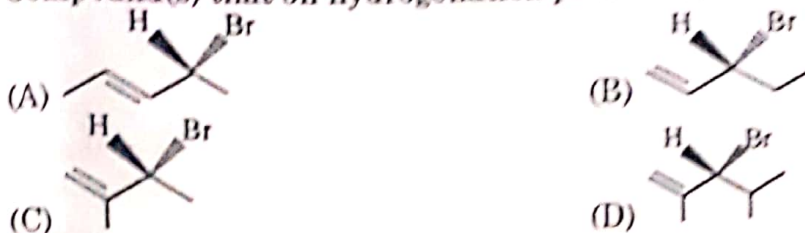
What will be the Degree of unsaturation of compound B?

SECTION-2 : One or More Options Correct Type

This section contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE OR MORE THAN ONE may correct. You will be awarded 4 marks if you darken all the bubble(s) corresponding to the correct answer(s) and zero mark if no bubbles are darkened. In all other cases minus Two (-2) mark will be awarded.

50. Which of the following is/ are taken as initial reagents in the preparation of $\text{K}_2\text{Cr}_2\text{O}_7$?
(A) FeCr_2O_4 (B) Na_2CO_3 (C) KCl (D) O_2

51. Compound(s) that on hydrogenation produce(s) optically active compound(s) is/are



Given $E^\circ_{Zn^{2+}/Zn} = -0.76 V$ $K_f [Cu(NH_3)_4]^{+2} = 4 \times 10^{11}$

$E^\circ_{Cu^{2+}/Cu} = 0.34 V$

[Also given : $\frac{2.303 \times R}{F} = 2 \times 10^{-4}$ and assume that E° values are independent on temperature.]

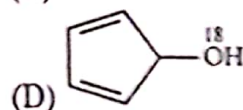
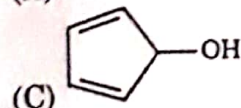
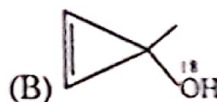
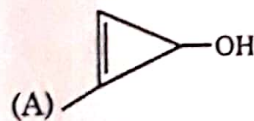
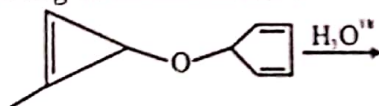
Which of the following is/are correct for given cell :

- (A) The emf of cell at 200 K is 1.08 V
(B) When 1 mole NH_3 added to cathode compartment then emf of cell at 300K is 0.8 V
(C) At 500 K, $[Cu^{2+}] = 2 \times 10^{-22}$ emf of the cell will be zero if conc. of Zn^{2+} is remain same.
(D) Addition of NH_3 does not affect the emf of given cell.

53. Select the correct statement(s)

- (A) H, P have similar value of EN.
(B) EN of Ga > EN of Al, due to scandide contraction.
(C) EN of C > EN of Si
(D) EN of C < EN of Si

54. Product of the following reaction is/are :

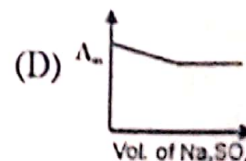
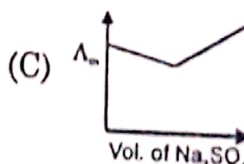
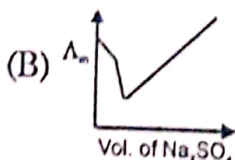
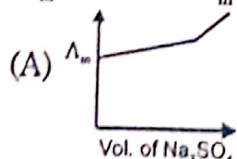


55. The vapour pressure of the solution of two liquids A($p^\circ = 80$ mm) and B($p^\circ = 120$ mm) is found to be 100 mm when $x_A = 0.4$. The result shows that :
(A) solution exhibits ideal behaviour (B) $\Delta H_{\text{solution}} < 0$
(C) solution shows negative deviation
(D) solution will show positive deviations for lower concentration and negative deviations for higher concentrations.

SECTION-3 : Single Correct Type

This section contains 5 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct. You will be awarded 4 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubbles are darkened. In all other cases minus one (-1) mark will be awarded.

56. Choose the incorrect match:
(A) HgS - vermilion
(B) Cu_5FeS_4 - Peacock ore
(C) $\text{CaSO}_4 + \text{Cu}(\text{OH})_2$ - Bordeaux mixture
(D) Ni-Fe alloy - Invar steel
57. Which of the following alkene is most reactive towards cationic polymerisation ?
(A) $\text{CH}_2 = \text{CH} - \text{CH}_3$ (B) $\text{CH}_2 = \text{CH} - \text{Cl}$
(C) $\text{CH}_2 = \text{CH} - \text{C}_6\text{H}_5$ (D) $\text{CH}_2 = \text{CHCOOC}_2\text{H}_5$
58. Consider a weak monobasic acid which is neutralised with KOH at 500 K. ΔG° of the reaction is $-13.818 \text{ K cal/mol}$. Find dissociation constant of acid.
($R = 2 \text{ cal/mol} \cdot \text{K}$).
(A) 10^{-9} (B) 10^{-8} (C) 10^{-12} (D) 10^6
59. The mixture of MgCl_2 and MgO is called :
(A) sorel cement (B) mixed salt
(C) Portland cement (D) Magnesium oxychloride
60. Which of the following is correct matching when BaCl_2 solution is titrated conductometrically with Na_2SO_4 solution ?
($\lambda_m^\circ(\text{Ba}^{2+}) > 2\lambda_m^\circ(\text{Na}^+)$)



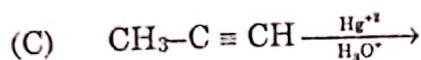
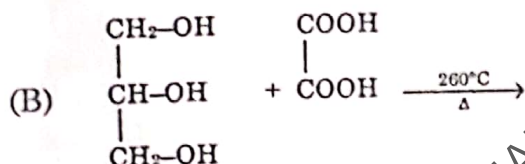
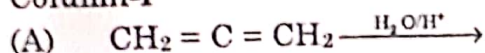
SECTION-4 : Matrix Match Type

This section contain 3 questions. Question has three statements (A, B, and C) given in **Column-I** and three statements (P, Q, and R) in **Column II**. Any given statement in Column-I can have correct matching with **ONE OR MORE THAN ONE** statement given in Column-II. For example, if for a given question, statement B matches with the statements given in Q, then for the particular question, against statement B, darken the bubbles corresponding to Q in the ORS. You will be awarded 6 marks if you darken all the bubble(s) corresponding to the correct answer(s) and zero mark if no bubbles are darkened. For each correct answer +2 mark will be awarded. No negative marks will be awarded for incorrect answers in this section.

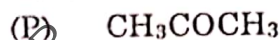
61. Match the pair of complex compounds with the properties that are same in them

Column-I	Column-II
(A) $[\text{AuCl}_4]^-$ & $[\text{PdCl}_4]^{2-}$	(P) magnetic moment value
(B) $[\text{Fe}(\text{dmg})_2]$ & $[\text{Ni}(\text{dmg})_2]$	(Q) EAN value
(C) $[\text{Fe}(\text{CO})_5]$ & $[\text{Ni}(\text{CO})_4]$	(R) Shape

62. Column-I



Column-II



(R) Enol is produced during the reaction which tautomerise into final product

63. Match the following :

Column- I (Graph)	Column-II (Slope)
(A) $\log [C]_t$ vs t (abscissa) is first order	(P) $-\frac{k}{2.303}$
(B) $\left(\frac{-dc}{dt}\right)$ vs $[C]_t$ for zero order	(Q) unity
(C) $\ln \left(\frac{-dc}{dt}\right)$ vs $\ln [C]_t$ for first order	(R) zero

ANSWER KEY		PHYSICS		26-04-2018	
43. 005	44. 003	45. 968 kJ/mole	46. 004	47. 002	
48. 875	49. 000	50. AB	51. AC	52. ABC	
53. AB	54. BC	55. BC	56. C	57. C	
58. A	59. A	60. C	61. A→PR, B→PR, C→PQ		
62. A→PR, B→Q, C→PR		63. (A) → R ; (B) → Q ; (C) → P			