

**SECTION – I****(SINGLE CORRECT ANSWER TYPE)**

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

MATHEMATICS

- A ray of light coming along the line $3x + 4y - 5 = 0$ gets reflected from the line $ax + by - 1 = 0$ and goes along the line $5x - 12y - 10 = 0$, then
 - $a = \frac{64}{115}, b = \frac{112}{15}$
 - $a = -\frac{64}{115}, b = \frac{8}{115}$
 - $a = \frac{64}{115}, b = \frac{-8}{115}$
 - $a = -\frac{64}{115}, b = \frac{-8}{115}$
- Find the equation of the sides of an isosceles right angled triangle whose hypotenuse is given by $3x + 4y = 4$ and the opposite vertex of the hypotenuse is $(2, 2)$
 - $x + 7y + 12 = 0, 7x + y - 16 = 0$
 - $x - 7y + 6 = 0, 7x + y - 16 = 0$
 - $x - 7y + 12 = 0, 7x + y - 16 = 0$
 - $x - 7y - 12 = 0, 8x + y + 1 = 0$
- A square of side a lies above the x -axis and has one vertex at the origin. The side passing through the origin makes an angle α (where, $0 < \alpha < \pi/4$) with the positive direction of x -axis. The equation of its diagonal not passing through the origin is
 - $y(\cos \alpha - \sin \alpha) - x(\sin \alpha - \cos \alpha) = a$
 - $y(\cos \alpha + \sin \alpha) - x(\sin \alpha - \cos \alpha) = a$
 - $y(\cos \alpha + \sin \alpha) - x(\sin \alpha + \cos \alpha) = a$
 - $y(\cos \alpha + \sin \alpha) + x(\sin \alpha - \cos \alpha) = a$
- The number of common tangents to the circles $x^2 + y^2 - 4x - 6y - 12 = 0$ and $x^2 + y^2 + 6x + 18y + 26 = 0$ is
 - 1
 - 2
 - 3
 - 4
- If two vertices of an equilateral triangle are $A(-a, 0)$ and $B(a, 0)$ where $a > 0$ and the third vertex C lies above x -axis, then the equation of the circumcircle of ΔABC is
 - $3x^2 + 3y^2 - 2\sqrt{3}ay = 3a^2$
 - $3x^2 + 3y^2 - 2ay = 3a^2$
 - $x^2 + y^2 - 2ay = a^2$
 - $x^2 + y^2 - \sqrt{3}ay = a^2$
- The lines $2x - 3y - 5 = 0$ and $3x - 4y = 7$ are the diameters of a circle of area 154 sq.units, then the equation of the circle is
 - $x^2 + y^2 + 2x - 2y - 62 = 0$
 - $x^2 + y^2 + 2x - 2y - 47 = 0$
 - $x^2 + y^2 - 2x + 2y - 47 = 0$
 - $x^2 + y^2 - 2x + 2y - 62 = 0$
- AB is chord of the circle $x + y = 25$ of A and B intersect at C . If $(2, 3)$ is the midpoint of AB then the area of the quadrilateral $OACB$ is
 - $50\sqrt{\frac{4}{3}}$
 - $50\sqrt{\frac{3}{13}}$
 - $50\sqrt{3}$
 - $\frac{50}{\sqrt{3}}$
- Three circles of radii, a, b, c ($a < b < c$) touch other externally, if they have x -axis as a common tangent, then
 - a, b, c are in A.P
 - $\frac{1}{\sqrt{a}} = \frac{1}{\sqrt{b}} + \frac{1}{\sqrt{c}}$

c) $\sqrt{a}, \sqrt{b}, \sqrt{c}$ are in A.P

d) $\frac{1}{\sqrt{b}} = \frac{1}{\sqrt{a}} + \frac{1}{\sqrt{c}}$

9. If $\frac{2}{\sqrt{5}}$ is length of the common chord of the circles $x^2 + y^2 + 2x + 2y + 1 = 0$ and

$x^2 + y^2 + \alpha x + 3y + 2 = 0, \alpha \neq 0$, then $\alpha =$

a) 4

b) 3

c) 2

d) 1

10. Find the length of the line segment joining the vertex of the parabola $y^2 = 4ax$ and a point on the parabola, where the line segment makes angle θ to the x-axis

a) $\frac{2a \cos \theta}{\sin^2 \theta}$

b) $\frac{4a \cos \theta}{\sin^2 \theta}$

c) $\frac{4a \cos \theta}{3 \sin^2 \theta}$

d) $\frac{5a \sin \theta}{3 \cos^2 \theta}$

11. If the chord of contact of tangents from a point P to the parabola $y^2 = 12x$ touches the parabola $x^2 = 24y$, then the locus of P is

a) straight line

b) circle

c) parabola

d) hyperbola

12. Let O be the vertex and Q be any point on the parabola $x^2 = 8y$. If the point P divides the line segment OQ internally in the ratio 1 : 3 then the locus of P is

a) $x^2 = y$

b) $y^2 = x$

c) $y^2 = 2x$

d) $x^2 = 2y$

13. The length of the common tangent to the ellipse $\frac{x^2}{25} + \frac{y^2}{4} = 1$ and circle $x^2 + y^2 = 16$ intercepted by the coordinate axes is

a) 5

b) $2\sqrt{7}$

c) $\frac{7}{\sqrt{3}}$

d) $\frac{14}{\sqrt{3}}$

14. If θ and ϕ are eccentric angles of the ends of a pair of conjugate diameters of the ellipse

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ then $\theta - \phi$ is equal to

a) $\pm \frac{\pi}{2}$

b) $\pm \pi$

c) 0

d) $\frac{\pi}{3}$

15. The equation of the circle passing through foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ and having centre at (0,3) is

a) $x^2 + y^2 - 6y - 7 = 0$

b) $x^2 + y^2 - 6y + 7 = 0$

c) $x^2 + y^2 - 6y - 5 = 0$

d) $x^2 + y^2 - 6y + 5 = 0$

16. If two points P and Q on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ whose centre C be such that CP

perpendicular to CQ, $a < b$ then $\frac{1}{CP^2} + \frac{1}{CQ^2} =$

a) $-\frac{1}{a^2} + \frac{1}{b^2}$

b) $\frac{1}{a^2} + \frac{1}{b^2}$

c) $-\frac{1}{a^2} - \frac{1}{b^2}$

d) $\frac{1}{a^2} - \frac{1}{b^2}$

17. The diameter of the hyperbola $9x^2 - 16y^2 = 14$ which is conjugate to $y = 2x$ is

a) $y = \frac{8}{9}x$

b) $y = \frac{9}{32}x$

c) $y = \frac{7}{8}x$

d) $y = \frac{12}{5}x$

18. A tangent to the hyperbola $\frac{x^2}{4} - \frac{y^2}{2} = 1$ meets x-axis at P and y-axis at Q. Lines PR and QR are drawn such that OPRQ is a rectangle (where 'O' is the origin). Then R lies on

a) $\frac{4}{x^2} + \frac{2}{y^2} = 1$

b) $\frac{2}{x^2} - \frac{4}{y^2} = 1$

c) $\frac{2}{x^2} + \frac{4}{y^2} = 1$

d) $\frac{4}{x^2} - \frac{2}{y^2} = 1$

19. The region represented by $|x - y| \leq 2$ and $|x + y| \leq 2$ is bounded by a
 a) rhombus of area $8\sqrt{2}$ sq.units b) square of area 16 sq.units
 c) square of side length $2\sqrt{2}$ units d) rhombus of side length 2 units
20. The area bounded by the angle bisectors of the lines represented by $x^2 - y^2 + 2y = 1$ and the line $x + y = 3$ is
 a) 2 b) 3 c) 4 d) 6

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

Marking scheme: +4 for correct answer, 0 in all other cases.

21. Given a family of lines $a(2x + y + 4) + b(x - 2y - 3) = 0$ the number of lines belonging to the family at distance $\sqrt{10}$ from (2, -3) is
22. The number of integral points (integral points mean both the coordinates should be integers) exactly in the interior of the triangle with vertices (0, 0), (21, 0), (0, 21) is
23. A line drawn through the point P(4, 7) cut the circle $x^2 + y^2 = 9$ at the points A and B then PA.PB is equal to
24. If the normal at a point 'P' on the parabola $y^2 = 12x$ cuts the curve again at 'Q' and if 'R' is the midpoint of PQ then the product of the ordinates of 'P' and 'R' is
25. Let a and b respectively be the semi-transverse and semi-conjugate axes of hyperbola whose eccentricity satisfies the equation $9e^2 - 18e + 5 = 0$. If s(5,0) is a focus and $5x = 9$ is the corresponding direction of this hyperbola, then $a^2 - b^2$ is equal to

SECTION - I
(SINGLE CORRECT ANSWER TYPE)

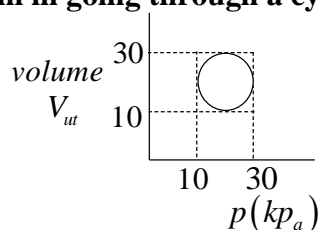
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PHYSICS

26. Speed of light (c) acceleration due to gravity (g) and pressure (p) are taken as fundamental units, the dimensions of gravitational constant (G)
 a) $c^0 g p^{-3}$ b) $c^2 g^3 p^{-2}$ c) $c^0 g^2 p^{-1}$ d) $c^2 g^2 p^{-2}$
27. Dimensions of ohm are same as (here h is planks constant e = electron charge)
 a) h/e b) h^2 / e c) h / e^2 d) h^2 / e^2
28. Suppose refractive index μ is given as $\mu = A + \frac{B}{\lambda^2}$ where A and B are constantans and λ is wavelength, then dimension of B are same as that of
 a) wavelength b) volume c) pressure d) area
29. If the value of r is 10.845 ohm and value of current is 3.23amp, the potential is 35.02935 its value of significant number would be
 a) 3.5v b) 35.0v c) 35.029v d) 35.030v
30. A clock with an iron pendulum keeps correct time as 20°C. How much it lose or gain if temperature changes to 40°C
 a) 10.368s b) 10.567s c) 10.638s d) 10.765s

31. The temperature of 2 moles of a gas which was held at constant volume was changed from 100°C to 120°C . The change in internal energy was found to be 80J . The heat capacity of gas at constant volume will be equal to
 a) 8J/K b) 4J/K c) 40J/K d) 2J/K
32. The efficiency of a cornot cycle is $\frac{1}{6}$. If in reducing the temperature of sink by 65°K , the efficiency becomes $\frac{1}{3}$. The initial and final temperatures between which the cycle is working are
 a) $117^{\circ}\text{C}, 52^{\circ}\text{C}$ b) $217^{\circ}\text{C}, 52^{\circ}\text{C}$ c) $317^{\circ}\text{C}, 52^{\circ}\text{C}$ d) $17^{\circ}\text{C}, 52^{\circ}\text{C}$
33. Heat energy observed by a system in going through a cyclic process, shown in figure is



- a) $10^{-1}\pi\text{J}$ b) $10^4\pi\text{J}$ c) $10^2\pi\text{J}$ d) $10^{-3}\pi\text{J}$
34. A gas at a pressure p_0 is contained in a vessel. If the masses of all the molecules are halved and their velocities doubled, the resulting pressure 'p' would be equal to
 a) $4p_0$ b) $2p_0$ c) p_0 d) $p_0/2$
35. The molecules of a given mass of a gas have r.m.s velocity 200m/s at 27°C and 10^5 N/m^2 pressure when the temperature is doubled and pressure is halved, the r.m.s speed of the molecules of the same gas is
 a) 200m/s b) 400m/s c) $200\sqrt{2}\text{m/s}$ d) $\frac{200}{\sqrt{2}}\text{m/s}$
36. The pressure inside a tyre is 4 times that of atmosphere. If the tyre bursts suddenly at temperature 300k , what will be the new temperature?
 a) $300\left(4^{\frac{7}{2}}\right)$ b) $300(4)^{\frac{2}{7}}$ c) $300(2)^{\frac{7}{2}}$ d) $300(4)^{-\frac{2}{7}}$
37. The end of two rods of different materials with their thermal conductivities, radii of cross section and lengths in ratio $1 : 2$ are maintained at the same temperature differences. If the rate of flow of heat in the large rod is 4cal/s , that in the shorter rod in cal/sec will be
 a) 1 b) 2 c) 8 d) 16
38. The temperature of furnace is 2324°C and the intensity is maximum in its radiation spectrum nearly at 12000A° . If the intensity in the spectrum of a star is maximum nearly at 4800A° , then calculate the surface temperature of the star
 a) 6219.5°C b) 6200.5°C c) 6220.5°C d) 6000°C
39. A body initially at 80°C cools to 64°C in 5 minutes and to 52°C in 10minutes. What will be the temperature after 15min and what is the temperature of surroundings?
 a) -40°C b) 41°C c) 42°C d) 43°C
40. Two soap bubbles of radii r_1 and r_2 in vacuums coalesce under isothermal conditions. The resulting bubble has radius is such that
 a) $R = \frac{(r_1 + r_2)}{2}$ b) $R = \frac{r_1 r_2}{r_1 + r_2}$ c) $R = \sqrt{r_1^2 + r_2^2}$ d) $R = r_1 + r_2$
41. Two liquid of densities d_1 and d_2 are flowing in identical capillaries under same pressure differences. If t_1 and t_2 are the time taken for the flow of equal quantities of liquid, then the ratio of coefficients of viscosities of liquids must be
 a) $\frac{d_1 d_2}{t_1 t_2}$ b) $\frac{d_1 t_1}{d_2 t_2}$ c) $\frac{d_1 t_2}{d_2 t_1}$ d) $\sqrt{\frac{d_1 t_1}{d_2 t_2}}$

53. The number of orbitals associated with third shell will be
 a) 2 b) 4 c) 9 d) 3
54. A substance absorbs electromagnetic radiations of wavelength 12.3nm and then emits another electromagnetic radiation of wavelength 24.6nm. If ratio of number of photons absorbed to number of photons emitted is 2 : 1 then ratio of energy absorbed to energy emitted will be
 a) 2 : 1 b) 1 : 1 c) 4 : 1 d) 1 : 4
55. The relative strength of inter-ionic intermolecular forces in the decreasing order is
 a) ion – dipole > dipole-dipole > ion-ion b) dipole – dipole > ion – dipole > ion – ion
 c) ion – ion > ion-dipole > dipole > dipole d) ion-dipole > ion – ion > dipole – dipole
56. The pressure of a 1 : 4 mixture of dyhydrogen and dioxygen enclosed in a vessel is one atmosphere. What would be the partial pressure of dioxygen.
 a) $0.8 \times 10^5 \text{ atm}$ b) 0.008 Nm^{-2} c) $8 \times 10^4 \text{ Nm}^{-2}$ d) 0.25atm
57. How does the surface tension of a liquid vary with increase in temperature?
 a) Remain same b) Decrease c) Increase d) No relation
58. Which of the following is not an example of redox reaction
 a) $\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$ b) $2\text{K} + \text{F}_2 \rightarrow 2\text{KF}$
 c) $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ d) $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{HCl}$
59. In which of the following compounds, an element exhibits two different oxidation states
 a) NH_2OH b) NH_4NO_3 c) N_2H_4 d) N_3H
60. If 500ml of a 5M solution is diluted to 1500ml , what will be the molarity of the solution obtained
 a) 1.5M b) 1.6M c) 0.017M d) 1.59M
61. The equilibrium constants K_{p1} and K_{p2} for the reactions $x \rightleftharpoons 2y$ and $Z \rightleftharpoons P+Q$, respectively are in the ratio 1 : 9. If the degree of dissociation of ‘X’ and ‘Z’ be equal then the ratio of total pressure at these equilibria is
 a) 1 : 36 b) 1 : 1 c) 1 : 3 d) 1 : 9
62. K_{a1}, K_{a2} and K_{a3} are in the respective ionization constants for the following reactions
 $\text{H}_2\text{S} \rightleftharpoons \text{H}^+ + \text{HS}^-$, $\text{HS}^- \rightleftharpoons \text{H}^+ + \text{S}^{2-}$, $\text{H}_2\text{S} \rightleftharpoons 2\text{H}^+ + \text{S}^{2-}$
 The correct relationship between K_{a1}, K_{a2}, K_{a3} is
 a) $K_{a3} = K_{a1} \times K_{a2}$ b) $K_{a3} = K_{a1} + K_{a2}$ c) $K_{a3} = K_{a1} - K_{a2}$ d) $K_{a3} = K_{a1} / K_{a2}$
63. Acidity of BF_3 can be explained on the basis of which of the following concepts
 a) Arrhenius concept b) Bronsted lowery concept
 c) Lewis concept d) Bronsted lowery as well as Lewis concept
64. In an exothermic reaction, heat is evolved and system loses heat to the surroundings for such system
 a) q_p will be negative b) ΔH will be negative
 c) q_p will be positive d) Both a and b
65. If the combustion of 1 gram of graphite produces 20.7kJ of heat, what will be molar enthalpy change
 a) $+2.48 \times 10^2 \text{ KJ.mol}^{-1}$ b) $+2.48 \times 10^2 \text{ J.mol}^{-1}$
 c) $-1.7 \times 10^2 \text{ KJ.mol}^{-1}$ d) $-2.48 \times 10^2 \text{ KJ.mol}^{-1}$
66. For the reaction at 298K $2A + B \rightarrow C$ $\Delta H = 400 \text{ KJ.mole}^{-1}$ and $\Delta S = 0.2 \text{ KJ.K}^{-1}.\text{mole}^{-1}$. At what temperature will the reaction becomes spontaneous considering ΔH and ΔS to be constant over the temperature range?
 a) above 2000K b) 1300K c) 1500K d) 1000K
67. Hybridization of ‘AS’ in ASF_5 is
 a) sp^3 b) sp^3d^2 c) sp^3d d) sp^3d^3
68. Bond order increasing order of $\text{N}_2^+, \text{N}_2, \text{O}_2, \text{O}_2^{2-}$

