

### MATHEMATICS – SET 1

1. Let  $S = \{x|x \text{ is a positive multiple of 3 less than } 100\}$   $P = \{x|x \text{ is a prime number less than } 20\}$ .

Then  $n(S) + n(P)$  is

- A) 34                                      B) 41                                      C) 33                                      D) 30
2. If  $\alpha + \beta = \frac{\pi}{4}$ , then the value of  $(1 + \tan\alpha)(1 + \tan\beta)$  is
- A) 1                                      B) 2                                      C) -2                                      D) Not defined
3. If  $x < 5$ , then
- A)  $-x < -5$                                       B)  $-x \leq -5$                                       C)  $-x > -5$                                       D)  $-x \geq -5$
4. If in an A.P.,  $S_n = qn^2$  and  $S_m = qm^2$ , where  $S_r$  denotes the sum of  $r$  terms of the A.P., then  $S_q$  equals
- A)  $\frac{q^3}{2}$                                       B)  $mnq$                                       C)  $q^3$                                       D)  $(m + n)q^2$
5. If the vertex of the parabola is the point  $(-3,0)$  and the directrix is the line  $x + 5 = 0$ , then its equation is
- A)  $y^2 = 8(x + 3)$       B)  $x^2 = 8(y + 3)$       C)  $y^2 = -8(x + 3)$       D)  $y^2 = 8(x + 5)$
6.  $\lim_{\theta \rightarrow 0} \frac{1 - \cos 4\theta}{1 - \cos 6\theta}$  is
- A)  $\frac{4}{9}$                                       B)  $\frac{1}{2}$                                       C)  $\frac{-1}{2}$                                       D) -1
7. Standard deviation of first 10 natural numbers is
- A) 5.5                                      B) 3.87                                      C) 2.97                                      D) 2.87
8. The maximum number of equivalence relations on the set  $A = \{1, 2, 3\}$  are
- A) 1                                      B) 2                                      C) 3                                      D) 5
9. The integrating factor of the differential equation  $\frac{dy}{dx} + y = \frac{1+y}{x}$  is
- 1)  $\frac{x}{e^x}$                                       2)  $\frac{e^x}{x}$                                       3)  $xe^x$                                       4)  $e^x$
10. If A is matrix of order  $m \times n$  and B is a matrix such that  $AB'$  and  $B'A$  are both defined, then order of matrix B is
- A)  $m \times m$                                       B)  $n \times n$                                       C)  $n \times m$                                       D)  $m \times n$
11. If  $f(x)f(y) = f(x + y)$  for all  $x, y$ ; suppose  $f(5) = 2$  and  $f'(0) = 3$ , then  $f'(5)$  is equal to
- A) 5                                      B) 6                                      C) 0                                      D) None of these

12. If  $f(x) = 2x$  and  $g(x) = \frac{x^2}{2} + 1$ , then which of the following can be a discontinuous functions.
- A)  $f(x) + g(x)$       B)  $f(x) - g(x)$       C)  $f(x) \cdot g(x)$       D)  $\frac{g(x)}{f(x)}$
13. The interval on which the function  $f(x) = 2x^3 + 9x^2 + 12x - 1$  is decreasing is :
- A)  $[-1, \infty)$       B)  $[-2, -1]$       C)  $(-\infty, -2]$       D)  $[-1, 1]$
14.  $\int |x| dx$  is equal to
- A)  $\frac{1}{2}x^2 + C$       B)  $-\frac{x^2}{2} + C$       C)  $x|x| + C$       D)  $\frac{1}{2}x|x| + C$
15. Evaluate  $\int_0^{2\pi} \sin\left(\frac{\pi}{4} + \frac{x}{2}\right) dx$
- A)  $-2\sqrt{2}$       B)  $-2$       C)  $\sqrt{2}$       D)  $2\sqrt{2}$
16. The area of the region bounded by parabola  $y^2 = x$  and the straight line  $2y = x$  is
- A)  $\frac{4}{3}$  sq. units      B) 1 sq. unit      C)  $\frac{2}{3}$  sq. units      D)  $\frac{1}{3}$  sq. units
17. The degree of the differential equation  $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}} = \frac{d^2y}{dx^2}$  is
- A) 4      B)  $\frac{3}{2}$       C) 2      D) Not defined
18. For any vector  $\vec{a}$ , the value of  $(\vec{a} \times \hat{i})^2 + (\vec{a} \times \hat{j})^2 + (\vec{a} \times \hat{k})^2$  is equal to
- A)  $\vec{a}^2$       B)  $3\vec{a}^2$       C)  $4\vec{a}^2$       D)  $2\vec{a}^2$
19. Distance of the point  $(\alpha, \beta, \gamma)$  from y-axis is
- A)  $\beta$       B)  $|\beta|$       C)  $|\beta| + |\gamma|$       D)  $\sqrt{\alpha^2 + \gamma^2}$
20. If A and B are two events and  $A \neq \Phi, B \neq \Phi$ , then
- A)  $P(A|B) = P(A) \cdot P(B)$       B)  $P(A|B) = \frac{P(A \cap B)}{P(B)}$   
 C)  $P(A|B) \cdot P(B|A) = 1$       D)  $P(A|B) = P(A)|P(B)$

### Physics set – 1

21. When a current of  $(2.5 \pm 0.5)$  A flows through a wire, it develops a potential difference of  $(20 \pm 1)V$ . The resistance of wire is

- A)  $(8 \pm 2)\Omega$       B)  $(8 \pm 1.5)\Omega$       C)  $(8 \pm 0.5)\Omega$       D)  $(8 \pm 3)\Omega$

22. The dimensions of torque are

- A)  $[MLT^{-2}]$       B)  $[ML^{-1}T^{-2}]$       C)  $[ML^2T^{-2}]$       D)  $[ML^{-2}T^{-2}]$

23. A body is moving according to the equation  $x = at + bt^2 - ct^3$  where

$x$  = displacement and  $a, b$  and  $c$  are constants. The acceleration of the body is

- A)  $a + 2bt$       B)  $2b + 6ct$       C)  $2b - 6ct$       D)  $3b - 6ct^2$

24. When unit vector  $\hat{n} = a\hat{i} + b\hat{j}$  is perpendicular to  $(\hat{i} + \hat{j})$ , then  $a$  and  $b$  are

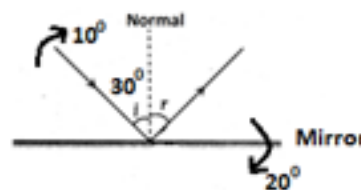
- A. 1,0      B) -2, 0      C) 3, 0      D)  $\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}$

25. A cricketer can throw a ball to a maximum horizontal distance of 100 m. With the same speed how much high above the ground can the cricketer throw the same ball?

- A) 50 m      B) 100 m      C) 150m      D) 200m

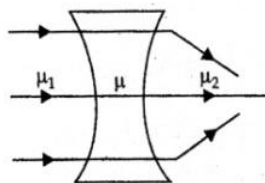
26. If the incidenting light ray is turned by  $100^\circ$  and mirrors by  $200^\circ$  as shown, then the angle turned by the reflected ray is

- A)  $30^\circ$  clockwise  
B)  $30^\circ$  anticlockwise  
C)  $50^\circ$  clockwise  
D)  $50^\circ$  anticlockwise



27. If the behavior of light rays is as shows in the figure, the relation between refractive indices  $\mu, \mu_1$  and  $\mu_2$  is

- A)  $\mu > \mu_2 > \mu_1$   
B)  $\mu < \mu_2 < \mu_1$   
C)  $\mu < \mu_2, \mu = \mu_1$   
D)  $\mu_2 < \mu_1, \mu = \mu_2$



28. For an angle of incidence  $\Theta$  on an equilateral prism of refractive index  $\sqrt{3}$ , the ray refracted is parallel to the base inside the prism. The value of  $\Theta$  is

- A)  $60^\circ$       B)  $30^\circ$       C)  $90^\circ$       D)  $75^\circ$

29. Two similar coils of radius  $R$  and number of turns  $N$  are lying with their planes at right angles to each other. The currents through them are  $I$  and  $2I$ . The resultant magnetic field at the center will be.

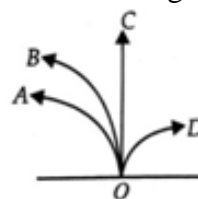
- A.  $\frac{NI\mu_0}{R}$       B)  $\frac{NI\mu_0}{2R}$       C)  $\frac{\sqrt{3}NI\mu_0}{2R}$       D)  $\frac{\sqrt{5}NI\mu_0}{2R}$

30. A proton, a deuteron and an  $\alpha$ - particle having the same kinetic energy are moving in circular trajectories in a constant magnetic field. If  $r_p, r_d$  and  $r_\alpha$  denote respectively the radii of the trajectories of these particles then

A)  $r_\alpha = r_d > r_p$       B)  $r_\alpha = r_d = r_p$   
 C)  $r_\alpha < r_d < r_p$       D)  $r_\alpha = r_p < r_d$

31. A neutron, a proton, an electron and an  $\alpha$ -particle enter a region of uniform magnetic field with the same velocities. The magnetic field is perpendicular and directed into the plane of the paper. The tracks of the particles are labeled in the figure. The electron follows the track

A) A  
 B) B  
 C) C  
 D) D



32. A galvanometer has a resistance of  $25\Omega$  and maximum of  $0.01\text{ A}$  current can be passed through it. In order to change it into an ammeter of range  $10\text{A}$ , the shunt resistance required is

A)  $\frac{5}{999}\Omega$       B)  $\frac{10}{999}\Omega$       C)  $\frac{15}{999}\Omega$       D)  $\frac{25}{999}\Omega$

33. The angle of dip is  $\theta$  at a place where the horizontal and vertical components of earth's magnetic field are equal. The value of  $\theta$  is

A)  $0^\circ$       B)  $30^\circ$       C)  $45^\circ$       D)  $60^\circ$

34. Electro –magnets are made of soft iron, because soft iron has

A. low susceptibility and low retentivity  
 B. high susceptibility and low retentivity  
 C. high susceptibility and high retentivity  
 D. low permeability and low retentivity

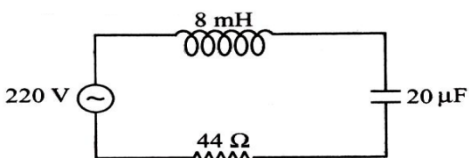
35. A steel wire of length  $l$  has a magnetic moment  $M$ . It is then bent into a semicircular arc. The new magnetic moment is

A.  $M$       B)  $\frac{2M}{\pi}$       C)  $\frac{M}{l}$       D)  $M \times l$

36. The interference pattern is obtained with two coherent light sources of intensity ratio 'n'.

In the interference pattern, the ratio  $\frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}}$  will be

A.  $\frac{\sqrt{n}}{(n+1)^2}$       B)  $\frac{\sqrt{n}}{n+1}$       C)  $\frac{2\sqrt{n}}{(n+1)}$       D)  $\frac{2\sqrt{n}}{(n+1)^2}$

37. A beam of natural light falls on a system of 5 polaroids, which are arranged in succession such that the pass axis of each Polaroid is turned through  $60^\circ$  with respect to the preceding one. The fraction of the incident light intensity that passes through the system is
- A.  $1/64$                       B.  $1/32$                       C.  $1/256$                       D.  $1/512$
38. The resolving power of a microscope, with air in the space between the objective and the object  $RP_1$ . If the space is filled with a liquid of  $n = 3/2$  and the resolving power is  $RP_2$ , then the ratio  $RP_1 : RP_2$  is
- A.  $1:2$                       B.  $2:1$                       C.  $2:3$                       D.  $3:2$
39. Switch S is closed at  $t = 0$ . After sufficiently long time, an iron rod is inserted into the inductor L. Then, the light bulb
- A) Glows more brightly  
B) gets dimmer  
C) Glows with the same brightness  
D) gets momentarily dimmer and then glows more brightly
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40. If in a transformer the number of turns of primary coil and secondary coil are 5 and 4 respectively and 220 V is applied to primary coil, then the ratio of current in primary and secondary coil is
- A.  $4 : 5$                       B.  $5 : 4$                       C.  $5 : 10$                       D.  $8 : 12$

### Set - 1 (chemistry)

41. The number of water molecules present in a drop of water weighing 0.018 g is
- A)  $6.022 \times 10^{23}$                       B)  $6.022 \times 10^{24}$                       C)  $6.022 \times 10^{19}$                       D)  $6.022 \times 10^{20}$
42. Empirical formula of a compound is  $CH_2O$  and its molecular mass is 90, the molecular formula of a compound is
- A)  $C_3H_6O_3$                       B)  $C_2H_4O_2$                       C)  $C_6H_{12}O_6$                       D)  $CH_2O$
43. Which of the following is possible?
- |    | n | l | m | s              |
|----|---|---|---|----------------|
| A. | 3 | 2 | 1 | 0              |
| B. | 3 | 0 | 0 | $-\frac{1}{2}$ |
| C. | 2 | 2 | 2 | $\frac{1}{2}$  |



54. The number of isomeric alcohols possible for  $C_4H_8O$  is  
 A) 3                                      B) 4                                      C) 5                                      D) 6
55. Cannizzaro's reaction is an example of auto Redox.  
 A) It is a typical reaction of aliphatic aldehydes  
 B) It is a reaction answered only by aromatic aldehydes  
 C) It is a reaction answered by all aldehydes  
 D) It is a reaction answered by only aldehydes containing alpha hydrogen
56. Gabriel phthalimide synthesis is used in the preparation of primary amines from phthalimide, which of the following reagents is not used during the process?  
 A) KOH                      B) NaOH                      C) HCl                      D) Alkyl Halides
57. Number of atoms per unit cell of a simple cube is  
 A) 1                      B) 2                      C) 4                      D) 3
58. AB... AB. . AB. .Close packed structure represents  
 A) simple cube                      B) bcc                      C) fcc                      D) hcp
59. Azeotropic mixtures are  
 A) Constant boiling mixtures                      B) Those which boil at different temperatures  
 C) Mixture of two solids                      D) None of these
60. When equimolar aqueous solutions of glucose, sodium chloride and barium nitrate are compared, the relative lowering of vapour pressure will be in the following order  
 A) Glucose > NaCl >  $Ba(NO_3)_2$                       B) Glucose = NaCl =  $Ba(NO_3)_2$   
 C)  $Ba(NO_3)_2$  > NaCl > Glucose                      D) NaCl >  $Ba(NO_3)_2$  > Glucose