



## PART-A (MATHEMATICS)

1. The equation  $e^{\sin x} - e^{-\sin x} - 4 = 0$  has :
- (1) infinite number of real roots
  - (2) no real roots
  - (3) exactly one real root
  - (4) exactly four real roots
2. Let  $\hat{a}$  and  $\hat{b}$  be two unit vectors. If the vectors  $c = \hat{a} + 2\hat{b}$  and  $d = 5\hat{a} - 4\hat{b}$  are perpendicular to each other, then the angle between  $\hat{a}$  and  $\hat{b}$  is :
- (1)  $\frac{\pi}{6}$
  - (2)  $\frac{\pi}{2}$
  - (3)  $\frac{\pi}{3}$
  - (4)  $\frac{\pi}{4}$
3. A spherical balloon is filled with  $4500\pi$  cubic meters of helium gas. If a leak in the balloon causes the gas to escape at the rate of  $72\pi$  cubic meters per minute, then the rate (in meters per minute) at which the radius of the balloon decreases 49 minutes after the leakage began is :
- (1)  $\frac{9}{7}$
  - (2)  $\frac{7}{9}$
  - (3)  $\frac{2}{9}$
  - (4)  $\frac{9}{2}$
4. **Statement-1 :** The sum of the series  $1 + (1 + 2 + 4) + (4 + 6 + 9) + (9 + 12 + 16) + \dots + (361 + 380 + 400)$  is 8000.
- Statement-2 :**  $\sum_{k=1}^n (k^3 - (k-1)^3) = n^3$ , for any natural number  $n$ .
- (1) Statement-1 is false, Statement-2 is true.
  - (2) Statement-1 is true, statement-2 is true; statement-2 is a correct explanation for Statement-1.
  - (3) Statement-1 is true, statement-2 is true; statement-2 is **not** a correct explanation for Statement-1.
  - (4) Statement-1 is true, statement-2 is false.
5. The negation of the statement "If I become a teacher, then I will open a school", is :
- (1) I will become a teacher and I will not open a school.
  - (2) Either I will not become a teacher or I will not open a school.
  - (3) Neither I will become a teacher nor I will open a school
  - (4) I will not become a teacher or I will open a school.
6. If the integral  $\int \frac{1}{\tan x - 2} dx = x + a \lambda n |\sin x - 2 \cos x| + k$ , then  $a$  is equal to :
- (1) -1
  - (2) -2
  - (3) 1
  - (4) 2



7. **Statement-1** : An equation of a common tangent to the parabola  $y^2 = 16\sqrt{3}x$  and the ellipse  $2x^2 + y^2 = 4$  is  $y = 2x + 2\sqrt{3}$ .

**Statement-2** : If the line  $y = mx + \frac{4\sqrt{3}}{m}$ , ( $m \neq 0$ ) is a common tangent to the parabola  $y^2 = 16\sqrt{3}x$  and the ellipse  $2x^2 + y^2 = 4$ , then  $m$  satisfies  $m^4 + 2m^2 = 24$ . —

- (1) Statement-1 is false, Statement-2 is true.  
(2) Statement-1 is true, statement-2 is true; statement-2 is a correct explanation for Statement-1.  
(3) Statement-1 is true, statement-2 is true; statement-2 is **not** a correct explanation for Statement-1.  
(4) Statement-1 is true, statement-2 is false.

8. Let  $A = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{pmatrix}$ . If  $u_1$  and  $u_2$  are column matrices such that  $Au_1 = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$  and  $Au_2 = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$ , then  $u_1 + u_2$  is equal

to :

- (1)  $\begin{pmatrix} -1 \\ 1 \\ 0 \end{pmatrix}$                       (2)  $\begin{pmatrix} -1 \\ 1 \\ -1 \end{pmatrix}$                       (3)  $\begin{pmatrix} -1 \\ -1 \\ 0 \end{pmatrix}$                       (4)  $\begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix}$

9. If  $n$  is a positive integer, then  $\sqrt[2n]{3+1} - \sqrt[2n]{3-1}$  is :
- (1) an irrational number                      (2) an odd positive integer  
(3) an even positive integer                      (4) a rational number other than positive integers

10. If 100 times the 100<sup>th</sup> term of an AP with non zero common difference equals the 50 times its 50<sup>th</sup> term, then the 150<sup>th</sup> term of this AP is :
- (1) -150                      (2) 150 times its 50<sup>th</sup> term  
(3) 150                      (4) zero

11. In a  $\Delta PQR$ , if  $3 \sin P + 4 \cos Q = 6$  and  $4 \sin Q + 3 \cos P = 1$ , then the angle  $R$  is equal to :
- (1)  $\frac{5\pi}{6}$                       (2)  $\frac{\pi}{6}$                       (3)  $\frac{\pi}{4}$                       (4)  $\frac{3\pi}{4}$

12. A equation of a plane parallel to the plane  $x - 2y + 2z - 5 = 0$  and at a unit distance from the origin is :
- (1)  $x - 2y + 2z - 3 = 0$     (2)  $x - 2y + 2z + 1 = 0$     (3)  $x - 2y + 2z - 1 = 0$     (4)  $x - 2y + 2z + 5 = 0$

13. If the line  $2x + y = k$  passes through the point which divides the line segment joining the points (1, 1) and (2, 4) in the ratio 3 : 2, then  $k$  equals :
- (1)  $\frac{29}{5}$                       (2) 5                      (3) 6                      (4)  $\frac{11}{5}$



14. Let  $x_1, x_2, \dots, x_n$  be  $n$  observations, and let  $\bar{x}$  be their arithmetic mean and  $\sigma^2$  be the variance  
**Statement-1** : Variance of  $2x_1, 2x_2, \dots, 2x_n$  is  $4\sigma^2$ .  
**Statement-2** : Arithmetic mean of  $2x_1, 2x_2, \dots, 2x_n$  is  $2\bar{x}$ .  
(1) Statement-1 is false, Statement-2 is true.  
(2) Statement-1 is true, statement-2 is true; statement-2 is a correct explanation for Statement-1.  
(3) Statement-1 is true, statement-2 is true; statement-2 is **not** a correct explanation for Statement-1.  
(4) Statement-1 is true, statement-2 is false.
15. The population  $p(t)$  at time  $t$  of a certain mouse species satisfies the differential equation  
$$\frac{dp(t)}{dt} = 0.5 p(t) - 450$$
. If  $p(0) = 850$ , then the time at which the population becomes zero is :  
(1)  $2 \ln 18$                       (2)  $\ln 9$                       (3)  $\frac{1}{2} \ln 18$                       (4)  $\ln 18$
16. Let  $a, b \in \mathbb{R}$  be such that the function  $f$  given by  $f(x) = \lambda n |x| + bx^2 + ax, x \neq 0$  has extreme values at  $x = -1$  and  $x = 2$ .  
**Statement-1** :  $f$  has local maximum at  $x = -1$  and at  $x = 2$ .  
**Statement-2** :  $a = \frac{1}{2}$  and  $b = \frac{-1}{4}$ .  
(1) Statement-1 is false, Statement-2 is true.  
(2) Statement-1 is true, statement-2 is true; statement-2 is a correct explanation for Statement-1.  
(3) Statement-1 is true, statement-2 is true; statement-2 is **not** a correct explanation for Statement-1.  
(4) Statement-1 is true, statement-2 is false.
17. The area bounded between the parabolas  $x^2 = \frac{y}{4}$  and  $x^2 = 9y$  and the straight line  $y = 2$  is :  
(1)  $20\sqrt{2}$                       (2)  $\frac{10\sqrt{2}}{3}$                       (3)  $\frac{20\sqrt{2}}{3}$                       (4)  $10\sqrt{2}$
18. Assuming the balls to be identical except for difference in colours, the number of ways in which one or more balls can be selected from 10 white, 9 green and 7 black balls is :  
(1) 880                      (2) 629                      (3) 630                      (4) 879
19. If  $f : \mathbb{R} \rightarrow \mathbb{R}$  is a function defined by  $f(x) = [x] \cos \left\{ \frac{(2x-1)}{2} \right\} \pi$ , where  $[x]$  denotes the greatest integer function, then  $f$  is :  
(1) continuous for every real  $x$ .  
(2) discontinuous only at  $x = 0$ .  
(3) discontinuous only at non-zero integral values of  $x$ .  
(4) continuous only at  $x = 0$ .
20. If the line  $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$  and  $\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$  intersect, then  $k$  is equal to :  
(1)  $-1$                       (2)  $\frac{2}{9}$                       (3)  $\frac{9}{2}$                       (4)  $0$



21. Three numbers are chosen at random without replacement from  $\{1, 2, 3, \dots, 8\}$ . The probability that their minimum is 3, given that their maximum is 6, is :
- (1)  $\frac{3}{8}$                       (2)  $\frac{1}{5}$                       (3)  $\frac{1}{4}$                       (4)  $\frac{2}{5}$
22. If  $z \neq 1$  and  $\frac{z^2}{-}$  is real, then the point represented by the complex number  $z$  lies :
- (1) either on the real axis or on a circle passing through the origin.  
(2) on a circle with centre at the origin.  
(3) either on the real axis or on a circle not passing through the origin.  
(4) on the imaginary axis.    —                      —                      —
23. Let  $P$  and  $Q$  be  $3 \times 3$  matrices  $P \neq Q$ . If  $P^3 = Q^3$  and  $P^2Q = Q^2P$ , then determinant of  $(P^2 + Q^2)$  is equal to :
- (1)  $-2$                       (2)  $1$                       (3)  $0$                       (4)  $-1$
24. If  $g(x) = \int_0^x \cos 4t \, dt$ , then  $g(x + \pi)$  equals
- (1)  $\frac{g(x)}{g(\pi)}$                       (2)  $g(x) + g(\pi)$                       (3)  $g(x) - g(\pi)$                       (4)  $g(x) \cdot g(\pi)$
25. The length of the diameter of the circle which touches the  $x$ -axis at the point  $(1, 0)$  and passes through the point  $(2, 3)$  is :
- (1)  $\frac{10}{3}$                       (2)  $\frac{3}{5}$                       (3)  $\frac{6}{5}$                       (4)  $\frac{5}{3}$
26. Let  $X = \{1, 2, 3, 4, 5\}$ . The number of different ordered pairs  $(Y, Z)$  that can be formed such that  $Y \subseteq X$ ,  $Z \subseteq X$  and  $Y \cap Z$  is empty, is :
- (1)  $5^2$                       (2)  $3^5$                       (3)  $2^5$                       (4)  $5^3$
27. An ellipse is drawn by taking a diameter of the circle  $(x - 1)^2 + y^2 = 1$  as its semi-minor axis and a diameter of the circle  $x^2 + (y - 2)^2 = 4$  as semi-major axis. If the centre of the ellipse is at the origin and its axes are the coordinate axes, then the equation of the ellipse is :
- (1)  $4x^2 + y^2 = 4$                       (2)  $x^2 + 4y^2 = 8$                       (3)  $4x^2 + y^2 = 8$                       (4)  $x^2 + 4y^2 = 16$
28. Consider the function,  $f(x) = |x - 2| + |x - 5|$ ,  $x \in \mathbb{R}$ .
- Statement-1 :**  $f'(4) = 0$   
**Statement-2 :**  $f$  is continuous in  $[2, 5]$ , differentiable in  $(2, 5)$  and  $f(2) = f(5)$ .
- (1) Statement-1 is false, Statement-2 is true.  
(2) Statement-1 is true, statement-2 is true; statement-2 is a correct explanation for Statement-1.  
(3) Statement-1 is true, statement-2 is true; statement-2 is **not** a correct explanation for Statement-1.  
(4) Statement-1 is true, statement-2 is false.



29. A line is drawn through the point (1, 2) to meet the coordinate axes at P and Q such that it forms a triangle OPQ, where O is the origin. If the area of the triangle OPQ is least, then the slope of the line PQ is :

(1)  $-\frac{1}{4}$

(2)  $-4$

(3)  $-2$

(4)  $-\frac{1}{2}$

30. Let ABCD be a parallelogram such that  $\vec{AB} = \vec{q}$ ,  $\vec{AD} = \vec{p}$  and  $\angle BAD$  be an acute angle. If  $\vec{r}$  is the vector that coincides with the altitude directed from the vertex B to the side AD, then  $\vec{r}$  is given by :

(1)  $\vec{r} = 3\vec{q} - \frac{3(\vec{p} \cdot \vec{q})}{\vec{p} \cdot \vec{p}} \vec{p}$

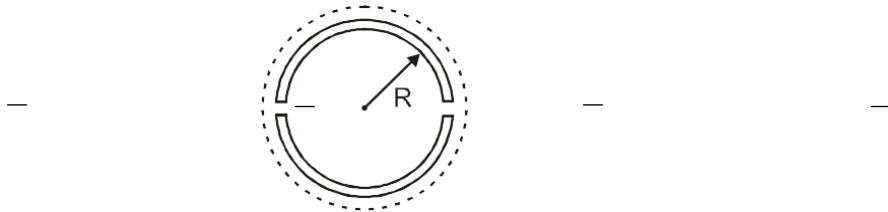
(2)  $\frac{\vec{p}}{r} = -\frac{\vec{p}}{q} + \left( \frac{\vec{p} \cdot \vec{q}}{\vec{p} \cdot \vec{p}} \right) \vec{p}$

(3)  $\frac{\vec{p}}{r} = \frac{\vec{p}}{q} - \left( \frac{\vec{p} \cdot \vec{q}}{\vec{p} \cdot \vec{p}} \right) \vec{p}$

(4)  $\frac{\vec{p}}{r} = -3\vec{p} + \frac{3(\vec{p} \cdot \vec{q})}{\vec{p} \cdot \vec{p}} \vec{p}$

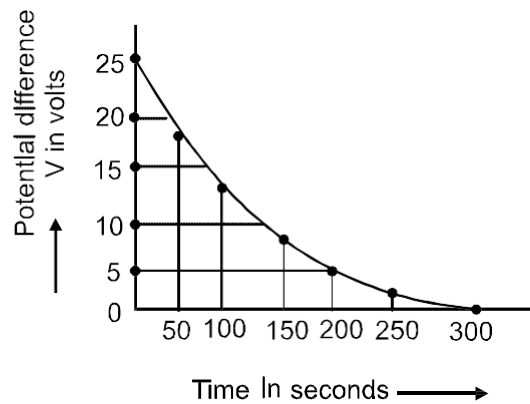
## PART-B (PHYSICS)

31. A wooden wheel of radius  $R$  is made of two semicircular parts (see figure). The two parts are held together by a ring made of a metal strip of cross sectional area  $S$  and length  $L$ .  $L$  is slightly less than  $2\pi R$ . To fit the ring on the wheel, it is heated so that its temperature rises by  $\Delta T$  and it just steps over the wheel. As it cools down to surrounding temperature, it presses the semicircular parts together. If the coefficient of linear expansion of the metal is  $\alpha$ , and its Young's modulus is  $Y$ , the force that one part of the wheel applies on the other part is :



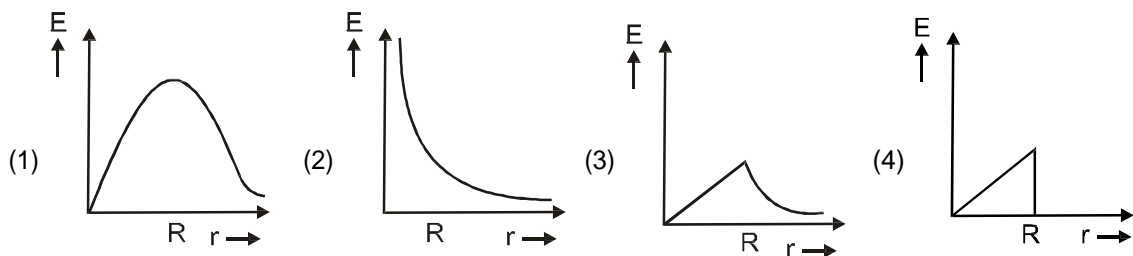
- (1)  $2\pi SY\alpha\Delta T$       (2)  $SY\alpha\Delta T$       (3)  $\pi SY\alpha\Delta T$       (4)  $2SY\alpha\Delta T$

32. The figure shows an experimental plot discharging of a capacitor in an RC circuit. The time constant  $\tau$  of this circuit lies between :



- (1) 150 sec and 200 sec      (2) 0 and 50 sec  
 (3) 50 sec and 100 sec      (4) 100 sec and 150 sec

33. In a uniformly charged sphere of total charge  $Q$  and radius  $R$ , the electric field  $E$  is plotted as function of distance from the centre. The graph which would correspond to the above will be :

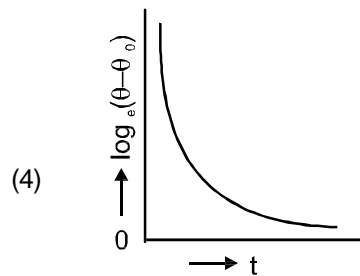
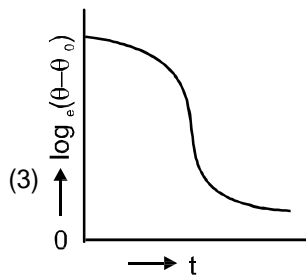
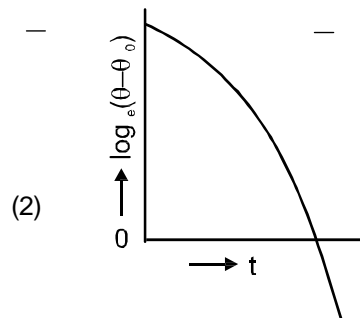
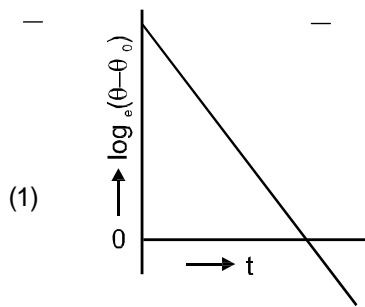




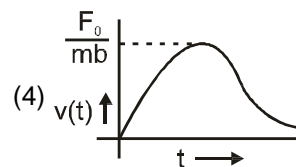
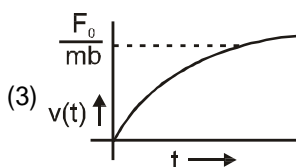
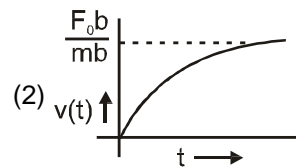
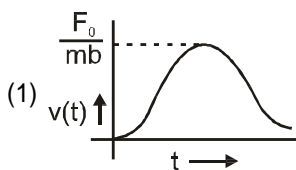
40. In Young's double slit experiment, one of the slit is wider than other, so that amplitude of the light from one slit is double of that from other slit. If  $I_m$  be the maximum intensity, the resultant intensity  $I$  when they interfere at phase difference  $\phi$  is given by :

(1)  $\frac{I_m}{9} (4 + 5 \cos\phi)$       (2)  $\frac{I_m}{3} \left( 1 + 2 \cos^2 \frac{\phi}{2} \right)$       (3)  $\frac{I_m}{5} \left( 1 + 4 \cos^2 \frac{\phi}{2} \right)$       (4)  $\frac{I_m}{9} \left( 1 + 8 \cos^2 \frac{\phi}{2} \right)$

41. A liquid in a beaker has temperature  $\theta(t)$  at time  $t$  and  $\theta_0$  is temperature of surroundings, then according to Newton's law of cooling the correct graph between  $\log_e(\theta - \theta_0)$  and  $t$  is :

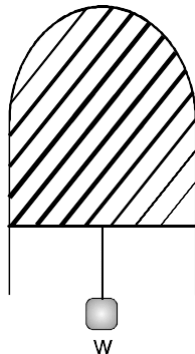


42. A particle of mass  $m$  is at rest at the origin at time  $t = 0$ . It is subjected to a force  $F(t) = F_0 e^{-bt}$  in the  $x$  direction. Its speed  $v(t)$  is depicted by which of the following curves ?



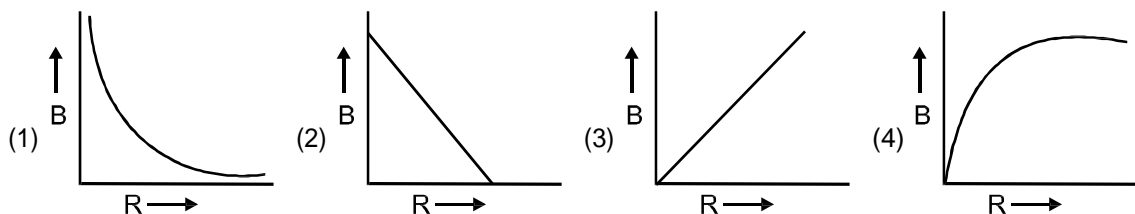
43. Two electric bulbs marked 25W – 220V and 100W – 220 V are connected in series to a 440 V supply. Which of the bulbs will fuse ?
- (1) both      (2) 100W      (3) 25W      (4) neither

44. Resistance of a given wire is obtained by measuring the current flowing in it and the voltage difference applied across it. If the percentage errors in the measurement of the current and the voltage difference are 3% each, then error in the value of resistance of the wire is :  
 (1) 6% (2) zero (3) 1% (4) 3%
45. A boy can throw a stone up to a maximum height of 10m. The maximum horizontal distance that the boy can throw the same stone up to will be :  
 (1)  $20\sqrt{2}$  m (2) 10 m (3)  $10\sqrt{2}$  m (4) 20m
46. This equation has statement 1 and Statement 2. Of the four choices given the Statements, choose the one that describes the two statements.  
**Statement 1** : Davisson-Germer experiment established the wave nature of electrons.  
**Statement 2** : If electrons have wave nature, they can interfere and show diffraction.  
 (1) Statement 1 is false, Statement 2 is true.  
 (2) Statement 1 is true, Statement 2 is false  
 (3) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation for statement 1  
 (4) Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 1
47. A thin liquid film formed between a U-shaped wire and a light slider supports a weight of  $1.5 \times 10^{-2}$  N (see figure). The length of the slider is 30 cm and its weight negligible. The surface tension of the liquid film is :

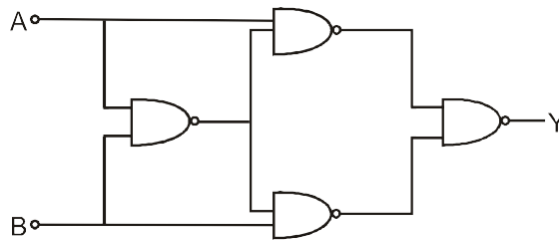


- (1)  $0.0125 \text{ Nm}^{-1}$  (2)  $0.1 \text{ Nm}^{-1}$  (3)  $0.05 \text{ Nm}^{-1}$  (4)  $0.025 \text{ Nm}^{-1}$

48. A charge  $Q$  is uniformly distributed over the surface of non-conducting disc of radius  $R$ . The disc rotates about an axis perpendicular to its plane and passing through its centre with an angular velocity  $\omega$ . As a result of this rotation a magnetic field of induction  $B$  is obtained at the centre of the disc. if we keep both the amount of charge placed on the disc and its angular velocity to be constant and vary the radius of the disc then the variation of the magnetic induction at the centre of the disc will be represented by the figure :



49. Truth table for system of four NAND gates as shown in figure is :



(1)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

(2)

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	1

(3)

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	0

(4)

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

50. A radar has a power of 1kW and is operating at a frequency of 10 GHz. It is located on a mountain top of height 500m. The maximum distance upto which it can detect object located on the surface of the earth (Radius of earth =  $6.4 \times 10^6$  m) is :

- (1) 80 km                      (2) 16 km                      (3) 40 km                      (4) 64 km

51. Assume that a neutron breaks into a proton and an electron. The energy released during this process is : (mass of neutron =  $1.6725 \times 10^{-27}$  kg, Mass of proton =  $1.6725 \times 10^{-27}$  kg, mass of electron =  $9 \times 10^{-31}$  kg)

- (1) 0.73 MeV                      (2) 7.10 MeV  
(3) 6.30 MeV                      (4) 5.4 MeV

52. A Carnot engine, whose efficiency is 40%, takes in heat from a source maintained at a temperature of 500K. It is desired to have an engine of efficiency 60%. Then, the intake temperature for the same exhaust (sink) temperature must be :

- (1) efficiency of carnot engine cannot be made larger than 50%  
(2) 1200 K  
(3) 750 K  
(4) 600 K

53. This question has Statement 1 and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements.  
If two springs  $S_1$  and  $S_2$  of force constants  $k_1$  and  $k_2$ , respectively, are stretched by the same force, it is found that more work is done on spring  $S_1$  than on spring  $S_2$ .  
**Statement 1** : If stretched by the same amount, work done on  $S_1$  will be more than that on  $S_2$   
**Statement 2** :  $k_1 < k_2$   
(1) Statement 1 is false, Statement 2 is true.  
(2) Statement 1 is true, Statement 2 is false  
(3) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation for statement 1  
(4) Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 1
54. Two cars of masses  $m_1$  and  $m_2$  are moving in circles of radii  $r_1$  and  $r_2$ , respectively. Their speeds are such that they make complete circles in the same time  $t$ . The ratio of their centripetal acceleration is :  
(1)  $m_1 r_1 : m_2 r_2$                       (2)  $m_1 : m_2$                       (3)  $r_1 : r_2$                       (4) 1 : 1
55. A cylindrical tube, open at both ends, has a fundamental frequency,  $f$ , in air. The tube is dipped vertically in water so that half of it is in water. The fundamental frequency of the air-column is now :  
(1)  $f$                       (2)  $f/2$                       (3)  $3f/4$                       (4)  $2f$
56. An object 2.4 m in front of a lens forms a sharp image on a film 12 cm behind the lens. A glass plate 1 cm thick, of refractive index 1.50 is interposed between lens and film with its plane faces parallel to film. At what distance (from lens) should object shifted to be in sharp focus on film ?  
(1) 7.2 m                      (2) 2.4 m                      (3) 3.2 m                      (4) 5.6 m
57. A diatomic molecule is made of two masses  $m_1$  and  $m_2$  which are separated by a distance  $r$ . If we calculate its rotational energy by applying Bohr's rule of angular momentum quantization, its energy will be given by : ( $n$  is an integer)  
(1)  $\frac{(m_1 + m_2)^2 n^2 h^2}{2m_1 m_2 r}$                       (2)  $\frac{n^2 h^2}{2(m_1 + m_2) r^2}$                       (3)  $\frac{2n^2 h^2}{(m_1 + m_2) r^2}$                       (4)  $\frac{(m_1 + m_2) n^2 h^2}{2m_1 m_2 r}$
58. A spectrometer gives the following reading when used to measure the angle of a prism.  
Main scale reading : 58.5 degree  
Vernier scale reading : 09 divisions  
Given that 1 division on main scale corresponds to 0.5 degree. Total divisions on the vernier scale is 30 and match with 29 divisions of the main scale. The angle of the prism from the above data :  
(1) 58.59 degree                      (2) 58.77 degree                      (3) 58.65 degree                      (4) 59 degree
59. This questions has statement-1 and statement-2. Of the four choices given after the statements, choose the one that best describe the two statements.  
An insulating solid sphere of radius  $R$  has a uniformly positive charge density  $\rho$ . As a result of this uniform charge distribution there is a finite value of electric potential at the centre of the sphere, at the surface of the sphere and also at a point out side the sphere. The electric potential at infinite is zero.  
**Statement-1** : When a charge 'q' is take from the centre of the surface of the sphere its potential energy changes by  $\frac{q\rho}{3\epsilon_0}$ .  
**Statement-2** : The electric field at a distance  $r$  ( $r < R$ ) from the centre of the sphere is  $\frac{\rho r}{3\epsilon_0}$   
(1) Statement-1 is true, Statement-2 is true; Statement-2 is not the correct explanation of statement-1.  
(2) Statement 1 is true Statement 2 is false.  
(3) Statement 1 is false Statement 2 is true.



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(4) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 1.

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60. Proton, Deuteron and alpha particle of same kinetic energy are moving in circular trajectories in a constant magnetic field. The radii of proton, deuteron and alpha particle are respectively  $r_p$ ,  $r_d$  and  $r_\alpha$ . Which one of the following relation is **correct**?

(1)  $r_\alpha = r_p = r_d$

(2)  $r_\alpha = r_p < r_d$

(3)  $r_\alpha > r_d > r_p$

(4)  $r_\alpha = r_d > r_p$

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## PART-C (CHEMISTRY)

61. Which among the following will be named as dibromidobis (ethylene diamine) chromium (III) bromide?  
 (1)  $[\text{Cr}(\text{en})_3]\text{Br}_3$       (2)  $[\text{Cr}(\text{en})_2\text{Br}_2]\text{Br}$       (3)  $[\text{Cr}(\text{en})\text{Br}_4]^-$       (4)  $[\text{Cr}(\text{en})\text{Br}_2]\text{Br}$
62. Which method of purification is represented by the following equation :  

$$\text{Ti}(\text{s}) + 2\text{I}_2(\text{g}) \xrightarrow{523\text{K}} \text{TiI}_4(\text{g}) \xrightarrow{1700\text{K}} \text{Ti}(\text{s}) + 2\text{I}_2(\text{g})$$
 (1) Zone refining (2) Cupellation      (3) Polling      (4) Van Arkel
63. Lithium forms body centred cubic structure. The length of the side of its unit cell is 351 pm. Atomic radius of the lithium will be :  
 (1) 75 pm      (2) 300 pm      (3) 240 pm      (4) 152 pm
64. The molecule having smallest bond angle is :  
 (1)  $\text{NCl}_3$       (2)  $\text{AsCl}_3$       (3)  $\text{SbCl}_3$       (4)  $\text{PCl}_3$
65. Which of the following compounds can be detected by Molisch's test :  
 (1) Nitro compounds      (2) Sugars      (3) Amines      (4) Primary alcohols
66. The incorrect expression among the following is :  
 (1)  $\frac{\Delta G_{\text{system}}}{\Delta S_{\text{total}}} = -T$       (2) In isothermal process,  $w_{\text{reversible}} = -nRT \ln \frac{V_f}{V_i}$   
 (3)  $\ln K = \frac{\Delta H^\circ - T\Delta S^\circ}{RT}$       (4)  $K = e^{-\Delta G^\circ/RT}$
67. The density of a solution prepared by dissolving 120 g of urea (mol. mass = 60 u) in 1000 g of water is 1.15 g/mL. The molarity of this solution is :  
 (1) 0.50 M      (2) 1.78 M      (3) 1.02 M      (4) 2.05 M
68. The species which can best serve as an initiator for the cationic polymerization is :  
 (1)  $\text{LiAlH}_4$       (2)  $\text{HNO}_3$       (3)  $\text{AlCl}_3$       (4)  $\text{BaLi}$
69. Which of the following on thermal decomposition yields a basic as well as acidic oxide ?  
 (1)  $\text{NaNO}_3$       (2)  $\text{KClO}_3$       (3)  $\text{CaCO}_3$       (4)  $\text{NH}_4\text{NO}_3$
70. The standard reduction potentials for  $\text{Zn}^{2+}/\text{Zn}$ ,  $\text{Ni}^{2+}/\text{Ni}$  and  $\text{Fe}^{2+}/\text{Fe}$  are  $-0.76$ ,  $-0.23$  and  $-0.44$  V respectively. The reaction  $\text{X} + \text{Y}^{2+} \rightarrow \text{X}^{2+} + \text{Y}$  will be spontaneous when :  
 (1)  $\text{X} = \text{Ni}$ ,  $\text{Y} = \text{Fe}$       (2)  $\text{X} = \text{Ni}$ ,  $\text{Y} = \text{Zn}$       (3)  $\text{X} = \text{Fe}$ ,  $\text{Y} = \text{Zn}$       (4)  $\text{X} = \text{Zn}$ ,  $\text{Y} = \text{Ni}$
71. According to Freundlich adsorption isotherm which of the following is correct?  
 (1)  $\frac{x}{m} \propto p^0$       (2)  $\frac{x}{m} \propto p^1$   
 (3)  $\frac{x}{m} \propto p^{1/n}$       (4) All the above are correct for different ranges of pressure



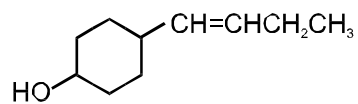
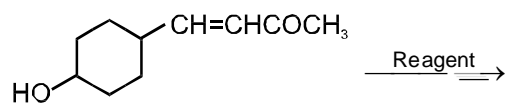
72. The equilibrium constant ( $K_c$ ) for the reaction  $N_2(g) + O_2(g) \rightarrow 2NO(g)$  at temperature T is  $4 \times 10^{-4}$ . The value of  $K_c$  for the reaction  $NO(g) \rightarrow \frac{1}{2} N_2(g) + \frac{1}{2} O_2(g)$  at the same temperature is :  
(1) 0.02                                      (2)  $2.5 \times 10^2$                                       (3)  $4 \times 10^{-4}$                                       (4) 50.0
73. The compressibility factor for a real gas at high pressure is :  
(1)  $1 + RT/pb$                                       (2) 1                                      (3)  $1 + pb/RT$                                       (4)  $1 - pb/RT$
74. Which one of the following statements is correct?  
(1) All amino acids except lysine are optically active  
(2) All amino acids are optically active — —  
(3) All amino acids except glycine are optically active  
(4) All amino acids except glutamic acids are optically active
75. Aspirin is known as :  
(1) Acetyl salicylic acid                                      (2) Phenyl salicylate  
(3) Acetyl salicylate                                      (4) Methyl salicylic acid
76. Ortho-Nitrophenol is less soluble in water than p- and m- Nitrophenols because :  
(1) o-Nitrophenol is more volatile steam than those of m- and p-isomers.  
(2) o-Nitrophenol shows Intramolecular H-bonding  
(3) o-Nitrophenol shows intermolecular H-bonding  
(4) Melting point of o-Nitrophenol is lower than those of m- and p-isomers.
77. How many chiral compounds are possible on monochlorination of 2- methyl butane ?  
(1) 8                                      (2) 2                                      (3) 4                                      (4) 6
78. Very pure hydrogen (99.9) can be made by which of the following processes ?  
(1) Reaction of methane with steam                                      (2) Mixing natural hydrocarbons of high molecular weight  
(3) Electrolysis of water                                      (4) Reaction of salts like hydrides with water
79. The electrons identified by quantum numbers n and  $\lambda$  :  
(a)  $n = 4, \lambda = 1$                                       (b)  $n = 4, \lambda = 0$   
(c)  $n = 3, \lambda = 2$                                       (d)  $n = 3, \lambda = 1$   
 $\lambda$   
can be placed in order of increasing energy as :  
(1) (c) < (d) < (b) < (a)                                      (2) (d) < (b) < (c) < (a)  
(3) (b) < (d) < (a) < (c)                                      (4) (a) < (c) < (b) < (d)
80. For a first order reaction (A)  $\rightarrow$  products the concentration of A changes from 0.1 M to 0.025 M in 40 minutes. The rate of reaction when the concentration of A is 0.01 M is :  
(1)  $1.73 \times 10^{-5}$  M/min                                      (2)  $3.47 \times 10^{-4}$  M/min  
(3)  $3.47 \times 10^{-5}$  M/min                                      (4)  $1.73 \times 10^{-4}$  M/min



81. Iron exhibits +2 and +3 oxidation states. Which of the following statements about iron is incorrect ?  
(1) Ferrous oxide is more basic in nature than the ferric oxide.  
(2) Ferrous compounds are relatively more ionic than the corresponding ferric compounds  
(3) Ferrous compounds are less volatile than the corresponding ferric compounds  
(4) Ferrous compounds are more easily hydrolysed than the corresponding ferric compounds.
82. The pH of a 0.1 molar solution of the acid HQ is 3. The value of the ionization constant,  $K_a$  of the acid is :  
(1)  $3 \times 10^{-1}$                       (2)  $1 \times 10^{-3}$                       (3)  $1 \times 10^{-5}$                       (4)  $1 \times 10^{-7}$
83. Which branched chain isomer of the hydrocarbon with molecular mass 72u gives only one isomer of mono substituted alkyl halide ?  
(1) Tertiary butyl chloride                      (2) Neopentane  
(3) Isohexane                      (4) Neohexane
84.  $K_f$  for water is  $1.86 \text{ K kg mol}^{-1}$ . If your automobile radiator holds 1.0 kg of water, how many grams of ethylene glycol ( $\text{C}_2\text{H}_6\text{O}_2$ ) must you add to get the freezing point of the solution lowered to  $-2.8^\circ\text{C}$  ?  
(1) 72 g                      (2) 93 g                      (3) 39 g                      (4) 27 g
85. What is DDT among the following :  
(1) Greenhouse gas                      (2) A fertilizer  
(3) Biodegradable pollutant                      (4) Non-biodegradable pollutant
86. The increasing order of the ionic radii of the given isoelectronic species is :  
(1)  $\text{Cl}^-$ ,  $\text{Ca}^{2+}$ ,  $\text{K}^+$ ,  $\text{S}^{2-}$                       (2)  $\text{S}^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Ca}^{2+}$ ,  $\text{K}^+$                       (3)  $\text{Ca}^{2+}$ ,  $\text{K}^+$ ,  $\text{Cl}^-$ ,  $\text{S}^{2-}$                       (4)  $\text{K}^+$ ,  $\text{S}^{2-}$ ,  $\text{Ca}^{2+}$ ,  $\text{Cl}^-$
87. 2-Hexyne gives trans-2-Hexene on treatment with :  
(1)  $\text{Pt}/\text{H}_2$                       (2)  $\text{Li}/\text{NH}_3$                       (3)  $\text{Pd}/\text{BaSO}_4$                       (4)  $\text{LiAlH}_4$
88. Iodoform can be prepared from all except :  
(1) Ethyl methyl ketone                      (2) Isopropyl alcohol  
(3) 3-Methyl-2-butanone                      (4) Isobutyl alcohol
89. In which of the following pairs the two species are not isostructural ?  
(1)  $\text{CO}_3^{2-}$  and  $\text{NO}_3^-$                       (2)  $\text{PCl}_4^+$  and  $\text{SiCl}_4$                       (3)  $\text{PF}_5$  and  $\text{BrF}_5$                       (4)  $\text{AlF}_6^{3-}$  and  $\text{SF}_6$



90. In the given transformation, which the following is the most appropriate reagent ?



(1)  $\text{NH}_2\text{NH}_2, \text{OH}^-$

—

(2)  $\text{Zn-Hg/HCl}$

—

(3)  $\text{Na, Liq, NH}_3$

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(4)  $\text{NaBH}_4$

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