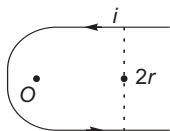


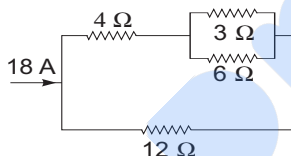
MET 2010 Memory Based Question Paper PDF

Physics

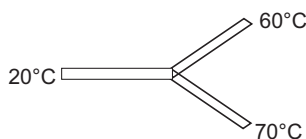
1. In the figure shown, the magnetic field induction at the point O will be



- (a) $\frac{\mu_0 i}{2\pi r}$ (b) $\left(\frac{\mu_0}{4\pi}\right)\left(\frac{i}{r}\right)(\pi + 2)$
 (c) $\left(\frac{\mu_0}{4\pi}\right)\left(\frac{i}{r}\right)(\pi + 1)$ (d) $\frac{\mu_0}{4\pi} \frac{i}{r} (\pi - 2)$
2. In the electrical network shown in the figure, the potential difference across $3\ \Omega$ resistance will be



- (a) 12 V (b) 2.4 V
 (c) 24 V (d) 36 V
3. Three identical thermal conductors are connected as shown in figure. Considering no heat loss due to radiation, temperature at the junction will be



- (a) 40°C (b) 60°C
 (c) 50°C (d) 35°C
4. Surface tension vanishes at

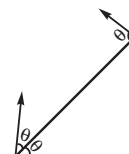
- (a) absolute zero temperature
 (b) transition temperature

- (c) critical temperature
 (d) None of the above

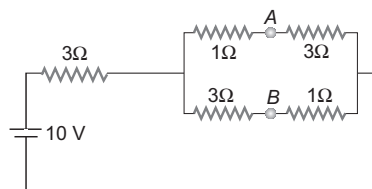
5. A transistor is working in common emitter mode. Its amplification factor (β) is 80. If the base current is $250\ \mu\text{A}$, the collector current will be

- (a) $1.25\ \mu\text{A}$ (b) $\frac{250}{80}\ \mu\text{A}$
 (c) $430\ \mu\text{A}$ (d) $250 \times 80\ \mu\text{A}$

6. From an inclined plane two particles are projected with same speed at same angle θ , one up and other down the plane as shown in figure, which of the following statements is/are correct?



- (a) The time of flight of each particle is the same
 (b) The particles will collide the plane with same speed
 (c) Both the particles strike the plane perpendicularly
 (d) The particles will collide in mid air if projected simultaneously and time of flight of each particle is less than the time of collision
7. A battery of emf 10 V is connected to resistance as shown in figure. The potential difference $V_A - V_B$ between the points A and B is



- (a) -2 V (b) 2 V
 (c) 5 V (d) $\frac{20}{11}\text{ V}$

8. Solar radiation is
 (a) transverse electromagnetic wave
 (b) longitudinal electromagnetic wave
 (c) stationary wave
 (d) None of the above

9. Fundamental frequency of an open pipe is f_0 ,
 Fundamental frequency when it is half filled with water is
 (a) f_0 (b) $f_0/2$
 (c) $2f_0$ (d) $3f_0$

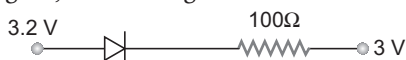
10. If the rms velocity of a gas is v , then
 (a) $v^2T = \text{constant}$
 (b) $v^2/T = \text{constant}$
 (c) $vT^2 = \text{constant}$
 (d) v is independent of T

11. A sounding source of frequency 500 Hz moves towards a stationary observer with a velocity 30 m/s . If the velocity of sound in air is 330 m/s , find the frequency heard by the observer.
 (a) 500 Hz (b) 550 Hz
 (c) 355 Hz (d) 55.5 Hz

12. At what height h above earth, the value of g becomes $g/2$? (R = Radius of earth)
 (a) $3R$ (b) $\sqrt{2}R$
 (c) $(\sqrt{2} - 1)R$ (d) $\frac{1}{\sqrt{2}}R$

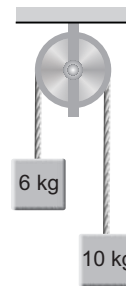
13. A freshly prepared radioactive source of half-life 2 h emits radiation of intensity which is 64 times the permissible safe level. Calculate the minimum time after which it would be possible to work safely with this source.
 (a) 12 h (b) 24 h
 (c) 6 h (d) 130 h

14. The current in the circuit shown in the figure, considering ideal diode is



- (a) 20 A (b) $2 \times 10^{-3}\text{ A}$
 (c) 200 A (d) $2 \times 10^{-4}\text{ A}$

15. The tension in the string in the pulley system shown in the figure is



- (a) 75 N (b) 80 N
 (c) 7.5 N (d) 30 N

16. A glass flask having mass 390 g and an interior volume of 500 cm^3 floats on water when it is less than half filled with water. The density of material of the flask is

- (a) 0.8 g/cc (b) 2.8 g/cc
 (c) 1.8 g/cc (d) 0.28 g/cc

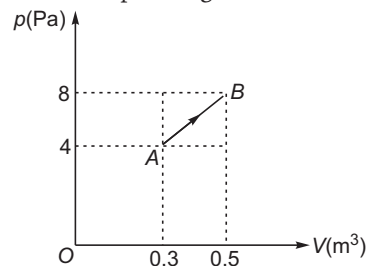
17. The angle of minimum deviation δ_m for an equilateral glass prism is 30° . Refractive index of the prism is

- (a) $1/\sqrt{2}$ (b) $\sqrt{2}$
 (c) $2\sqrt{2}$ (d) $1/2\sqrt{2}$

18. When the wavelength of sound changes from 1 m to 1.01 m , the number of beats heard are 4 . The velocity of sound is

- (a) 404 m/s (b) 4.04 m/s
 (c) 414 m/s (d) 400 m/s

19. An ideal gas expands along the path AB as shown in the p - V diagram. The work done is



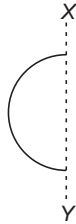
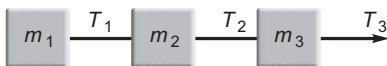
- (a) $4 \times 10^4\text{ J}$ (b) $1.2 \times 10^5\text{ J}$
 (c) $2.4 \times 10^5\text{ J}$ (d) None of these

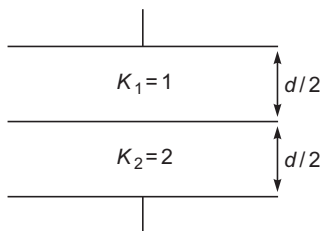
20. If force is proportional to square of velocity, then the dimensions of proportionality constant is

- (a) $[\text{ML}^{-1}\text{T}]$ (b) $[\text{ML}^{-1}\text{T}^0]$
 (c) $[\text{MLT}^0]$ (d) $[\text{M}^0\text{LT}^{-1}]$

21. Two bodies A and B having temperatures 327°C and 427°C are radiating heat to the

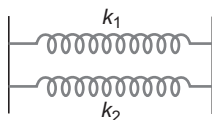
- surrounding. The surrounding temperature is 27°C . The ratio of rates of heat radiation of A to that of B is
- (a) 0.52 (b) 0.31
(c) 0.81 (d) 0.42
22. Two bulbs 40 W and 60 W and rated voltage 240 V are connected in series across a potential difference of 420 V. Which bulb will work at above its rated voltage?
- (a) 40 W bulb (b) 60 W bulb
(c) Both will work (d) None of these
23. Two cars A and B move along a concentric circular path of radius r_A and r_B with velocities v_A and v_B maintaining constant distance, then $\frac{v_A}{v_B}$ is equal to
- (a) $\frac{r_B}{r_A}$ (b) $\frac{r_A}{r_B}$
(c) $\frac{r_A^2}{r_B^2}$ (d) $\frac{r_B^2}{r_A^2}$
24. A body of mass 10 kg is moving with a constant velocity of 10 m/s. When a constant force acts for 4 s on it, it moves with a velocity 2 m/s in the opposite direction. The acceleration produced in it is
- (a) 3 m/s^2 (b) -3 m/s^2
(c) 0.3 m/s^2 (d) 0.03 m/s^2
25. A beam of light is incident at 60° to a plane surface. The reflected and refracted rays are perpendicular to each other then refractive index of the surface is
- (a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$
(c) $\frac{1}{2\sqrt{3}}$ (d) None of these
26. Two wires of lengths l and $2l$, radii r and $2r$ respectively having same Young's modulus are hung with a weight mg . Net elongation is
- (a) $\frac{3mg l}{\pi r^2 Y}$ (b) $\frac{2mg l}{3\pi r^2 Y}$
(c) $\frac{3mg l}{2\pi r^2 Y}$ (d) $\frac{3mg l}{4\pi r^2 Y}$
27. A ball rolls off the top of stairway with a horizontal velocity of magnitude 1.8 m/s. The steps are 0.20 m high and 0.20 m wide. Which step will the ball hit first?
- (a) First (b) Second
(c) Third (d) Fourth
28. The peak value of an alternating emf E given by $E = E_0 \cos \omega t$ is 10 V and its frequency is 50 Hz. At a time $t = \frac{1}{600}$ s, the instantaneous value of the emf is
- (a) 10 V (b) $5\sqrt{3}$ V
(c) 5 V (d) 1 V
29. A circuit area 0.01 m^2 is kept inside a magnetic field which is normal to its plane. The magnetic field changes from 2 T to 1 T in 1 ms. If the resistance of the circuit is 2Ω . The amount of heat evolved is
- (a) 0.05 J (b) 50 J
(c) 0.50 J (d) 500 J
30. A convex lens is placed between object and a screen. The size of object is 3 cm and an image of height 9 cm is obtained on the screen. When the lens is displaced to a new position, what will be the size of image on the screen?
- (a) 2 cm (b) 6 cm
(c) 4 cm (d) 1 cm
31. A gas is suddenly expanded such that its final volume becomes 3 times its initial volume. If the specific heat at constant volume of the gas is $2R$, then the ratio of initial to final pressures is nearly equal to
- (a) 5 (b) 6.5
(c) 7 (d) 3.5
32. Two pendulums have time periods T and $5T/4$. They start SHM at the same time from the mean position. What will be the phase difference between them after the bigger pendulum completed one oscillation?
- (a) 45° (b) 90°
(c) 60° (d) 30°
33. A body is coming with a velocity of 72 km/h on a rough horizontal surface of coefficient of friction 0.5. If the acceleration due to gravity is 10 m/s^2 , find the minimum distance it can be stopped.
- (a) 400 m (b) 40 m
(c) 0.40 m (d) 4 m
34. A bullet comes out of the barrel of gun of length 2 m with a speed 80 m/s. The average acceleration of the bullet is
- (a) 1.6 m/s^2 (b) 160 m/s^2
(c) 1600 m/s^2 (d) 16 m/s^2

35. A disc of radius 0.1 m is rotating with a frequency 10 rev/s in a normal magnetic field of strength 0.1 T. Net induced emf is
 (a) $2\pi \times 10^{-2} \text{ V}$ (b) $\pi \times 10^{-2} \text{ V}$
 (c) $\frac{\pi}{2} \times 10^{-2} \text{ V}$ (d) None of these
36. 1 cm³ of water at its boiling point absorbs 540 cal of heat to become steam with a volume of 1671 cm³. If the atmospheric pressure = $1.013 \times 10^5 \text{ N/m}^2$ and the mechanical equivalent of heat = 4.19 J/cal, the energy spent in this process in overcoming intermolecular forces is
 (a) 540 cal (b) 40 cal
 (c) 500 cal (d) zero
37. A string fixed at both ends oscillates in 5 segments, length 10 m and velocity of wave is 20 m/s. What is the frequency?
 (a) 5 Hz (b) 15 Hz
 (c) 10 Hz (d) 2 Hz
38. When the amplitude of a body executing SHM becomes twice what happens?
 (a) Maximum potential energy is doubled
 (b) Maximum kinetic energy is doubled
 (c) Total energy is doubled
 (d) Maximum velocity is doubled
39. The time period of a geostationary satellite at a height 36000 km is 24 h. A spy satellite orbits earth at a height 6400 km. What will be the time period of spy satellite? [Radius of the earth = 6400 km]
 (a) 5 h (b) 4 h
 (c) 3 h (d) 12 h
40. A bomb of mass 9 kg explodes into two parts. One part of mass 3 kg moves with velocity 16 m/s, then the KE of the other part is
 (a) 162 J (b) 150 J
 (c) 192 J (d) 200 J
41. In the reaction
 ${}^7\text{N}^{14} + \alpha \longrightarrow {}^8\text{X}^{17} + {}^1\text{P}^1$
 identify X.
 (a) O₂ (b) N₂
 (c) He (d) Ar
42. Current in a coil changes from 5 A to 10 A in 0.2 s. If the coefficient of self-induction is 10 H, then the induced emf is
 (a) 112 V (b) 250 V
 (c) 125 V (d) 230 V
43. The force of interaction between two charges $q_1 = 6\mu\text{C}$ and $q_2 = 2\mu\text{C}$ is 12 N. If charge $q = -2\mu\text{C}$ is added to each of the charges, then the new force of interaction is
 (a) $2 \times 10^{-7} \text{ N}$ (b) Zero
 (c) 30 N (d) $2 \times 10^{-3} \text{ N}$
44. The number of turns in primary coil of a transformer is 20 and the number of turns in the secondary is 10. If the voltage across the primary is 220 V, what is the voltage across the secondary?
 (a) 110 V (b) 130 V
 (c) 190 V (d) 310 V
45. An electron of an atom transits from n_1 to n_2 . In which of the following, maximum frequency of photon will be emitted?
 (a) $n_1 = 1$ to $n_2 = 2$ (b) $n_1 = 2$ to $n_2 = 1$
 (c) $n_1 = 2$ to $n_2 = 6$ (d) $n_1 = 6$ to $n_2 = 2$
46. A rod of length L and mass M is bent to form a semicircular ring as shown in figure. The moment of inertia about XY is
 (a) $\frac{1}{4} \frac{ML^2}{\pi^2}$ (b) $\frac{2ML^2}{3\pi^2}$
 (c) $\frac{ML^2}{2}$ (d) $\frac{ML^2}{2}$
- 
47. In the figure shown, $m_1 = 10 \text{ kg}$, $m_2 = 6 \text{ kg}$, $m_3 = 4 \text{ kg}$. If $T_3 = 40 \text{ N}$, $T_2 = ?$
- 
- (a) 13 N (b) 32 N
 (c) 25 N (d) 35 N
48. A stone is thrown at an angle θ to be horizontal reaches a maximum height H . Then the time of flight of stone will be
 (a) $\sqrt{\frac{2H}{g}}$ (b) $2\sqrt{\frac{2H}{g}}$
 (c) $\frac{2\sqrt{2H \sin \theta}}{g}$ (d) $\frac{\sqrt{2H \sin \theta}}{g}$
49. Two parallel plates of area A are separated by two different dielectrics as shown in figure. The net capacitance is



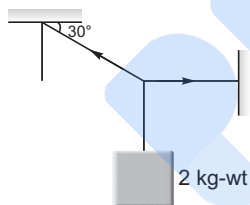
- (a) $\frac{\epsilon_0 A}{2d}$ (b) $\frac{\epsilon_0 A}{d}$
(c) $\frac{3\epsilon_0 A}{d}$ (d) $\frac{4\epsilon_0 A}{3d}$

50. Two springs of force constants k_1 and k_2 are connected as shown. The effective spring constant k is



- (a) $k_1 + k_2$ (b) $\frac{k_1}{k_2}$
(c) $k_1 k_2$ (d) $2k_1 k_2$

51. A body of weight 2 kg is suspended as shown in figure. The tension T_1 in the horizontal string (in kg-wt) is



- (a) $2/\sqrt{3}$ (b) $\sqrt{3}/2$
(c) $2\sqrt{3}$ (d) 2

52. If the momentum of a body is increased by 100%, then the percentage increase in the kinetic energy is

- (a) 150% (b) 200%
(c) 225% (d) 300%

53. In Young's double slit experiment, slit separation is 0.6 mm and the separation between slit and screen is 1.2 m. The angular width is (the wavelength of light used is 4800 Å)

- (a) 30 rad (b) 8×10^{-4} rad
(c) 12 rad (d) 70.5 rad

54. X-ray of wavelength $\lambda = 2 \text{ Å}$ is emitted from the metal target. The potential difference applied across the cathode and the metal target is

- (a) 5525 V (b) 320 V
(c) 6200 V (d) 3250 V

55. Two identical masses m moving with velocities u_1 and u_2 collide perfectly inelastically. Find the loss in energy.

- (a) $m(u_1 - u_2^2)$ (b) $\frac{m}{4}(u_1 - u_2)^2$
(c) $\frac{m}{2}(u_1 - u_2)^2$ (d) $m(u_1 - u_2)^3$

56. A constant torque acting on a uniform circular wheel changes its angular momentum from A_0 to $4A_0$ in 4 s. The magnitude of this torque is

- (a) $\frac{3A_0}{4}$ (b) A_0
(c) $4A_0$ (d) $12A_0$

57. When a number of small droplets combines to form a large drop, then

- (a) energy is absorbed
(b) energy is liberated
(c) energy is neither liberated nor absorbed
(d) process is independent of energy

58. With what minimum acceleration can a fireman slide down a rope while breaking strength of the rope is $\frac{2}{3}$ of the weight?

- (a) $\frac{2}{3}g$ (b) g
(c) $\frac{1}{3}g$ (d) Zero

59. If two waves represented by $y_1 = 4 \sin \omega t$ and $y_2 = 3 \sin \left(\omega t + \frac{\pi}{3} \right)$ interfere at a point. The

amplitude of the resulting wave will be about

- (a) 7 (b) 6
(c) 5 (d) 3.5

60. Saturated vapour is compressed to half its volume without any change in temperature, then the pressure will be

- (a) doubled (b) halved
(c) the same (d) Zero

Chemistry

- The root mean square velocity of a gas is doubled when the temperature is
 - increased four times
 - increased two times
 - reduced to half
 - reduced to one fourth
- Acidity of phenol is due to
 - hydrogen bonding
 - phenolic group
 - benzene ring
 - resonance stabilisation of its anion
- In which one of the following pairs the radius of the second species is greater than that of the first?

(a) Na, Mg	(b) O^{2-} , N^{3-}
(c) Li^+ , Be^{2+}	(d) Ba^{2+} , Sr^{2+}
- The radius of the first Bohr orbit of hydrogen atom is 0.529 Å. The radius of the third orbit of H^+ will be

(a) 8.46 Å	(b) 0.705 Å
(c) 1.59 Å	(d) 4.79 Å
- Both Co^{3+} and Pt^{4+} have a coordination number of six. Which of the following pairs of complexes will show approximately the same electrical conductance for their 0.001 M aqueous solutions?
 - $CoCl_3 \cdot 4NH_3$ and $PtCl_4 \cdot 4NH_3$
 - $CoCl_3 \cdot 3NH_3$ and $PtCl_4 \cdot 5NH_3$
 - $CoCl_3 \cdot 6NH_3$ and $PtCl_4 \cdot 5NH_3$
 - $CoCl_3 \cdot 6NH_3$ and $PtCl_4 \cdot 3NH_3$
- When ice melts into water, the entropy
 - becomes zero
 - remains same
 - decreases
 - increases
- Reduction of nitrobenzene in the presence of Zn/NH_4Cl gives
 - azobenzene
 - hydrazobenzene
 - N-phenyl hydroxyl amine
 - aniline
- Which one of the following is not a protein?
 - Wool
 - Nail
 - Hair
 - DNA
- Which of the following hexoses will form the same osazone when treated with excess phenyl hydrazine?
 - D-glucose, D-fructose and D-galactose
 - D-glucose, D-fructose and D-mannose
 - D-glucose, D-mannose and D-galactose
 - D-fructose, D-mannose and D-galactose
- A silver cup is plated with silver by passing 965C of electricity. The amount of Ag deposited is

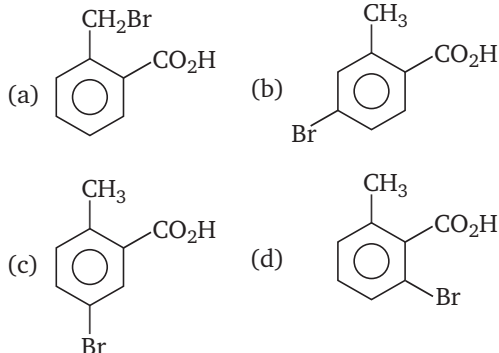
(a) 107.89 g	(b) 9.89 g
(c) 1.0002 g	(d) 1.08 g
- The standard emf of a cell involving one electron change is found to be 0.591 V at 25°C. The equilibrium constant of the reaction is ($F = 96,500 \text{ C mol}^{-1}$)

(a) 1.0×10^1	(b) 1.0×10^5
(c) 1.0×10^{10}	(d) 1.0×10^{30}
- E° values of Mg^{2+}/Mg is -2.37 V , of Zn^{2+}/Zn is -0.76 V and Fe^{2+}/Fe is -0.44 V . Which of the statements is correct?
 - Zn will reduce Fe^{2+}
 - Zn will reduce Mg^{2+}
 - Mg oxidises Fe
 - Zn oxidises Fe
- The maximum proportion of available volume that can be filled by hard spheres in diamond is

(a) 0.52	(b) 0.34
(c) 0.32	(d) 0.68
- If we mix a pentavalent impurity in a crystal lattice of germanium, what type of semiconductor formation will occur?
 - p-type
 - n-type
 - Both (a) and (b)
 - None of the two
- Which one of the following complexes is an outer orbital complex? (Atomic numbers Mn = 25, Fe = 26, Co = 27, Ni = 28)

(a) $[Fe(CN)_6]^{4-}$	(b) $[Mn(CN)_6]^{4-}$
(c) $[Co(NH_3)_6]^{3+}$	(d) $[Ni(NH_3)_6]^{2+}$
- The product of reaction between alcoholic silver nitrite with ethyl bromide is
 - ethene
 - ethane
 - ethyl nitrile
 - nitro ethane
- Iso-propyl chloride undergoes hydrolysis by
 - S_N1 mechanism
 - S_N2 mechanisms
 - S_N1 and S_N2 mechanisms
 - Neither S_N1 nor S_N2 mechanism

18. *o*-toluic acid on reaction with $\text{Br}_2 + \text{Fe}$ gives



19. Consider the acidity of the carboxylic acids

I. PhCOOH

II. $\text{o-NO}_2\text{C}_6\text{H}_4\text{COOH}$

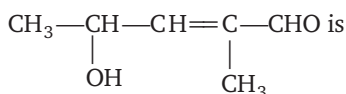
III. $\text{p-NO}_2\text{C}_6\text{H}_4\text{COOH}$

IV. $\text{m-NO}_2\text{C}_6\text{H}_4\text{COOH}$

Which of the following order is correct?

- (a) $\text{I} > \text{II} > \text{III} > \text{IV}$ (b) $\text{II} > \text{IV} > \text{III} > \text{I}$
(c) $\text{II} > \text{IV} > \text{I} > \text{III}$ (d) $\text{II} > \text{III} > \text{IV} > \text{I}$
20. Which of the following does not answer iodoform test?
- (a) *n*-butyl alcohol
(b) Acetophenone
(c) Acetaldehyde
(d) Ethylmethyl ketone
21. Which one of the following undergoes reaction with 50% sodium hydroxide solution to give the corresponding alcohol and acid?
- (a) Phenol (b) Benzaldehyde
(c) Butanal (d) Benzoic acid

22. The IUPAC name of



- (a) 4-hydroxy-1-methylpentanal
(b) 4-hydroxy-2-methylpent-2-en-1-al
(c) 2-hydroxy-4-methylpent-3-en-5-al
(d) 2-hydroxy-3-methylpent-2-en-5-al
23. The activation energy of exothermic reaction $\text{A} \rightarrow \text{B}$ is 80 kJ mol^{-1} . The heat of reaction is 200 kJ mol^{-1} . The activation energy for the reaction $\text{B} \rightarrow \text{A}$ (in kJ mol^{-1}) will be
- (a) 80 (b) 120
(c) 40 (d) 280

24. Which of the following electrolytes is least effective in coagulating ferric hydroxide solution?

(a) KBr (b) K_2SO_4
(c) K_2CrO_4 (d) $\text{K}_4[\text{Fe}(\text{CN})_6]$

25. Of the following outer electronic configurations of atoms, the highest oxidation state is achieved by which one of them?

(a) $(n-1)d^8, ns^2$ (b) $(n-1)d^5, ns^1$
(c) $(n-1)d^3, ns^2$ (d) $(n-1)d^5, ns^2$

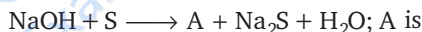
26. The relative lowering of vapour pressure of a dilute aqueous solution containing non volatile solute is 0.0125. The molality of the solution is about

(a) 0.70 (b) 0.50
(c) 0.90 (d) 0.80

27. When hydrogen peroxide is added to acidified potassium dichromate, a blue colour is produced due to formation of

(a) CrO_3 (b) Cr_2O_3
(c) CrO_5 (d) CrO_4^{2-}

28. In the following reaction,



(a) Na_2SO_4 (b) Na_2SO_3
(c) Na_2S (d) $\text{Na}_2\text{S}_2\text{O}_3$

29. On igniting Fe_2O_3 at 1400°C , the product obtained is

(a) Fe_2O_3 melt (b) FeO
(c) Fe_3O_4 (d) metallic iron

30. Sulphuric acid has great affinity for water because

(a) it hydrolyses the acid
(b) it decomposes the acid
(c) acid forms hydrates with water
(d) acid decomposes water

31. Helium-oxygen mixture is used by deep sea divers in preference to nitrogen-oxygen mixture because

(a) helium is much less soluble in blood than nitrogen
(b) nitrogen is much less soluble in blood than helium
(c) due to high pressure deep under the sea nitrogen and oxygen react to give poisonous nitric oxide
(d) nitrogen is highly soluble in water

32. One mole of CO_2 contains
 (a) 3 g atoms of CO_2
 (b) 18.1×10^{23} molecules of CO_2
 (c) 6.02×10^{23} atoms of O
 (d) 6.02×10^{23} atoms of C
33. The equivalent weight of KMnO_4 for acid solution is
 (a) 79 (b) 52.16
 (c) 158 (d) 31.6
34. Which has the highest weight?
 (a) 1 m^3 of water
 (b) A normal adult man
 (c) 10 L of Hg
 (d) All have same weight
35. Which has the highest e/m ratio?
 (a) He^{2+} (b) H^+
 (c) He^+ (d) D^+
36. The ionisation potential order for which set is correct?
 (a) $\text{Cs} < \text{Li} < \text{K}$ (b) $\text{Cs} > \text{Li} > \text{B}$
 (c) $\text{Li} > \text{K} > \text{Cs}$ (d) $\text{B} > \text{Li} < \text{K}$
37. The oxidation state of Fe in Fe_3O_4 is
 (a) +3 (b) $8/3$
 (c) +6 (d) +2
38. For a first order reaction, the concentration changes from 0.8 to 0.4 in 15 min. The time taken for the concentration to change from 0.1 M to 0.025 M is
 (a) 30 min (b) 15 min
 (c) 7.5 min (d) 60 min
39. When phenol is treated with excess of bromine water, it gives
 (a) *m*-bromophenol
 (b) *o*- and *p*-bromophenols
 (c) 2, 4-dibromophenol
 (d) 2, 4, 6-tribromophenol
40. Which reaction is suitable for the preparation of α -chloroacetic acid?
 (a) Hell-Volhard Zelinsky reaction
 (b) Nef reaction
 (c) Stephen's reaction
 (d) Perkin condensation
41. Which one of the following compounds will dissolve in an alkali solution after it has undergone reaction with Hinsberg reagent?
 (a) CH_3NH_2 (b) $(\text{CH}_3)_3\text{N}$
 (c) $(\text{C}_2\text{H}_5)_2\text{NH}$ (d) $\text{C}_6\text{H}_5\text{NHC}_6\text{H}_5$
42. Angle strain in cyclopropane is
 (a) $24^\circ 44'$ (b) $9^\circ 44'$
 (c) $44'$ (d) $-5^\circ 16'$
43. A group of atoms can function as a ligand only when
 (a) it is a small molecule
 (b) it has an unshared electron pair
 (c) it is a negatively charged ion
 (d) it is a positively charged ion
44. The bond order in NO is 2.5 while that in NO^+ is 3. Which of the following statements is true for these two species?
 (a) Bond length in NO^+ is greater than in NO
 (b) Bond length in NO is greater than in NO^+
 (c) Bond length in NO^+ is equal to that in NO
 (d) Bond length is unpredictable
45. In a homonuclear molecule which of the following set of orbitals is degenerate?
 (a) $\sigma 2s$ and $\sigma 1s$ (b) $\pi 2p_x$ and $\pi 2p_y$
 (c) $\pi 2p_x$ and $\sigma 2p_z$ (d) $\sigma 2p_z$ and $\pi 2p_x$
46. The pH of a neutral water sample is 6.5. Then the temperature of water
 (a) is 25°C
 (b) is more than 25°C
 (c) is less than 25°C
 (d) can be more or less than 25°C
47. Which is Lewis acid?
 (a) BF_3 (b) NF_3
 (c) Cl^- (d) H_2O
48. The pH of 10^{-10} M NaOH solution is nearest to
 (a) 4 (b) -10
 (c) 4 (d) 7
49. Which of the following is not true for carbanions?
 (a) The carbon carrying the charge has eight valence electrons
 (b) They are formed by heterolytic fission
 (c) They are paramagnetic
 (d) The carbon carrying the charge is sp^3 hybridised
50. Which among the following statements is correct with respect to the optical isomers?
 (a) Enantiomers are non-superimposable mirror images
 (b) Diastereomers are superimposable mirror images
 (c) Enantiomers are superimposable mirror images
 (d) *Meso* forms have no plane of symmetry

51. Inductive effect involves
 (a) delocalisation of σ -electrons
 (b) displacement of σ -electrons
 (c) delocalisation of n -electrons
 (d) displacement of π -electrons
52. The solubility of AgCl in 0.2 M NaCl solution is (K_{sp} of AgCl = 1.20×10^{-10})
 (a) 6.0×10^{-10} M (b) 0.2 M
 (c) 1.2×10^{-10} M (d) 0.2×10^{-10} M
53. Lipids are
 (a) nucleic acids occurring in plants
 (b) proteins occurring in animals
 (c) carbohydrates occurring in plants
 (d) fats of natural origin
54. The enzyme pepsin hydrolyses
 (a) proteins to amino acids
 (b) fats to fatty acids
 (c) glucose to ethyl alcohol
 (d) polysaccharides to monosaccharides
55. Carbon cannot be used in the reduction of Al_2O_3 because
 (a) it is an expensive proposition
 (b) the enthalpy of formation of CO_2 is more than that of Al_2O_3
 (c) pure carbon is not easily available
 (d) the enthalpy of formation of Al_2O_3 is too high
56. Oxalic acid when heated with conc H_2SO_4 , gives
 (a) H_2O_2 and CO_2 (b) CO and CO_2
 (c) H_2O_2 and CO (d) CO_2 and H_2S
57. At $25^\circ C$, the highest osmotic pressure is exhibited by 0.1 M solution of
 (a) urea (b) glucose
 (c) KCl (d) $CaCl_2$
58. Ammonia is dried over
 (a) slaked lime
 (b) calcium chloride
 (c) phosphorus pentoxide
 (d) quick lime
59. $C_6H_6 \xrightarrow[350\text{ K}]{H_2SO_4} A \xrightarrow[\text{Fusion}]{\text{Alkali}} B \xrightarrow[H_2O]{Br_2} C$
 In the above sequence, C is
 (a) o-bromophenol
 (b) p-bromophenol
 (c) m-bromophenol
 (d) 2, 4, 6-tribromophenol
60. Collin's reagent is used to convert
 (a) $>C=O \longrightarrow >CHOH$
 (b) $-CH_2OH \longrightarrow -CHO$
 (c) $-CHO \longrightarrow -COOH$
 (d) $-CHO \longrightarrow -CH_2OH$

Mathematics

1. The range of the function $f(x) = \log_e(3x^2 - 4x + 5)$ is
 (a) $\left(-\infty, \log_e \frac{11}{3}\right]$
 (b) $\left[\log_e \frac{11}{3}, \infty\right)$
 (c) $\left[-\log_e \frac{11}{3}, \log_e \frac{11}{3}\right]$
 (d) None of the above
2. The domain of the function $f(x) = \frac{\sqrt{9-x^2}}{\sin^{-1}(3-x)}$ is
 (a) (2, 3) (b) [2, 3)
 (c) (2, 3] (d) None of these
3. The numbers a_n 's are defined by
 $a_0 = 1, a_{n+1} = 3n^2 + n + a_n, (n \geq 0)$
- Then, a_n is equal to
 (a) $n^3 + n^2 + 1$ (b) $n^3 - n^2 + 1$
 (c) $n^3 - n^2$ (d) $n^3 + n^2$
4. Nishi has 5 coins each of the different denomination. The number different sums of money she conform
 (a) 32 (b) 25
 (c) 31 (d) None of these
5. There are P copies of n-different books. The number of different ways in which a non-empty selection can be made from them, is
 (a) $(P+1)^n - 1$ (b) $P^n - 1$
 (c) $(P+1)^{n-1} - 1$ (d) None of these
6. Out of 18 points in a plane no three are in the same straight line except five points which are collinear. The number of straight lines that can be formed joining them, is

- (a) 143 (b) 144
(c) 153 (d) None of these
7. The term independent of x in $\left[\sqrt{\left(\frac{x}{3}\right)} + \sqrt{\left(\frac{3}{2x^2}\right)} \right]^{10}$ is
(a) 1 (b) $^{10}C_1$
(c) $\frac{5}{12}$ (d) None of these
8. The greatest coefficient in the expansion of $(1+x)^{2n}$ is
(a) $^{2n}C_n$ (b) $^{2n}C_{n-1}$
(c) $^{2n}C_{n-2}$ (d) None of these
9. The number of terms in the expansion of $(\sqrt{5} + \sqrt[4]{11})^{124}$ which are integers, is equal to
(a) 0 (b) 30 (c) 31 (d) 32
10. The constant term in the expansion of $(1+x)^m \left(1 + \frac{1}{x}\right)^n$ is
(a) $^{m+n}C_{m-1}$ (b) $^{m+n}C_n$
(c) $^{m+n}C_{m-n}$ (d) None of these
11. If $a > 1$, roots of the equation $(1-a)x^2 + 3ax - 1 = 0$ are
(a) one positive and one negative
(b) both negative
(c) both positive
(d) both non-real complex
12. The number of values of the triplet (a, b, c) for which $a \cos 2x + b \sin^2 x + c = 0$ is satisfied by all real x , is
(a) 0 (b) 2
(c) 3 (d) infinite
13. If α, β, γ are such that $\alpha + \beta + \gamma = 2$, $\alpha^2 + \beta^2 + \gamma^2 = 6$, $\alpha^3 + \beta^3 + \gamma^3 = 8$, then $\alpha^4 + \beta^4 + \gamma^4$ is
(a) 5 (b) 18
(c) 12 (d) 36
14. If a, b, c are three distinct positive real numbers of real roots of $ax^2 + 2b|x| - c = 0$ is
(a) 4 (b) 2
(c) 0 (d) None of these
15. If A is a skew-symmetric matrix, then trace of A is
(a) 1 (b) -1
(c) 0 (d) None of these
16. If the matrix $A = \begin{bmatrix} y+a & b & c \\ a & y+b & c \\ a & b & y+c \end{bmatrix}$ has rank 3, then
(a) $y \neq (a+b+c)$
(b) $y \neq 1$
(c) $y = 0$
(d) $y \neq -(a+b+c)$ and $y \neq 0$
17. For positive numbers x, y, z the numerical value of the determinant $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix}$ is
(a) 0 (b) 1
(c) 2 (d) None of these
18. If A is an orthogonal matrix, then
(a) $\det A = \text{not exist}$ (b) $\det A = 0$
(c) $\det A = \pm 1$ (d) None of these
19. Let a, b, c be real numbers with $a \neq 0$ and let α, β be the roots of the equation $ax^2 + bx + c = 0$, then $a^3x^2 + abcx + c^3 = 0$ has roots
(a) $\alpha^2\beta, \beta^2\alpha$ (b) α, β^2
(c) $\alpha^2\beta, \beta\alpha$ (d) $\alpha^3\beta, \beta^3\alpha$
20. If n_1, n_2 are positive integers, then $(1+i)^{n_1} + (1+i^3)^{n_1} + (1+i^5)^{n_2} + (1+i^7)^{n_2}$ is a real number if and only if
(a) $n_1 = n_2 + 1$
(b) $n_1 = n_2$
(c) n_1, n_2 are any two negative integers
(d) n_1, n_2 are both any positive integers
21. The equation $|z+i| - |z-i| = k$ represent a hyperbola, if
(a) $-2 < k < 2$ (b) $k > 2$
(c) $0 < k < 2$ (d) None of these
22. The period of the function $f(x) = |\sin 4x| + |\cos 4x|$ is
(a) $\pi/2$ (b) $\pi/8$
(c) $\pi/4$ (d) None of these
23. If $\cos x = \frac{2 \cos y - 1}{2 - \cos y}$, where $x, y \in (0, \pi)$, then $\tan \frac{x}{2} \cdot \cot \frac{y}{2}$ is equal to
(a) $\sqrt{2}$ (b) $\sqrt{3}$
(c) $\frac{1}{\sqrt{2}}$ (d) $\frac{1}{\sqrt{3}}$

24. The value of $\cos \frac{2\pi}{15} \cdot \cos \frac{4\pi}{15} \cdot \cos \frac{8\pi}{15} \cdot \cos \frac{16\pi}{15}$ is equal to
 (a) $\frac{1}{16}$ (b) $\frac{1}{32}$
 (c) $\frac{1}{64}$ (d) $\frac{1}{8}$
25. The sum of all the solutions of the equation $\cos x \cdot \cos\left(\frac{\pi}{3} + x\right) \cdot \cos\left(\frac{\pi}{3} - x\right) = \frac{1}{4}$, $x \in [0, 6\pi]$ is
 (a) 15π (b) 30π
 (c) $\frac{110\pi}{3}$ (d) None of these
26. $2 \tan^{-1}(\operatorname{cosec} \tan^{-1} x - \tan \cot^{-1} x)$ is equal to
 (a) $\cot^{-1} x$ (b) $\cot^{-1} \frac{1}{x}$
 (c) $\tan^{-1} x$ (d) None of these
27. The value of $\sin^{-1} \left[\cos \left(\sin^{-1} \sqrt{\frac{2-\sqrt{3}}{4}} + \cos^{-1} \frac{\sqrt{12}}{4} + \sec^{-1} \sqrt{2} \right) \right]$ is
 (a) 0 (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{6}$ (d) $\frac{\pi}{2}$
28. In a ΔABC , $\angle B = 90^\circ$, then $\tan^2\left(\frac{A}{2}\right)$ is
 (a) $\frac{b-c}{b+c}$ (b) $\frac{b+c}{b-c}$
 (c) $\frac{b-2c}{b+c}$ (d) None of these
29. In a triangle, if $r_1 > r_2 > r_3$, then
 (a) $a > b > c$ (b) $a < b < c$
 (c) $a > b$ and $b < c$ (d) $a < b$ and $b > c$
30. A and B are two points on one bank of a straight river and C, D are two other points on the other bank of river, if direction from A to B is same as that from C to D and $AB = a$, $\angle CAD = \alpha$, $\angle DAB = \beta$, $\angle CBA = \gamma$, then CD is equal to
 (a) $\frac{a \sin \beta \cdot \sin \gamma}{\sin \alpha \cdot \sin(\alpha + \beta + \gamma)}$
 (b) $\frac{a \sin \alpha \cdot \sin \gamma}{\sin \beta \cdot \sin(\alpha + \beta + \gamma)}$
 (c) $\frac{a \sin \alpha \cdot \sin \beta}{\sin \gamma \cdot \sin(\alpha + \beta + \gamma)}$
 (d) None of the above
31. In a trapezoid of the vector $\vec{BC} = \lambda \vec{AD}$. We will, then find that $\vec{P} = \vec{AC} + \vec{BD}$ is collinear with $\vec{AD}$. If $\vec{P} = \mu \vec{AD}$, then
 (a) $\mu = \lambda + 1$ (b) $\lambda = \mu + 1$
 (c) $\lambda + \mu = 1$ (d) $\mu = 2 + \lambda$
32. If $P(\vec{p})$, $Q(\vec{q})$, $R(\vec{r})$ and $S(\vec{s})$ be four points such that $3\vec{p} + 8\vec{q} = 6\vec{r} + 5\vec{s}$, then the lines PQ and RS are
 (s) skew (b) intersecting
 (c) parallel (d) None of these
33. Let $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$, if $\vec{c}$ is a vector such that $\vec{a} \cdot \vec{c} = |\vec{c}|$, $|\vec{c} - \vec{a}| = 2\sqrt{2}$ and the angle between $\vec{a} \times \vec{b}$ and $\vec{c}$ is 30° , then $|(\vec{a} \times \vec{b}) \times \vec{c}|$ is equal to
 (a) $\frac{2}{3}$ (b) $\frac{3}{2}$
 (c) 2 (d) 3
34. Consider a tetrahedron with faces F_1, F_2, F_3, F_4 . Let $\vec{V}_1, \vec{V}_2, \vec{V}_3, \vec{V}_4$ be the vectors whose magnitudes are respectively equal to areas of F_1, F_2, F_3, F_4 and whose directions are perpendicular to these faces in outward direction, then $|\vec{V}_1 + \vec{V}_2 + \vec{V}_3 + \vec{V}_4|$ equals
 (a) 1 (b) 4
 (c) $\vec{0}$ (d) None of these
35. If V is the volume of the parallelopiped having three coterminal edges as $\vec{a}, \vec{b}$ and $\vec{c}$, then the volume of the parallelopiped having three coterminal edge as
 $\vec{\alpha} = (\vec{a} \cdot \vec{a})\vec{a} + (\vec{a} \cdot \vec{b})\vec{b} + (\vec{a} \cdot \vec{c})\vec{c}$
 $\vec{\beta} = (\vec{a} \cdot \vec{b})\vec{a} + (\vec{b} \cdot \vec{b})\vec{b} + (\vec{b} \cdot \vec{c})\vec{c}$
 $\vec{\gamma} = (\vec{a} \cdot \vec{c})\vec{a} + (\vec{b} \cdot \vec{c})\vec{b} + (\vec{c} \cdot \vec{c})\vec{c}$ is
 (a) V^3 (b) $3V$
 (c) V^2 (d) $2V$

36. Let us define the length of a vector $a\hat{i} + b\hat{j} + c\hat{k}$ as $|a| + |b| + |c|$. This definition coincides with the usual definition of length of a vector $a\hat{i} + b\hat{j} + c\hat{k}$, iff
- $a = b = c = 0$
 - any two of a, b and c are zero
 - any one of a, b and c is zero
 - $a + b + c = 0$
37. Let $\vec{u} = \hat{i} + \hat{j}$, $\vec{v} = \hat{i} - \hat{j}$ and $\vec{w} = \hat{i} + 2\hat{j} + 3\hat{k}$, if $\hat{n}$ is a unit vector such that $\vec{u} \cdot \hat{n} = 0$ and $\vec{v} \cdot \hat{n} = 0$, then $|\vec{w} \cdot \hat{n}|$ is equal to
- 3
 - 0
 - 1
 - 2
38. For two events A and B , it is given that $P(A) = P\left(\frac{A}{B}\right) = \frac{1}{4}$ and $P\left(\frac{B}{A}\right) = \frac{1}{2}$. Then
- A and B are mutually exclusive events
 - A and B are dependent events
 - $P\left(\frac{A}{B}\right) = \frac{3}{4}$
 - None of the above
39. The least number of times a fair coin must be tossed so that the probability of getting atleast one head is atleast 0.8 is
- 7
 - 6
 - 5
 - 3
40. If x follows a binomial distribution with parameters $n = 100$ and $p = \frac{1}{3}$, then $p(X = r)$ is maximum when r equals
- 16
 - 32
 - 33
 - None of these
41. If $\bar{x}_1$ and $\bar{x}_2$ are the means of two distributions such that $\bar{x}_1 < \bar{x}_2$ and $\bar{x}$ is the mean of the combined distribution, then
- $\bar{x} < \bar{x}_1$
 - $\bar{x} > \bar{x}_2$
 - $\bar{x} = \frac{\bar{x}_1 + \bar{x}_2}{2}$
 - $\bar{x}_1 < \bar{x} < \bar{x}_2$
42. If the axes be turned through an angle $\tan^{-1} 2$. What does the equation $4xy - 3x^2 = a^2$ become?
- $X^2 - 4Y^2 = a^2$
 - $X^2 + 4Y^2 = a^2$
 - $X^2 + 4Y^2 = -a^2$
 - None of these
43. If t_1, t_2 and t_3 are distinct, the points $(t_1, 2at_1 + at_1^3)$, $(t_2, 2at_2 + at_2^3)$, $(t_3, 2at_3 + at_3^3)$ are collinear, if
- $t_1 t_2 t_3 = 1$
 - $t_1 + t_2 + t_3 = t_1 t_2 t_3$
 - $t_1 + t_2 + t_3 = 0$
 - $t_1 + t_2 + t_3 = -1$
44. The distance of the point $(2, 3)$ from the line $2x - 3y + 9 = 0$ measured along a line $x - y + 1 = 0$ is
- $4\sqrt{2}$
 - $2\sqrt{2}$
 - $\sqrt{2}$
 - $\frac{1}{\sqrt{2}}$
45. The equation of the straight line which passes through the intersection of the lines $x - y - 1 = 0$ and $2x - 3y + 1 = 0$ and is parallel to x -axis, is
- $y = 3$
 - $y = -3$
 - $x + y = 3$
 - None of these
46. If the straight line $a_1x + b_1y + c_1 = 0$, $a_1x + b_1y + c_2 = 0$, $a_2x + b_2y + d_1 = 0$ and $a_2x + b_2y + d_2 = 0$ are the sides of rhombus, then
- $(a_2^2 + b_2^2)(c_1 - c_2)^2 = (a_1^2 + b_1^2)(d_1 - d_2)^2$
 - $(a_1^2 + b_1^2)|d_1 - d_2| = (a_2^2 + b_2^2)|c_1 - c_2|$
 - $(a_2^2 + b_2^2)(d_1 - d_2)^2 = (a_1^2 + b_1^2)(c_1 - c_2)^2$
 - $(a_1^2 + b_1^2)|c_1 - c_2| = (a_2^2 + b_2^2)|d_1 - d_2|$
47. The equation $3x^2 + 7xy + 2y^2 + 5x + 5y + 2 = 0$ represents
- a pair of straight lines
 - a circle
 - an ellipse
 - a hyperbola
48. To the lines $ax^2 + 2hxy + by^2 = 0$ the lines $a^2x^2 + 2h(a + b)xy + b^2y^2 = 0$, are
- equally inclined
 - perpendicular
 - bisector of the angle
 - None of the above
49. Consider four circles $(x \pm 1)^2 + (y \pm 1)^2 = 1$, then the equation of smaller circle touching these four circle is
- $x^2 + y^2 = 3 - \sqrt{2}$
 - $x^2 + y^2 = 6 - 3\sqrt{2}$
 - $x^2 + y^2 = 5 - 2\sqrt{2}$
 - $x^2 + y^2 = 3 - 2\sqrt{2}$

50. The locus of the point of intersection of tangents to the circle $x = a \cos \theta$, $y = a \sin \theta$ at the points, whose parametric angles differ by $\frac{\pi}{2}$, is
 (a) a straight line
 (b) a circle
 (c) a pair of straight line
 (d) None of the above
51. The equation of the circle passing through (1, 0) and (0, 1) and having the smallest possible radius is
 (a) $x^2 - y^2 - x - y = 0$
 (b) $x^2 + y^2 - x - y = 0$
 (c) $x^2 + y^2 + x + y = 0$
 (d) $x^2 + y^2 - 2x - 2y = 0$
52. The length of the common chord of the two circles $(x - a)^2 + (y - b)^2 = c^2$ and $(x - b)^2 + (y - a)^2 = c^2$ is
 (a) $\sqrt{4c^2 + 2(a - b)^2}$ (b) $\sqrt{4c^2 - (a - b)^2}$
 (c) $\sqrt{4c^2 - 2(a - b)^2}$ (d) $\sqrt{2c^2 - 2(a - b)^2}$
53. If $\left(m_i, \frac{1}{m_i}\right)$ are four distinct points on a circle, then
 (a) $m_1 m_2 m_3 m_4 = 1$
 (b) $m_1 m_2 m_3 m_4 = -1$
 (c) $m_1 m_2 m_3 m_4 = \frac{1}{2}$
 (d) $\frac{1}{m_1} + \frac{1}{m_2} + \frac{1}{m_3} + \frac{1}{m_4} = \frac{1}{4}$
54. If the normal to the parabola $y^2 = 4ax$ at the point $(at^2, 2at)$ cuts the parabola again at $(aT^2, 2aT)$, then
 (a) $-2 \leq T \leq 2$
 (b) $T \in (-\infty, -8) \cup (8, \infty)$
 (c) $T^2 < 8$
 (d) $T^2 \geq 8$
55. The number of real tangents that can be drawn to the ellipse $3x^2 + 5y^2 = 32$ passing through (3, 5) is
 (a) 0 (b) 1
 (c) 2 (d) infinite
56. If the equation $lx^2 + 2mxy + ny^2 = 0$ represents a pair conjugate diameter of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, then
 (a) $la^2 + nb^2 = 0$ (b) $la^2 = nb^2$
 (c) $2la^2 = nb^2$ (d) None of these
57. If e is the eccentricity of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and θ is the angle between the asymptotes, then $\cos\left(\frac{\theta}{2}\right)$ is equal to
 (a) $\frac{1}{e}$ (b) $\frac{-1}{e}$
 (c) e (d) $\frac{2}{e}$
58. The tangent and normal to a rectangular hyperbola $xy = c^2$ at a point cuts off intercepts a_1 and a_2 on one axis and b_1, b_2 on the other, then $a_1 a_2 + b_1 b_2$ is equal to
 (a) 1 (b) 2
 (c) 3 (d) 0
59. The direction cosines of any normal to the xy -plane are
 (a) 1, 0, 0 (b) 0, 1, 0
 (c) 1, 1, 0 (d) 0, 0, 1
60. The locus of the equation $xy + yz = 0$ is
 (a) a pair of straight lines
 (b) a pair of parallel lines
 (c) a pair of perpendicular planes
 (d) None of the above
61. The reflection of the point (2, -1, 3) in the plane $3x - 2y - z = 9$ is
 (a) $\left(\frac{26}{7}, \frac{15}{7}, \frac{17}{7}\right)$ (b) $\left(\frac{26}{7}, \frac{-15}{7}, \frac{17}{7}\right)$
 (c) $\left(\frac{15}{7}, \frac{26}{7}, \frac{-17}{7}\right)$ (d) $\left(\frac{26}{7}, \frac{17}{7}, \frac{-15}{7}\right)$
62. $\lim_{x \rightarrow 0} \frac{\sqrt{1 - \cos 2x}}{\sqrt{2} \cdot x}$ is
 (a) 1 (b) -1
 (c) zero (d) does not exist
63. If $f(x) = \begin{cases} ax^2 + b, & 0 \leq x < 1 \\ x + 3, & 1 < x \leq 2 \\ 4, & x = 1 \end{cases}$, then the value of (a, b) for which $f(x)$ cannot be continuous at $x = 1$ is
 (a) (2, 2) (b) (3, 1)
 (c) (4, 0) (d) (5, 2)
64. If $f(x) = \log_x(\log x)$, then $f'(x)$ at $x = e$ is
 (a) $1/e$ (b) e
 (c) $-1/e$ (d) 0

65. Radius of the circle

$$\vec{r}^2 + \vec{r} \cdot (2\hat{i} - 2\hat{j} - 4\hat{k}) - 19 = 0,$$

$$\vec{r} \cdot (\hat{i} - 2\hat{j} + 2\hat{k}) + 8 = 0, \text{ is}$$

- (a) 5 (b) 4
(c) 3 (d) 2
66. If $x^y = e^{x-y}$, then $\frac{dy}{dx}$ is equal to
(a) $\frac{\log x}{(1 + \log x)^2}$ (b) $\frac{x-y}{(1 + \log x)}$
(c) $\frac{x-y}{(1 + \log x)^2}$ (d) $\frac{1}{(1 + \log x)}$
67. If $y = \sin(m \sin^{-1} x)$, then $(1 - x^2) y'' - xy'$ is equal to
(a) $m^2 y$ (b) my
(c) $-m^2 y$ (d) None of these
68. If $f(x) = (ax + b) \sin x + (cx + d) \cos x$, then the values of a, b, c and d such that $f'(x) = x \cos x$ for all x , are
(a) $b = c = 0, a = d = 1$
(b) $b = d = 0, a = c = 1$
(c) $c = d = 0, a = b = 1$
(d) None of the above
69. If a particle is moving such that the velocity acquired is proportional to the square root of the distance covered, then its acceleration is
(a) a constant (b) $\propto s^2$
(c) $\propto \frac{1}{s^2}$ (d) $\propto \frac{1}{s}$
70. The point in the interval $[0, 2\pi]$, where $f(x) = e^x \sin x$ has maximum slope, is
(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$
(c) π (d) $\frac{3\pi}{2}$
71. The function $f(x) = \frac{ax + b}{(x-1)(x-4)}$ has a local maxima at $(2, -1)$, then
(a) $b = 1, a = 0$ (b) $a = 1, b = 0$
(c) $b = -1, a = 0$ (d) $a = -1, b = 0$
72. If $z = \tan(y + ax) + \sqrt{y - ax}$, then $z_{xx} - a^2 z_{yy}$ is equal to
(a) 0 (b) 2
(c) $z_x + z_y$ (d) $z_x z_y$

73. If $\int f(x) dx = F(x)$, then $\int x^3 f(x^2) dx$ is equal to

- (a) $\frac{1}{2} [x^2 \{F(x)\}^2 - \int \{F(x)\}^2 dx]$
(b) $\frac{1}{2} [x^2 F(x^2) - \int F(x^2) d(x^2)]$
(c) $\frac{1}{2} [x^2 F(x) - \frac{1}{2} \int \{F(x)\}^2 dx]$
(d) None of the above

74. $\int \frac{x^2 + 4}{x^4 + 16} dx$ is equal to

- (a) $\frac{1}{2\sqrt{2}} \tan^{-1} \left(\frac{x^2 + 4}{2x} \right) + c$
(b) $\frac{1}{2\sqrt{2}} \tan^{-1} \left(\frac{x^2 - 4}{2\sqrt{2}x} \right) + c$
(c) $\frac{1}{2\sqrt{2}} \tan^{-1} \left(\frac{x^2 + 4}{2\sqrt{2}x} \right) + c$
(d) $\frac{1}{2} \tan^{-1} \left(\frac{x^2 - 4}{2x} \right) + c$

75. Evaluate $\int \frac{1}{(x+1)\sqrt{x^2-1}} dx$

- (a) $\sqrt{\frac{x+1}{x-1}} + c$ (b) $\sqrt{\frac{x-1}{x+1}} + c$
(c) $\sqrt{\frac{1}{x+1}} + c$ (d) None of these

76. The value of the integral $\int_{\pi/2}^{3\pi/2} [\sin x] dx$, where $[\cdot]$ denotes the greatest integer function, is

- (a) $\frac{\pi}{2}$ (b) $-\frac{\pi}{2}$
(c) 0 (d) π

77. The area of the loop the curve $ay^2 = x^2(a-x)$ is

- (a) $\frac{8a^2}{15}$ sq unit (b) $\frac{4a^2}{15}$ sq unit
(c) $\frac{2a^2}{15}$ sq unit (d) None of these

78. Solution of the differential equation

$$x = 1 + xy \frac{dy}{dx} + \frac{(xy)^2}{2!} \left(\frac{dy}{dx} \right)^2 + \frac{(xy)^3}{3!} \left(\frac{dy}{dx} \right)^3 + \dots \text{ is}$$

- (a) $y = \log_e(x) + c$
 (b) $y = (\log_e x)^2 + c$
 (c) $y = \pm \sqrt{(\log_e x)^2 + 2c}$
 (d) $xy = x^y + k$
79. If the solution of the differential equation $\frac{dy}{dx} = \frac{ax+3}{2y+f}$ represents a circle, then the value of a is

- (a) 2 (b) -2
 (c) 3 (d) -4

80. The approximate value of $\int_1^5 x^2 dx$ using trapezoidal rule with $n = 4$ is
 (a) 41 (b) 41.5
 (c) 41.75 (d) 42

General English and Aptitude

Directions (1-4) In each of the following questions, choose the alternative which best expresses the meaning of the word given in capital letters.

1. MOSQUERADE
 (a) to provide support
 (b) to go in disguise
 (c) to mesmerise
 (d) marathon race
2. PREPOSTEROUS
 (a) careful (b) casual
 (c) absurd (d) deterrent
3. SOLITUDE
 (a) musical composition
 (b) aloneness
 (c) true statement
 (d) single mindedness
4. PROPITIOUS
 (a) favourable (b) clean
 (c) nearby (d) patriotic

Directions (5-8) In each of the following questions, choose the alternative which is opposite in meaning to the word given in capital letters.

5. RELENTLESS
 (a) merciless (b) yielding
 (c) monotonous (d) incisive
6. FORBEARANCE
 (a) patience (b) self-control
 (c) intolerance (d) preference
7. PALTRY
 (a) absolete (b) cautious
 (c) random (d) plentiful
8. EXODUS
 (a) influx (b) return
 (c) home coming (d) restoration

Directions (9-12) In each of the following questions, choose the most suitable alternative to fill in the blank.

9. The.....argument put forth for not disclosing the facts did not impress anybody.
 (a) intemperate (b) spurious
 (c) specious (d) convincing
10. Director, he said, would.....the matter at once.
 (a) invigilate (b) explore
 (c) investigate (d) survey
11. Everyone was.....by surprise when she announced her plan to marry that boy.
 (a) moved (b) shaken
 (c) taken (d) prevailed
12. Your case is so unique that I am not getting any.....to support it.
 (a) reason (b) help
 (c) happening (d) precedent

Directions (13-16) In each of the following questions, choose the alternative which can be substituted for the given sentence.

13. The writing or compiling of dictionaries
 (a) Lexicography (b) Numismatics
 (c) Cytology (d) Demography
14. The study of Insects
 (a) Chromatics (b) Dactylology
 (c) Calligraphy (d) Entomology
15. Murder of one's brother
 (a) Regiside (b) Foeticide
 (c) Fratricide (d) Uxoricide
16. Government by one person
 (a) Autonomy (b) Autocracy
 (c) Plutocracy (d) Theocracy

Directions (17-20) In each of the following questions, choose the alternative which can best improve the given sentence by substituting the italicised portion. If the sentence is correct as it is, your answer is (d).

17. She cut a *sad figure* in her first performance on the stage.
 (a) made a sorry figure
 (b) cut a sorry face
 (c) cut a sorry figure
 (d) no improvement
18. *No sooner I saw* the tiger, than I ran away.
 (a) as soon as I saw
 (b) no sooner I had seen
 (c) no sooner did I see
 (d) no improvement
19. If he *had time* he will call you.
 (a) would have (b) would have had
 (c) has (d) no improvement
20. *All his answers* were correct.
 (a) his all answers (b) his every answers
 (c) all of his answers (d) no improvement
- Directions (21-25)** *In the following questions, choose the group of words that shows the same relationship as given at the top of every question.*
21. Jam : Jelly : Pickles
 (a) Butter : Marmalade : Grapes
 (b) Granite : Basalt : Coke
 (c) Cow : Dry : Draft
 (d) Bleat : Bray : Grunt
22. Mountain : Height : Climber
 (a) River : Length : Water
 (b) Land : Farmer : Crop
 (c) College : Building : Student
 (d) Sea : Depth : Diver
23. Head : Brain : Think
 (a) Eyes : Lashes : See
 (b) Skin : Sweat : Touch
 (c) Feet : Dance : Toe
 (d) Mouth : Teeth : Chew
24. Jute : Cotton : Wool
 (a) Potato : Carrot : Bean
 (b) Canada : Chile : Asia
 (c) Liver : Heat : Blood
 (d) Shark : Cod : Eel
25. Sial : Sima : Mantle
 (a) Core : Asteroid : Comet
 (b) Pneumonia : Tetanus : Hepatitis
 (c) Calcite : Magnesium : Zinc
 (d) Wrestling : Karate : Boxing
- Directions (26-30)** *In the following questions, choose the option which shows common feature in the relationship given in each question.*
26. Rourkela : Bokaro : Durgapur
 (a) They have steel plants
 (b) They have coal mines
 (c) They have atomic power plants
 (d) They have the best technical colleges
27. Chlorine : Fluorine : Iodine
 (a) These are names of inert gases
 (b) These are gases at room temperature
 (c) These are transition elements
 (d) These are halogens
28. Petrol : Phosphorus : Cooking gas
 (a) They are fuels
 (b) They are highly inflammable
 (c) They can be sold without permit
 (d) India has to import them
29. Green : Violet : Orange
 (a) They are primary colours
 (b) These colours occur together in a rainbow
 (c) They are made by mixing other colours
 (d) These colours are not found in butterflies
30. Supernova : Protostar : Red Giant
 (a) These are kinds of stars
 (b) These are members of galaxies
 (c) These are stages in the life of a star
 (d) These move about the Sun
31. The classical dance, Kathakali belongs to
 (a) Tamil Nadu (b) Karnataka
 (c) Orissa (d) Kerala
32. The highest civilian award in India is
 (a) Paramveer Chakra
 (b) Bharat Ratna
 (c) Bhatnagar Award
 (d) Kalinga Award
33. Who is called 'Nightingale of India'?
 (a) Sarojini Naidu (b) Lata Mangeshkar
 (c) Amir Khushro (d) Asha Bhosale
34. Nehru Trophy is related with
 (a) Cricket (b) Volleyball
 (c) Hockey (d) Badminton
35. The headquarters of NATO is situated at
 (a) Brussels (b) Geneva
 (c) Newyork (d) Paris
36. The first Indian woman to swim across the English channel is
 (a) Bachendri Pal (b) Santosh Yadav
 (c) Nirja Mishra (d) Aarti Saha

37. Which of the following river is related with Bhakra-Nagal Project?
(a) Ravi (b) Satluj
(c) Gandak (d) Mahanadi
38. Namdhapha National Park is located in
(a) Rajasthan
(b) Orissa
(c) Arunachal Pradesh
(d) UP
39. Which of the following is known as 'evening star'?
(a) Venus (b) Mercury
(c) Saturn (d) Jupiter
40. Which of the following was the founder of Indian National Congress?
(a) Jawahar Lal Nehru
(b) Mahatma Gandhi
(c) Moti Lal Nehru
(d) A. O. Hume

prepp
Your Personal Exam Guide