



CHRISTIAN MEDICAL  
COLLEGE VELLORE

# CMC Vellore

## Sample Paper 2013





# CMC Vellore

## Medical Entrance Exam

### Solved Paper 2013

#### Physics

- Hygen's wave theory of light cannot explain
  - photoelectric effect
  - polarisation
  - interference
  - diffraction
- A truck is moving eastwards with a velocity of 15 m/s. In 10 s, the velocity changes to 15 m/s northwards. Its average acceleration during this time will be
  - $3\sqrt{2}$  m/s northwards
  - $\sqrt{2}$  m/s northwards
  - $3/\sqrt{2}$  m/s northwards
  - None of the above
- A body sliding on a smooth inclined plane requires 4 s to reach the bottom starting from rest at the top. Then the time taken to travel one eight the distance starting rest at the top, will be
  - 16 s
  - 4 s
  - $\sqrt{2}$  s
  - 0.5 s
- Energy of simple harmonic motion depends on
  - $\frac{1}{\omega^2}$
  - $\omega$
  - $\frac{1}{a^2}$
  - $\pi$
- If the potential of a capacitor having capacity 6  $\mu\text{F}$  is increased from 10 V to 20 V then increase in its energy is
  - $12 \times 10^{-7}$  J
  - $9 \times 10^{-7}$  J
  - $4.5 \times 10^{-7}$  J
  - $2.25 \times 10^{-7}$  J
- A bullet of mass 0.1 kg is fired with a speed of 100 m/s. The mass of gun being 50 kg. Then the velocity of recoil become
  - 0.05 m/s
  - 0.5 m/s
  - 0.1 m/s
  - 0.2 m/s
- The electrical conductivity of earth's atmosphere increases with altitudes of
  - variation of atmosphere
  - in a capacitor coilings
  - measure the voltage
  - measure the charge
- In an AC circuit, the potential difference across an inductance and resistance connected in series are 16 V and 20 V respectively. Total potential difference across the circuit will be
  - 10.0 V
  - 25.6 V
  - 25.6 V
  - 30.6 V
- If a wire of resistance  $R$  is stretched to triple its length, then the new resistance is
  - $9R$
  - $3R$
  - $R/3$
  - $9/R$
- Atomic number of nucleus is  $Z$ , while its mass number is  $M$ , what will be number of neutrons in nucleus?
  - $M - Z$
  - $M + Z$
  - $M^2$
  - $M^2 Z$
- The nuclear energy produced in nuclear reactor is used to run
  - AC motor
  - electric generator
  - electric generator
  - DC motor
- If the phase difference between two points separated by 0.8 in wave of frequency 120 Hz, is  $0.5\pi$  then the velocity of the wave is will be
  - 768 Hz
  - 770 Hz
  - 384 Hz
  - 385 Hz



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13. A 12 pF capacitor is connected to a 50 V. The electrostatic energy is stored in the capacitor will be  
(a)  $2.5 \times 10^{-1}$  J (b)  $3.5 \times 10^{-12}$  J  
(c)  $0.5 \times 10^{-2}$  J (d)  $1.5 \times 10^{-2}$  J
14. Cyclotron is a device which used to  
(a) measuring the charge  
(b) measure of the voltage  
(c) acceleration protons  
(d) acceleration of electrons
15. The dimensions of potential difference are  
(a)  $[ML^2T^{-2}Q^{-1}]$  (b)  $[ML^2T^2Q^2]$   
(c)  $[LT^2Q]$  (d)  $[M^2LT^{-2}Q^{-1}]$
16. Light takes  $t_1$  sec to travel a distance  $x$  cm in vacuum and the same light takes  $t_2$  sec to travel  $10x$  cm in the medium, critical angle for the corresponding medium is  
(a)  $\sin^{-1}\left(\frac{10t_1}{t_2}\right)$  (b)  $\sin^{-1}\left(\frac{t_1}{10t_2}\right)$   
(c)  $\sin^{-1}\left(\frac{t_2}{10t_1}\right)$  (d)  $\sin^{-1}\left(\frac{10t_2}{t_1}\right)$
17. If the critical angle for total internal reflection from a medium to vacuum is  $30^\circ$ , then the velocity of light in the medium will be  
(a)  $3 \times 10^8$  m/s (b)  $2 \times 10^8$  m/s  
(c)  $1.5 \times 10^8$  m/s (d)  $6 \times 10^8$  m/s
18. Which one of the following discovered cyclotron?  
(a) Maxwell (b) Lawrence  
(c) Levis (d) Bohr
19. A gas initially at  $18^\circ\text{C}$  is compressed adiabatically to one eighth of its original volume. Then the temperature of the gas after compression is  
(a)  $395.4^\circ\text{C}$  (b)  $144^\circ\text{C}$   
(c)  $887.4^\circ\text{C}$  (d)  $18^\circ\text{C}$
20. A stone is dropped into a lake from a tower of 500 m height. The sound of splash will be heard after  
(a) 11.5 s (b) 21 s (c) 3.75 s (d) 10 s
21. An aeroplane having a wing space of 35 m flies due north with the speed of 90 m/s given  $B$  is  $4 \times 10^{-5}$  T. The potential difference between the tips of the wings will be  
(a) 0.013 V (b) 1.26 V  
(c) 12.6 V (d) 0.126 V
22. A radioactive element has half-life of 3.6 days. In what time will it be left  $1/32^{\text{nd}}$  undecayed?  
(a) 4 days (b) 12 days  
(c) 18 days (d) 24 days
23. The wavelength associated with an electron accelerated through a potential difference of 100 V is of the order of  
(a)  $1.2 \text{ \AA}$  (b)  $10.5 \text{ \AA}$  (c)  $100 \text{ \AA}$  (d)  $1000 \text{ \AA}$
24. The thermodynamic coordinates of a jar A filled with a gas are  $p, V$  and  $T$  and another jar B filled with another gas  $2p, V/4$  and  $2T$ , where the symbols have their usual meanings. The ratio of the number of molecules of jar A to those of jar B is  
(a) 4 : 1 (b) 2 : 2 (c) 1 : 2 (d) 1 : 1
25. When the kinetic energy of a body executing SHM is  $1/3$  of the potential energy. The displacement of the body is  $x$  per cent of the amplitude, where  $x$  is  
(a) 33 (b) 87 (c) 67 (d) 50
26. In the case of horse is pulling a cart, force that causes the horse to move forward is the force that  
(a) the horse exerts on the ground  
(b) the horse exerts on the cart  
(c) the ground exerts on the horse  
(d) the cart exerts on the horse
27. If the pressure of a gas contained in a vessel is increased by 0.4%. When heated through  $1^\circ\text{C}$ , the initial temperature had been  
(a) 2500 K (b) 250 K (c)  $250^\circ\text{C}$  (d)  $25^\circ\text{C}$
28. The capacitance of a spherical conductor with radius 1 m is  
(a)  $9 \times 10^{-2}$  F (b)  $1 \mu\text{F}$   
(c)  $2.5 \times 10^{-10}$  F (d)  $1 \times 10^{-6}$  F



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29. Which of the following have higher specific charge?  
(a) Positron (b) Proton  
(c) He (d) None of these
30. For an enclosed maintained at 1000 K, the maximum radiation occurs at wavelength  $\lambda_m$ . If the temperature is raised to 2000 K, the peak will shift to  
(a)  $\frac{\lambda_m}{2}$  (b)  $2\lambda_m$  (c)  $2^4\lambda_m$  (d)  $2^{-4}\lambda_m$
31. A coil of area  $5 \text{ cm}^2$  and of 20 turns is placed in uniform magnetic field of  $10^4 \text{ T}$ . The normal to the plane of the coil makes an angle of  $60^\circ$  with the magnetic field. The flux in Maxwell through the coil is  
(a)  $5 \times 10^2$  (b)  $5 \times 10^4$   
(c)  $2 \times 10^4$  (d)  $5 \times 10^3$
32. An electron jumps from the 4<sup>th</sup> orbits to the 2<sup>nd</sup> orbit of hydrogen atom. Given the Rydberg's constant  $R = 10^5 \text{ cm}^{-1}$ , the frequency in Hz of the emitted radiation will be  
(a)  $\frac{3}{6} \times 10^5$  (b)  $16/3 \times 10^{15}$   
(c)  $9/16 \times 10^{15}$  (d)  $3/4 \times 10^{15}$
33. The Kepler's second law states that the straight line joining the planet to the sun sweeps out equal areas in equal times. The statement is equivalent to saying that  
(a) total acceleration is zero  
(b) transverse acceleration is zero  
(c) longitudinal acceleration is zero  
(d) radial acceleration is zero
34. A diatomic gas is heated at constant pressure. What fraction of the heat energy is used to increase the internal energy?  
(a)  $\frac{3}{5}$  (b)  $\frac{3}{7}$  (c)  $\frac{5}{7}$  (d) 5/9
35. In interference pattern the energy is  
(a) created at the maximum  
(b) destroyed at the minimum  
(c) conserved but redistributed  
(d) All of the above
36. A lens behaves as a converging lens in air and diverging lens in water. The refractive index of the material of the lens is  
(a) equal to that of water  
(b) less than that of water  
(c) greater than that of water  
(d) Nothing can be predicted
37. The electron emitted in beta radiation originates from  
(a) inner orbits of atoms  
(b) free electron existing in nucleus  
(c) decay of neutron in the nucleus  
(d) photon escaping from the nucleus
38. If elements with principal quantum number  $n > 4$  were not allowed in nature than the number of possible elements would be  
(a) 32 (b) 60 (c) 10 (d) 4
39. The square of resultant of two equal forces is three times their product. Angle between the forces is  
(a)  $\pi$  (b)  $\pi/2$  (c)  $\pi/4$  (d)  $\pi/3$
40. Which of the following is different from others?  
(a) Wavelength (b) Velocity  
(c) Frequency (d) Amplitude
41. A capacitor of capacitance  $C$  has charge  $Q$  and stored energy is  $W$ . If the charge is increased to  $2Q$ , the stored energy will be  
(a)  $\frac{W}{4}$  (b)  $\frac{W}{2}$  (c)  $2W$  (d)  $4W$
42. A cylindrical conductor is placed near another positively charged conductor the net charge acquired by the cylindrical conductor will be  
(a) positive only  
(b) negative only  
(c) zero  
(d) Either positive or negative
43. A point moves such that its displacement as function of time is given by  $x^2 = t^2 + 1$ . Its acceleration at time  $t$  is  
(a)  $\frac{1}{x^3}$  (b)  $-\frac{t}{x^2}$  (c)  $\frac{1}{x} - \frac{t^2}{x^3}$  (d)  $\frac{1}{x} - \frac{t}{x^2}$



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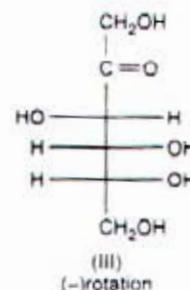
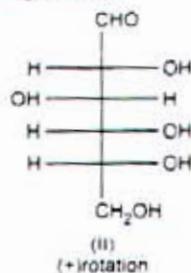
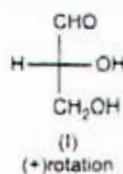
44. If the speed of light wave  $\frac{2}{3}$  of its present value, the energy released in a given atomic explosion will be decreased by a fraction  
(a)  $\frac{2}{3}$  (b)  $\frac{4}{9}$  (c)  $\frac{5}{9}$  (d)  $\frac{2}{9}$
45. Alcohol is more volatile than water, because  
(a) its boiling point is lower than water  
(b) it is an organic liquid  
(c) its freezing point is lower than water  
(d) its vapour pressure is 2.5 times greater than water
46. A body has same temperature as that of the surrounding, then  
(a) it radiates same heat as it absorbs  
(b) it absorbs more, radiates less heat  
(c) it radiates more, absorbs less heat  
(d) it never radiates heat
47. In a transistor configuration  $\beta$  parameter is  
(a)  $I_b/I_c$  (b)  $I_c/I_b$   
(c)  $I_c/I_e$  (d)  $I_e/I_c$
48. The ratio of forward biased to reverse biased resistance for  $p-n$  junction diode is  
(a)  $10^{-1} : 1$  (b)  $10^{-2} : 1$   
(c)  $10^{-3} : 1$  (d)  $10^{-4} : 1$
49. A water film is made between two 10 cm long straight wire and at a distance of 0.5 cm. If distance between the wire is increased by 1 mm. Then work done will be  
(a)  $9.22 \times 10^{-6} \text{ J}$  (b)  $1.44 \times 10^{-6} \text{ J}$   
(c)  $2.88 \times 10^{-6} \text{ J}$  (d)  $5.76 \times 10^{-6} \text{ J}$
50. A capacitor of  $20 \mu\text{F}$  capacity charged upto 500 V is connected in parallel with another capacitor of  $10 \mu\text{F}$  which is charged upto 200 V. Their common potential is  
(a) 500 V (b) 400 V (c) 300 V (d) 200 V
51. What will happen when a 40 W, 220 V lamp and 100 W, 220 V lamp are connected in series across 40 V supply?  
(a) 100 W lamp will fuse  
(b) 40 W lamp will fuse  
(c) Both lamps will fuse  
(d) Neither lamp will fuse
52. The displacement of a particle of mass 3 g executing simple harmonic motion is given by  $Y = 3 \sin(0.2t)$  in SI units. The kinetic energy of the particle at a points which is at a distance equal to  $\frac{1}{3}$  of its amplitude from its mean position is  
(a)  $12 \times 10^{-3} \text{ J}$  (b)  $25 \times 10^{-3} \text{ J}$   
(c)  $0.48 \times 10^{-3} \text{ J}$  (d)  $0.24 \times 10^{-3} \text{ J}$
53. The radius of gyration of a rod of length  $L$  and mass  $M$  about an axis perpendicular to its length and passing through a point at a distance  $L/3$  from one of its ends is  
(a)  $\frac{\sqrt{7}}{6}L$  (b)  $\frac{L^2}{9}$  (c)  $\frac{L}{3}$  (d)  $\frac{\sqrt{5}}{2}L$
54. The apparent weight of a person inside a lift is  $w_1$  when lift moves up with a certain acceleration and is  $w_2$  when lift moves down with same acceleration. The weight of the person when lift moves up with constant speed is  
(a)  $\frac{w_1 + w_2}{2}$  (b)  $\frac{w_1 - w_2}{2}$  (c)  $2w_1$  (d)  $2w_2$
55. The magnitude of magnetic induction for a current carrying toroid of uniform cross-section is  
(a) uniform over the whole cross-section  
(b) maximum on the outer edge  
(c) maximum on the inner edge  
(d) maximum at the centre of cross-section
56. Isogonic lines are those for which  
(a) declination is the same at all places on the line  
(b) angle of dip is the same at all place on the line  
(c) the value of horizontal component of earth's magnetic field is the same  
(d) All of the above
57. Each atom of an iron bar ( $5 \text{ cm} \times 1 \text{ cm} \times 1 \text{ cm}$ ) has a magnetic moment  $1.8 \times 10^{-23} \text{ Am}^{-2}$  that the density of iron is  $7.18 \times 10^3 \text{ kg/m}^3$ , atomic weight is 56 and Avogadro number is  $6.02 \times 10^{23}$ . The magnetic moment of bar in the state of magnetic saturation will be  
(a) 4.75 A/m (b) 5.74 A/m  
(c) 7.54 A/m (d) 75.4 A/m



58. A current of 1A is flowing on the sides of an equilateral triangle of sides  $4.5 \times 10^{-2}$  m. The magnetic field at the centroid of the triangle is  
 (a)  $2 \times 10^{-5}$  T (b)  $4 \times 10^{-5}$  T  
 (c)  $8 \times 10^{-5}$  T (d)  $1.2 \times 10^{-4}$  T
59. If the equation of transverse wave is  $y = 5 \sin 2\pi \left[ \frac{t}{0.04} - \frac{x}{40} \right]$ , where distance is in cm and time in second and then the wavelength of the wave is  
 (a) 60 cm (b) 40 cm  
 (c) 35 cm (d) 25 cm
60. A 700 pF capacitor is charged by a 50 V battery. The electrostatic energy stored by it is  
 (a)  $17.0 \times 10^{-8}$  J (b)  $13.5 \times 10^{-8}$  J  
 (c)  $9.5 \times 10^{-8}$  J (d)  $8.7 \times 10^{-7}$  J

## Chemistry

1. When benzene sulphonic acid and *p*-nitrophenol are treated with  $\text{NaHCO}_3$ , the gases released respectively are  
 (a)  $\text{SO}_2$ ,  $\text{CO}_2$   
 (b)  $\text{CO}_2$ ,  $\text{CO}_2$   
 (c)  $\text{SO}_2$ ,  $\text{NO}$   
 (d)  $\text{SO}_2$ ,  $\text{NO}_2$
2. Amongst the following antihistamines, which are antacids?  
 I. Ranitidine II. Cimetidine III. Terfenadine  
 IV. Brompheniramine  
 (a) I and II (b) III only  
 (c) I and III (d) III and IV
3. Which of the following polymers cannot have vinylic monomer units?  
 (a) Acrilan (b) Polystyrene  
 (c) Nylon (d) Teflon
4. Optical rotations of some compounds along with their structures are given below. Which of them have D- configuration?

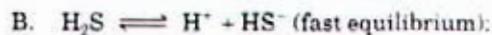
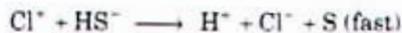


- (a) I, II, III (b) II, III  
 (c) I, II (d) III
5. Due to the presence of ambidentate ligands coordination compounds show isomerism. Palladium complexes of the type  $[\text{Pd}(\text{C}_6\text{H}_5)_2(\text{SCN})_2]$  and  $[\text{Pd}(\text{C}_6\text{H}_5)_2(\text{NCS})_2]$  are  
 (a) linkage isomerism  
 (b) coordination isomerism  
 (c) ionisation isomerism  
 (d) geometrical isomerism
6. Amongst the following, the most stable complex is  
 (a)  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$  (b)  $[\text{Fe}(\text{NH}_3)_6]^{3+}$   
 (c)  $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$  (d)  $[\text{FeCl}_6]^{3-}$
7. In a 0.010M solution of oxalic acid,  $\text{H}_2\text{C}_2\text{O}_4$ ,  $K_1 = 5.9 \times 10^{-2}$ ,  $K_2 = 6.4 \times 10^{-5}$ , the species present in the lowest concentration is  
 (a)  $\text{H}_2\text{C}_2\text{O}_4$  (b)  $\text{H}_3\text{O}^+$   
 (c)  $\text{HC}_2\text{O}_4^-$  (d)  $\text{C}_2\text{O}_4^{2-}$



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8.  $K_a$  for HF is  $3.5 \times 10^{-4}$  calculate  $K_b$  for the fluoride ion.  
 (a)  $3.5 \times 10^{-4}$  (b)  $1.0 \times 10^{-7}$   
 (c)  $2.85 \times 10^{-11}$  (d)  $1.0 \times 10^{-14}$
9. A face centred cubic lattice is made up of two types of atoms A and B, in which A occupies the corner positions and B occupies the face centres. If atom along an axis joining the diagonally opposite corners on a face are removed, the empirical formula of the remaining solid would be  
 (a)  $A_2B_2$  (b)  $A_3B_3$   
 (c)  $A_3B_6$  (d)  $A_4B_4$
10. The normal oxidation potential of zinc referred to the standard hydrogen electrode is 0.76V and that of copper is 0.34V at 25°C, when excess of zinc is added to solution of copper sulphate, zinc displaces copper till equilibrium is reached. What is the ratio of concentration to  $Zn^{2+}$  to  $Cu^{2+}$  ions at equilibrium?  
 (a)  $1.69 \times 10^{-3} : 1$  (b)  $1.243 \times 10^{22} : 1$   
 (c)  $1.1679 \times 10^{-27}$  (d)  $1.124243 \times 10^{22}$
11. For the following metals A, B, C, D react with each other (N.R. = no reaction).  
 $A + B^+ \rightarrow NR$      $B + C^+ \rightarrow NR$   
 $B + D^+ \rightarrow B^+ + D$      $C + D^+ \rightarrow C^+ + D$   
 $A + C \rightarrow C^+ + A$      $D + A^+ \rightarrow D^+ + A$
- What is the order of the metals in increasing reducing strength?  
 (a)  $B < D < A < C$  (b)  $C < B < D < A$   
 (c)  $A < D < B < C$  (d)  $D < C < A < B$
12. Suppose that the electron spin quantum number could have three possible values which of the following atomic numbers would not correspond to a noble gas?  
 (a) 3 (b) 15 (c) 27 (d) 42
13. Calculate the number of revolutions per second made around the nucleus by an electron in the third Bohr's orbit of a hydrogen atom.  
 (a)  $2.43 \times 10^{14}$  (b)  $2.43 \times 10^{17}$   
 (c)  $2.43 \times 10^{16}$  (d)  $2.43 \times 10^{11}$
14. Which of the following regarding decay of  $Al^{25}$  is not true?  
 (a) It may decay by positron emission  
 (b) It may decay by a neutron emission  
 (c) It may decay by electron capture  
 (d) The product nucleus is Mg
15. 2.0 g of benzoic acid dissolved in 25.0g of benzene shows a depression in freezing point equal to 1.62 K. Molal depression constant,  $K_f$  of benzene is  $4.9 \text{ K kg mol}^{-1}$ , what is the percentage association of the acid if it forms dimer in the solution?  
 (a) 78.2% (b) 82.6% (c) 89.7% (d) 99.2%
16. A gas X at 1 atm is bubbled through a solution containing a mixture of 1 M  $Y^-$  and 1 M  $Z^-$  ions at 25°C. If the reduction potential of  $Z > Y > X$ , then  
 (a) Y will oxidise Z but not X  
 (b) Y will oxidise both X and Z  
 (c) Y will oxidise Z but  
 (d) Y will reduce both X and Z
17. Conductivity of 0.00241 M acetic acid solution is  $7.896 \times 10^{-5} \text{ Scm}^{-1}$ , what would be its dissociation constant?  
 (a)  $1.85 \times 10^{-4}$  (b)  $32.76 \times 10^{-5}$   
 (c)  $1.85 \times 10^{-7}$  (d)  $32.76 \times 10^{-7}$
18. The rate of a gaseous reaction is given by the expression  $k[A][B]$ . If the volume of the reaction vessel is suddenly reduced to  $\frac{1}{4}$ th of the initial volume, the reaction rate relating to original rate will be  
 (a)  $\frac{1}{10}$  (b)  $\frac{1}{8}$  (c) 8 (d) 16
19. Consider the reaction :  
 $Cl_2(aq) + H_2S(aq) \longrightarrow S(s) + 2H^+(aq) + 2Cl^-(aq)$
- The rate equation for this reaction is , rate =  $k[Cl_2][H_2S]$
- Which of these mechanisms is consistent with this rate equation?  
 A.  $Cl_2 + H_2S \longrightarrow H^+ + Cl^- + Cl^+ + HS^-$  (slow)



- (a) Neither A nor B      (b) A only  
(c) B only                      (d) Both A and B

20. Which of the following phenomenon occurs when a chalk stick is dipped in the ink?

- I. absorption of solvent  
II. adsorption of coloured substance  
III. absorption and adsorption both of solvent  
IV. adsorption of solvent

- (a) I and II                      (b) II and III  
(c) III only                      (d) IV only



Which oxidation states are more characteristic for lead and tin?

- (a) For lead +4, for tin +2  
(b) for lead +2, for tin +4  
(c) For lead +2, for tin +2  
(d) For lead +4, for tin +4

22. The structure of  $\text{IF}_7$  is

- (a) trigonal bipyramid  
(b) octahedral  
(c) pentagonal bipyramid  
(d) square pyramid

23. The correct order of increasing bond angles in the following species is

- (a)  $\text{ClO}_2 < \text{Cl}_2\text{O} < \text{ClO}_2^-$       (b)  $\text{Cl}_2\text{O} < \text{ClO}_2 < \text{ClO}_2^-$   
(c)  $\text{ClO}_2^- < \text{Cl}_2\text{O} < \text{ClO}_2$       (d)  $\text{Cl}_2\text{O} < \text{ClO}_2^- < \text{ClO}_2$

24. In case of lanthanides, which of the following statements is not correct?

- (a) All the members exhibit +3 oxidation state  
(b) Because of similar properties, the separation of lanthanoids is not easy  
(c) Availability of 4f electrons results in the formation of compounds in +4 state for all the members of the series  
(d) There is a gradual decrease in the radii of the members with increasing atomic number in the series

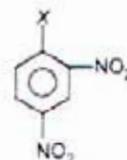
25. The acidic, basic or amphoteric nature of  $\text{Mn}_2\text{O}_7$ ,  $\text{V}_2\text{O}_5$  and  $\text{CrO}$  are respectively

- (a) acidic, amphoteric, basic  
(b) acidic, acidic, basic  
(c) basic, amphoteric, acidic  
(d) acidic, basic, basic

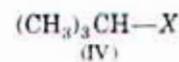
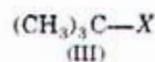
26. The correct order of increasing reactivity of C - X bond towards nucleophile in the following compounds is



(I)



(II)

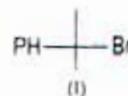


- (a) I < II < IV < III  
(b) III < II < IV < I  
(c) I < II < III < IV  
(d) III < IV < II < I

27. Alkyl halides undergoing nucleophilic bimolecular substitution involve

- (a) formation of carbocation  
(b) racemic mixture  
(c) inversion of configuration  
(d) retention of configuration

28. Arrange these compounds in order of increasing  $\text{S}_{\text{N}}1$  reaction rate



(I)



(II)



(III)

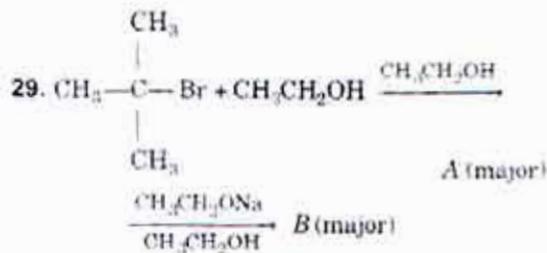


(IV)

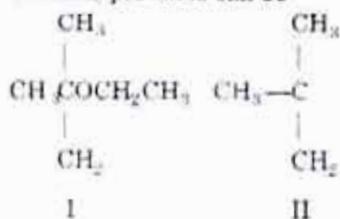
- (a) IV < II < III < I  
(b) I < II < III < IV  
(c) IV < I < III < II  
(d) IV < I < II < III



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Possible products can be



A and B can be respectively

- (a) I, II  
(b) II, I  
(c) II in both cases  
(d) I in both cases

30. Consider the following reaction.



Which response contains all the correct statements about this process?

- (i) Dehydration  
(ii) Carbon skeleton migration  
(iii) E<sub>1</sub> mechanism  
(iv) Most stable carbocation is formed

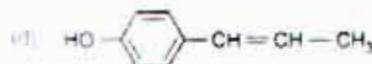
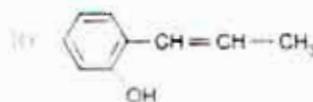
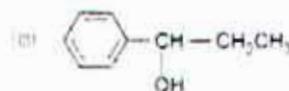
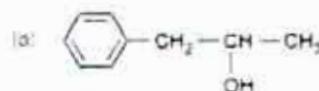
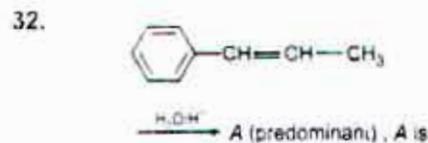
- (a) i, iii  
(b) i, ii, iii  
(c) i, ii, iv  
(d) i, iii, iv

31. Scheme I: Mg / Ether / D<sub>2</sub>O

Scheme II: CaO / NaOD (soda lime)

Which is used to replace Br by D in bromocyclohexane?

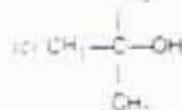
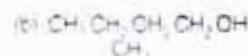
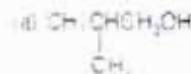
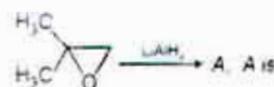
- (a) I  
(b) II  
(c) Both I and II  
(d) None of the above



33. Identify a reagent from the following list which can be easily distinguish between 1-butane and 2-butyne.

- (a) Bromine / CCl<sub>4</sub>  
(b) H<sub>2</sub> / Lindlar's catalyst  
(c) Dilute H<sub>2</sub>SO<sub>4</sub> / HgSO<sub>4</sub>  
(d) Ammoniacal Cu<sub>2</sub>Cl<sub>2</sub> solution

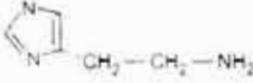
34.



(d) No reaction



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35.  $\text{CH}_2=\underset{\text{OH}}{\text{CH}}\text{CH}_2\text{CH}_2\text{OH} \xrightarrow{\text{MnO}_2} \text{A}$ , A is
- (a)  $\text{CH}_2=\text{CHCOCH}_2\text{CH}_2\text{OH}$   
 (b)  $\text{CH}_2=\text{CH}-\underset{\text{OH}}{\text{CH}}\text{CH}_2\text{CHO}$   
 (c)  $\text{CH}_2=\text{CHCOCH}_2\text{CHO}$   
 (d)  $\text{CH}_2=\text{CHCOCH}_2\text{COOH}$
36.  $\text{CH}_3\overset{\text{O}}{\parallel}\text{CCH}_2\text{C}\equiv\text{CH} \xrightarrow{\text{HOOH}} \xrightarrow{\text{NaNH}_2/\text{CH}_3\text{I}} \xrightarrow{\text{H}^+} \text{A}$ , A is
- (a)  $\text{CH}_3\text{COCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$   
 (b)  $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_2\text{CH}_3$   
 (c)  $\text{CH}_3\text{COCH}_2\text{C}\equiv\text{CCH}_3$   
 (d)  $\text{CH}_3\text{COCH}_2\text{HC}=\text{CHCH}_3$
37. How will you convert butan-2-one to propanoic acid?
- (a) Tollen's reagent  
 (b) Fehling's solution  
 (c)  $\text{NaOH}/\text{I}_2/\text{H}^+$   
 (d)  $\text{NaOH}/\text{NaI}/\text{H}^+$
38. The smallest ketone and its next homologue are reacted with  $\text{NH}_2\text{OH}$  to form oxime
- (a) two different oximes are formed  
 (b) three different oximes are formed  
 (c) two oximes are optically active  
 (d) all oximes are optically active
39. Which of the following has the highest value of energy gap?
- (a) Aluminium (b) Silver  
 (c) Germanium (d) Diamond
40. x grams of water is mixed in 69 g ethanol. Mole fraction of ethanol in the resultant solution is 0.6. What is the value of x in grams?
- (a) 54 (b) 36 (c) 18 (d) 9
41. Blood cells will remain as such in
- (a) hypertonic solution  
 (b) hypotonic solution  
 (c) isotonic solution  
 (d) None of the above
42. Number of atoms of He in 100 u of He (atomic weight of He = 4u) are
- (a) 25 (b) 50  
 (c) 100 (d)  $100 \times 6 \times 10^{23}$
43. 74.5 g of a metallic chloride contains 35.5 g of chlorine. the equivalent weight of the metal is
- (a) 19.5 (b) 35.5  
 (c) 39 (d) 78.0
44. Benzene diazonium chloride on reaction with phenol in weakly basic medium gives
- (a) diphenyl ether  
 (b) p-hydroxy azo benzene  
 (c) chloro benzene  
 (d) benzene
45.  $\text{CHCl}_3 + \text{C}_6\text{H}_5\text{NH}_2 + 3\text{NaOH} \longrightarrow \text{A} + 3\text{B} + 3\text{C}$
- In the above reaction, the product A is
- (a) chlorobenzene (b) phenyl isocyanide  
 (c) phenyl cyanide (d) phenyl chloride
46. Complete hydrolysis of cellulose gives
- (a) D-fructose (b) D-ribose  
 (c) D-glucose (d) L-glucose
47. Vitamin B<sub>6</sub> is known as
- (a) pyridoxin (b) thiamine  
 (c) tocopherol (d) riboflavin
48. The drug  is used as
- (a) vasodilator (b) antacid  
 (c) analgesic (d) antiseptic
49.  $\text{H}_2\text{O}$  is dipolar, whereas  $\text{BeF}_2$  is not. It is because
- (a) the electronegativity of F is greater than that of O  
 (b)  $\text{H}-\text{O}$  involves hydrogen bonding whereas  $\text{BeF}_2$  is a discrete molecule  
 (c)  $\text{H}_2\text{O}$  is linear and  $\text{BeF}_2$  is angular  
 (d)  $\text{H}_2\text{O}$  is angular and  $\text{BeF}_2$  is linear
50. Among the following the paramagnetic compound is
- (a)  $\text{Ni}_2\text{O}_3$  (b)  $\text{O}_2$   
 (c)  $\text{N}_2\text{O}$  (d)  $\text{KO}_2$



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51. Hydration of different ions in aqueous solution is an example of
- ion induced dipole interaction
  - dipole-dipole interaction
  - dipole-induced dipole interaction
  - ion-dipole interaction
52. Generally, IE, increases along a period But there are some exceptions. One which is not an exception is
- N and O
  - Na and Mg
  - Mg and Al
  - Be and B
53. The electron affinity values ( in  $\text{kJ mol}^{-1}$ ) of three halogens X, Y, Z are respectively  $-349$ ,  $-333$  and  $-325$ . Then X, Y and Z respectively are
- $\text{F}_2$ ,  $\text{Cl}_2$  and  $\text{Br}_2$
  - $\text{Cl}_2$ ,  $\text{F}_2$  and  $\text{Br}_2$
  - $\text{Cl}_2$ ,  $\text{Br}_2$  and  $\text{F}_2$
  - $\text{Br}_2$ ,  $\text{Cl}_2$  and  $\text{F}_2$
54. According to the kinetic theory of gases, in an ideal gas, between two successive collisions a gas molecule travels
- in a circular path
  - in a wavy path
  - in a straight line path
  - with an accelerated velocity
55. Root mean square speed of  $\text{N}_2(g)$  in air is  $515 \text{ ms}^{-1}$ . What is the average speed of He gas in the same air?
- $536.8 \text{ ms}^{-1}$
  - $839.2 \text{ ms}^{-1}$
  - $1245.5 \text{ ms}^{-1}$
  - $1255.3 \text{ ms}^{-1}$
56. Photochemical dissociation produces a normal oxygen atom and a oxygen atom  $2.5 \text{ eV}$  more energetic than normal one. Also the average bond energy of  $\text{O}_2$  into normal oxygen is  $498 \text{ kJ mol}^{-1}$ . Determine the longest wavelength required for photochemical decomposition of  $\text{O}_2$ .
- 126 nm
  - 175 nm
  - 190 nm
  - 205 nm
57. If  $l = 3$ , what can be said about  $n$ ?
- $n$  must be less than 3
  - $n$  must be equal to 3
  - $n$  must be greater than 3
  - $n$  must be equal to 4
58.  $\text{H}_2(g) + 2\text{NO}(g) \rightleftharpoons \text{N}_2\text{O}(g) + \text{H}_2\text{O}(g)$ ;  
 $K_c = 1.4 \times 10^5$  at  $25^\circ\text{C}$
- If the reaction mixture contains  $0.05 \text{ M H}_2(g)$ ,  $0.02 \text{ M NO}(g)$ ,  $5.4 \text{ M N}_2\text{O}(g)$  and  $8.7 \text{ M H}_2\text{O}(g)$  at some particular moment, intime then we accurately predict that
- the reaction is very close to equilibrium
  - the reaction is very far to equilibrium
  - the reaction is at equilibrium
  - both the  $\text{H}_2(g)$  and  $\text{NO}(g)$  concentration must increase significantly to reach equilibrium
59. A conc. aq. solution of  $\text{H}_2\text{SO}_4$  is 86% by mass and has a density of  $1.78 \text{ g mL}^{-1}$ . 50 mL of this solution is diluted to 1 L with water. What is the  $\text{H}^+$  ion concentration of the dilute solution in  $\text{mol L}^{-1}$ ?
- 0.15
  - 0.51
  - 0.78
  - 1.56
60. A certain process releases  $64.0 \text{ kJ}$  of heat which is transferred to the surroundings at a constant pressure and a constant temperature of  $300 \text{ K}$ . For this process  $\Delta S_{\text{surr}}$  is
- $64.0 \text{ KJ}$
  - $-64.0 \text{ KJ}$
  - $-213 \text{ JK}^{-1}$
  - $213 \text{ JK}^{-1}$

## Biology

- Iodine is obtained from the members of
  - green algae
  - brown algae
  - red algae
  - blue-green algae
- If large quantities of domestic sewage are continuously emptied into a small stream, it leads to
  - algal bloom
  - eutrophication
  - increase in temperature



3. Which of the following planets is called "twin of the earth"
- (a) Mars (b) Pluto  
(c) Venus (d) Mercury
4. In which one of following would you expect to find glyoxysomes?
- (a) Endosperm of wheat  
(b) Endosperm of castor  
(c) Palisade cells in leaf  
(d) Root hair
5. Vaccines prepared through recombinant DNA technology are called
- (a) First generation vaccines  
(b) 2nd generation vaccine  
(c) 3rd generation vaccine  
(d) None of above
6. Continued exposure of vinyl chloride may cause cancers of the
- (a) Liver (b) WBCs  
(c) Lymphoid tissue (d) Spleen
7. Miracidium larva occurs in the life history of
- (a) roundworm (b) liver fluke  
(c) earthworm (d) tapeworm
8. Male *Ascaris* is differentiable from female *Ascaris* in
- (a) presence of post-anal papillae  
(b) presence of pre-anal papillae  
(c) presence of penial setae  
(d) All of the above
9. Penetrant, valent and glutinant are type of
- (a) nematocyst of *Hydra*  
(b) tentacles of *Hydra*  
(c) zooids of *Obelia*  
(d) tentacles of *Obelia*
10. Which of the following enzyme is used in PCR (Polymerase Chain Reaction)?
- (a) *Taq* polymerase (b) Vent polymerase  
(c) Both (a) and (b) (d) None of these
11. A woman with straight hair marries with a man with curly hair and who is known to be heterozygous for the trait. What is the chance that their first child will have curly hair?
- (a) No change (b) One in two  
(c) It is certain (d) One in four
12. Which of the following are required in minimum amount by human?
- (a) Iron, iodine, carbon, Mn, Cu, O<sub>2</sub>  
(b) iron, iodine, Mn, Cu, Zn, fluorine  
(c) Iron, iodine, Mn, Zn, hydrogen  
(d) N, O<sub>2</sub>, Zn, fluorine
13. Which of the following nerve of man is both sensory and motor?
- (a) Olfactory (b) Trigeminal  
(c) Optic (d) Auditory
14. Highest number of antibiotics are produced by
- (a) *Bacillus* (b) *Penicillium*  
(c) *Streptomyces* (d) *Griseofulvin*
15. Nurse tissue technique is applied in
- (a) pollen culture (b) embryo culture  
(c) ovule culture (d) ovary culture
16. The reflectivity percentage of incident light on earth is meteorologically called as
- (a) Albedo (b) Tornado  
(c) Refraction (d) Reradiation
17. Eusthenopteron connects
- (a) reptiles and birds  
(b) birds and mammals  
(c) fishes and amphibians  
(d) amphibians and reptiles
18. The numbers of stomata and epidermal cells in 1 mm<sup>2</sup> leaf area of lower epidermis of leaves of X, Y and Z plants are given below. Arrange the plants in decreasing order of their stomatal index.
- | Cell | Number of Stomata | No. of epidermal Cells |
|------|-------------------|------------------------|
| X    | 30                | 150                    |
| Y    | 60                | 240                    |
| Z    | 90                | 400                    |
- The correct answer is
- (a) X Y Z (b) Y Z X  
(c) Z Y X (d) Y X Z



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19. Which one of the following components of ecosystem comes from outside?  
(a) Energy (b) Oxygen  
(c) Insects (d) Temperature
20. The genome of *Caenorhabditis elegans* consist of  
(a) 3 billion bp (base pair) and 30000 genes  
(b) 12 million bp and 6000 genes  
(c) 4.7 million bp and 4000 genes  
(d) 97 million bp and 13000 genes
21. Dermatogen, periblem and plerome are  
(a) permanent tissues  
(b) meristematic tissues  
(c) intercalary tissues  
(d) secondary tissue
22. Which one is viral disease in silkworm?  
(a) Flacherie (b) Maggot disease  
(c) Muscardine (d) Pebrine diseases
23. Which one is correct sequence of following events as per their discovery?  
I. Formulation of the chromosome theory of inheritance.  
II. Experiments which proved that DNA is the genetic material.  
III. Mendel's law of inheritance.  
(a) I, III and II (b) I, II and III  
(c) III, I and II (d) II, I and III
24. Which of the following has more imbibition power?  
(a) Cellulose (b) Hemicellulose  
(c) Fat (d) Protein
25. The structural and functional unit of the striated muscle fibre is called  
(a) sarcolemma (b) sarcomere  
(c) sarcoplasm (d) myofibril
26. The fossils record of placoderms is found in the era  
(a) Mesozoic (b) Coenozoic  
(c) Archaozoic (d) Palaeozoic
27. An examples of gene silencing is  
(a) *Bt* cotton (b) transgenic rice  
(c) *Flavr Savr* tomato (d) transgenic maize
28. How many number of reducing powers are required to synthesise one molecule of glyceraldehyde phosphate?  
(a) 9 ATP and 6 NADPH  
(b) 3 ATP and 3NADPH  
(c) 6 ATP and 6 NADPH  
(d) 9 ATP and 36 NADPH
29. Who proposed the central dogma?  
(a) Francis Crick (b) William Klug  
(c) Beadle and Tatum (d) Watson and Crick
30. Which of the following disease is non-cancerous?  
(a) BPH (b) Hepatitis-B virus  
(c) Carcinoma of testis (d) Melanoma
31. Fragile X syndrome is characterised by  
(a) excessive bleeding  
(b) colour blindness  
(c) paralysis of a limb  
(d) mental retardation and abnormal facial appearance with large ears and long face
32. Where can we study mitosis?  
(a) Brain (b) Legs  
(c) Nail base (d) Kidney
33. The type of joints between the human skull bones is called  
(a) cartilaginous joint (b) hinge joint  
(c) fibrous joint (d) synovial joint
34. Somatostatin is a hormone secreted by hypothalamus. It inhibits the excretion of  
(a) thyroxine (b) GH (Growth Hormone)  
(c) vasopressin (d) ACTH
35. Natural selection favours the leaf butterfly because it shows  
(a) counter shading  
(b) Batesian mimicry  
(c) Mullerian mimicry  
(d) protective resemblance
36. The portion of the endometrium that covers the embryo and is located between the embryo and uterine cavity is the  
(a) decidua basalis (b) decidua umbilicus  
(c) decidua capsularis (d) decidua functionalis



37. Duration of complete cardiac diastole is  
(a) 0.1 sec (b) 0.4 sec  
(c) 0.3 sec (d) 0.5 sec
38. Which of the following is not the main function of lymph glands.  
(a) Basophil (b) Neutrophil  
(c) Lymphocyte (d) Eosinophil
39. Which is not connected with factors of ageing?  
(a) Wear and tear (b) Neurohormonal  
(c) Epimorphosis (d) Metabolic rate
40. Auxetic growth is seen in  
(a) rotifers (b) nematodes  
(c) funiculates (d) All of these
41. Biolytic technique is used in  
(a) tissue culture process  
(b) gene transfer process  
(c) hybridisation process  
(d) germplasm conservation process
42. Which of the following is correctly matched?  
(a) Iron age—Present age  
(b) Bronze age—Age of agriculture, use of cloths and utensils  
(c) Mesolithic age—Age of tools, stones and bones  
(d) Palaeolithic age—Age of animal husbandry, language, reading and write
43. Which of the following virus spreaded through blood?  
(a) Hepatitis-A virus  
(b) Hepatitis-B virus  
(c) Hepatitis-E virus  
(d) Both (a) and (b)
44. A higher dose of alcohol may leads to  
(a)  $\text{CH}_3\text{CHO}$  accumulation in liver  
(b) lowering of glucose level in blood  
(c) causes gastritis  
(d) All of the above
45. Which one of the following is suitable for experiment on linkage?  
(a)  $\text{AA aa} \times \text{Aa Bb}$   
(b)  $\text{AaBb} \times \text{AaBb}$   
(c)  $\text{AABB} \times \text{aabb}$   
(d)  $\text{aaBB} \times \text{aabb}$
46. Surgical procedure for child birth is called  
(a) dilation and curettage (D and C)  
(b) artificial rupture of membrane  
(c) caesarean  
(d) shroddkar
47. Å (Angstrom) means  
(a)  $10^{-9}$  m (b)  $10^{-8}$  m  
(c)  $10^{-10}$  m (d)  $10^{-11}$  m
48. The type of arrangement of flower and mode of distribution of flower on a shoot of palm tree is  
(a) spikelet (b) spadix  
(c) spike of spikelets (d) compound spadix
49. The protein first hypothesis (in origin of life) is given by  
(a) Sidney Fox (b) Thomas Cern  
(c) Cairns Smith (d) Sidney Altman
50. Ozone layer is present in  
(a) stratosphere (b) Troposphere  
(c) mesosphere (d) ionosphere
51. Enzyme renin acts upon  
(a) angiotensinogen (b) vasodilation  
(c) blood pressure (d) digestion process
52. Types of quills (flight) feathers is/are  
(a) filoplume (b) remiges  
(c) coverts (d) Both (b) and (c)
53. Ishihara chart is used to detect  
(a) eye sight (b) colour blindness  
(c) diabetes (d) tuberculosis
54. Coelom is present between  
(a) ectoderm and endoderm  
(b) mesoderm and ectoderm  
(c) body wall and ectoderm  
(d) mesoderm and endoderm
55. The major excretory product of arthropods  
(a) ammonia (b) urea  
(c) uric acid (d) trimethyl oxide
56. Structurally the amphicribal vascular bundles resemble closely to  
(a) dictyostele (b) solenostele  
(c) siphonostele (d) protostele



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57. In a detritus food chain detritus is broken down into form of inorganic elements by detritivore. The process of break down of detritus is known as

- (a) mulching (b) leaching  
(c) mineralisation (d) fragmentation

58. Savannah can be defined as

- (a) temperate forest  
(b) tropical forest  
(c) monsoon forest  
(d) grassland with scattered trees

59. Which of the following statements is true for lysosome?

- (a) Suicidal bag  
(b) Stain for acid phosphatase  
(c) Some cytosolic protein contains signals directing them to lysosome  
(d) All of the above

60. Match the following columns.

Column I	Column II
A. Oral contraceptives	1. Passage of sperm is blocked
B. IUDs	2. Released hormone to block ovulation
C. Implants/Norplant	3. Inhibit secretion of LH and FSH
D. Vasectomy	4. Prevent fertilisation/implantation of embryo

Codes

- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 4 | 3 | 1 | 2 |
| (b) | 3 | 4 | 2 | 1 |
| (c) | 3 | 4 | 1 | 2 |
| (d) | 3 | 2 | 5 | 1 |

## General Aptitude & Current Issues

1. The holidays for the banks are declared as per

- (a) Reserve Bank Act  
(b) Banking Regulation Act  
(c) Negotiable Instruments Act  
(d) Companies Act

2. The primary sector includes all of the following, except

- (a) forestry (b) manufacturing  
(c) mining (d) agriculture

3. Planning commission of India is

- (a) a constitutional body  
(b) an independent and autonomous body  
(c) a statutory body  
(d) a non-statutory body

4. Which of the following is not covered under the monetary and credit policy of RBI?

- (a) Bank Rate  
(b) Repo Rate  
(c) Cash Reserve Ratio  
(d) Exchange rate of Foreign currencies

5. Which of the following is associated with white Revolution in India?

- (a) Dadabhai Naoroji (b) Verghese Kurien  
(c) Spencer Hatch (d) MS Swaminathan

6. During the time of which Mughal Emperor did the English East India Company established its first factory in India?

- (a) Akbar (b) Jahangir  
(c) Shahjahan (d) Aurangzeb

7. What is the local name of Mohenjodaro?

- (a) Mound of the Dead (b) Mound of the Great  
(c) Mound of the Living (d) Mound of the Sun

8. Which one of the following planets has largest number of natural satellites or Moons?

- (a) Jupiter (b) Mars  
(c) Saturn (d) Venus

9. By which name does the Brahmaputra river enter into India?

- (a) Manas (b) Dhansiri  
(c) Dihang (d) Tsangpo



10. Mullaperiyar dam whose safety has been a matter of concern is a dispute between  
(a) Tamil Nadu and Andhra Pradesh  
(b) Karnataka and Kerala  
(c) Tamil Nadu and Kerala  
(d) Tamil Nadu and Karnataka
11. Maps on large-scale, representing both natural and man-made features are called  
(a) Topographic maps (b) Thematic maps  
(c) Atlas maps (d) Wall maps
12. Blood group was discovered by  
(a) Pavlov (b) Alexander Fleming  
(c) William Harvey (d) Landsteiner
13. The enzyme that converts glucose to ethyl alcohol is  
(a) diastase (b) zymase  
(c) maltase (d) invertase
14. Chromosomes consist of  
(a) DNA and lipids (b) RNA and amino acids  
(c) RNA and sugar (d) DNA and proteins
15. Which of the metals causes Itai-Itai disease?  
(a) Cobalt (b) Copper  
(c) Chromium (d) Cadmium
16. Which of the following is known as 'graveyard' of RBCs?  
(a) Spleen (b) Liver  
(c) Bone marrow (d) Appendix
17. The anti malarial drug quinine is made from a plant. The plant is  
(a) neem (b) eucalyptus  
(c) cinamon (d) cinchona
18. Conversion of chemical energy into electrical energy occur in  
(a) atomic bombs (b) electric heaters  
(c) battery (d) dynamo
19. A water tank appears shallower when it is viewed from top due to  
(a) rectilinear propagation of light  
(b) reflection  
(c) total internal reflection  
(d) refraction
20. Non-stick cooking utensils are coated with  
(a) polystyrene (b) polyvinyl chloride  
(c) black point (d) tetlon
21. The scientist who first discovered that the Earth revolves round the Sun was  
(a) Newton (b) Dalton  
(c) Copernicus (d) Eisten
22. What is correcting errors in a programme called?  
(a) Compiling (b) Debugging  
(c) Grinding (d) Interpreting
23. The set of instructions which tells a computer what to do is called  
(a) matter (b) instructor  
(c) compiler (d) Programme
24. Which was mainly responsible for the Bhopal Mishap in 1984?  
(a) Methyl Isocyanate (b) Carbon di oxide  
(c) Ammonia (d) Carbon monoxide
25. Glycol is added to aviation gasoline because it  
(a) prevents freezing of petrol  
(b) reduces consumption of petrol  
(c) reduces evaporation of petrol  
(d) increase efficiency of petrol
26. Which one of the following is used as a moderator in a nuclear reactor?  
(a) Radium (b) Ordinary water  
(c) Thorium (d) Heavy water
27. Global warming is a consequences of  
(a) radioactive fall out (b) ozone depletion  
(c) green house effect (d) acid rain
28. Acid rain is due to air pollution by  
(a) carbon dioxide  
(b) carbon monoxide  
(c) methane  
(d) nitrous oxide and sulphur dioxide
29. The concept of 'carbon credit' originated from which one of the following?  
(a) Kyoto protocol (b) Earth summit  
(c) Marrakeh protocol (d) G-8 summit



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30. A person well known as father Terasa is  
(a) Aryaratne (b) Gemara Fachel  
(c) Abdul Sattar Edhi (d) Baba Amte
31. The largest biogas plant of the world was inaugurated in  
(a) USA (b) Ireland (c) Finland (d) Germany
32. The correct sequence order of the most populous countries of the world is  
(a) China India, USA, Brazil, Indonesia  
(b) China, India, Brazil, Indonesia, USA  
(c) China, India, Indonesia, USA, Brazil  
(d) China, India, USA, Indonesia, Brazil
33. Who is the author of the book 'My life'?  
(a) Hillary Clinton (b) Bill Clinton  
(c) The Dalai Lama (d) Imran Khan
34. The Headquarter of European union is situated in  
(a) England (b) Germany  
(c) France (d) Belgium
35. The Cannes award is given for excellence in which of the following fields?  
(a) Films (b) Journalism  
(c) Economics (d) Literature
36. The inaugural world Test Cricket Championship will take place in 2017 in  
(a) England and Wales  
(b) West Indies  
(c) Australia  
(d) India, Sri Lanka and Pakistan
37. Intensity of an earthquake is measured with  
(a) Barometer (b) Hydrometer  
(c) Polygraph (d) Seismograph
38. Sushil kumar won the medal at London Olympic event is a famous  
(a) Table tennis player  
(b) Wrestling champion  
(c) Golf player  
(d) None of the above
39. UN International day for natural disaster reduction is observed on  
(a) 6th July (b) 15th September  
(c) 13th October (d) 18th November
40. As per census 2011, the sex ratio of India is  
(a) 940 (b) 933 (c) 927 (d) 937
41. The President of Indian National Congress at the time of partition of India was  
(a) C. Rajagopalachari (b) JB Kripalani  
(c) Jawaharlal Nehru (d) None of these
42. Article 368 of the Indian Constitution provides  
(a) Financial emergency  
(b) UPSC  
(c) Amendment to the constitution  
(d) Local government
43. The Right to Information Act of Parliament received the assent of the President of India on  
(a) 15th July 2005 (b) 16th June 2005  
(c) 15th June 2005 (d) 12th October 2005
44. The number of Anglo Indians who can be nominated by the President to the Lok Sabha is  
(a) 2 (b) 3 (c) 4 (d) 5
45. Devaluation of currency helps in promoting  
(a) imports (b) exports  
(c) tourism (d) national income
46. 2018 FIFA World Cup would be held in  
(a) France (b) Russia  
(c) Qatar (d) Netherlands
47. Insufficient blood supply in the human body is referred to as  
(a) Hemostasis (b) Haemorrhage  
(c) Ischaemia (d) Hypertension
48. What percentage does the Indian population comprise in the world?  
(a) 17.00% (b) 16.31%  
(c) 17.31% (d) 16.25%
49. Which one among the following gases readily combines with the haemoglobin of the blood?  
(a) Methane  
(b) Nitrogen dioxide  
(c) Carbon monoxide  
(d) Sulphur dioxide



50. Human blood is a viscous fluid. This viscosity is due to  
(a) proteins in blood (b) platelets in plasma  
(c) sodium in serum (d) RB and WBC in blood
51. Who translated Ramayan into Persian in accordance with the wishes of Akbar?  
(a) Abul Fazi  
(b) Faizi  
(c) Abdul Qadir Badami  
(d) Abdur-Rahim Khan-I-Khanna
52. With which of the following movements is Arun Asaf Ali associated?  
(a) Non-cooperation movement  
(b) Civil Disobedient movement  
(c) Individual Satyagraha  
(d) Quit India Movement
53. Who is competent to dissolve the Rajya Sabha?  
(a) Chairman of Rajya Sabha  
(b) The President  
(c) The joint-Session of Parliament  
(d) None of the above
54. The 9th schedule to the Indian Constitution was added by  
(a) First Amendment  
(b) Eighth Amendment  
(c) Ninth Amendment  
(d) Forty Second Amendment
55. The largest planet in our Solar System is  
(a) Mars (b) Jupiter (c) Saturn (d) Butterfly
56. The highest grade and best quality coal is  
(a) Lignite (b) Peat  
(c) Bituminous (d) Anthracite
57. Which one of the following longitudes determines the Indian standard time?  
(a) 85.5°E (b) 86.5°E (c) 84.5°E (d) 82.5°E
58. Which of the following is a land locked state?  
(a) Gujarat (b) Andhra Pradesh  
(c) Madhya Pradesh (d) Tamil Nadu
59. Ctrl shift and alt are called .... keys.  
(a) modifier (b) function  
(c) alphanumeric (d) adjustment
60. Storage which stores or retains data after power off is called  
(a) volatile storage  
(b) non-volatile storage  
(c) sequential storage  
(d) direct storage
61. Study of disease like cancer is called  
(a) osteology (b) oncology  
(c) halyology (d) nephrology
62. Bile is stored in  
(a) mouth (b) liver  
(c) gall bladder (d) stomach
63. Alpha-Keratin is a protein, present in  
(a) blood (b) skin (c) lymph (d) egg
64. Atomic power plant works on the principle of  
(a) fission  
(b) fusion  
(c) thermal combustion  
(d) All of the above
65. Cylindrical lens is used by a person suffering from  
(a) astigmatism (b) myopia  
(c) hypermetropia (d) presbyopia
66. The chemical used as a 'fixer' in photography is  
(a) sodium sulphate  
(b) sodium thiosulphate  
(c) ammonium persulphate  
(d) borax
67. Higher concentration of nitrogen di oxide in atmosphere air causes  
(a) cancer (b) bronchitis  
(c) asphyxiation (d) corrosion
68. The first woman to become a Chief Minister of any state in India was.....  
(a) Nandini Satpathy (b) Dr. J. Jayalalitha  
(c) Sucheta Kriplani (d) Mayawati
69. CBT stands for  
(a) continued test Ban treaty  
(b) continued test based treatments  
(c) comprehensive test ban treaty  
(d) commercial test based tariff



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70. Where is the Central Food Technology Research Institute situated?

- (a) Delhi (b) Agara  
(c) Anmedabad (d) Mysore

71. When did WHO (World Health Organisation) come into force on

- (a) 6th April, 1948 (b) 7th April, 1948  
(c) 10th April, 1948 (d) 26th April, 1948

72. Which one of the following is the biggest flower in the world?

- (a) Sun flower (b) Lotus  
(c) Glory Lily (d) Rafflesia

73. Palk strait connects India to

- (a) Sri Lanka (b) Pakistan  
(c) Myanmar (d) None of these

74. Who is the 158th member of WTO?

- (a) Russia (b) Vanuatu  
(c) Laos (d) Australia

75. Lok Sabha passed the National Food Security Bill 2013 on

- (a) 22nd August, 2013 (b) 23rd August, 2013  
(c) 26th August, 2013 (d) 27th August, 2013

**Direction** Select the related word from the given alternative.

76. Botany : Plants :: Entomology?

- (a) insects (b) Snakes (c) Birds (d) Germs

77. Arrange the following words according to English dictionary.

- (i) Billan (ii) Biturcate  
(iii) Bilateral (iv) Bilirubin  
(a) ii, iii, iv (b) iv, iii, ii, i  
(c) ii, iii, i, iv (d) ii, iii, iv, i

78. Which one set of letters when sequentially placed at the gaps in the given letters series shall complete it?

ccbb\_aa\_ccbbbaa\_c

- (a) acbc (b) baca (c) baba (d) acba

79. Find the wrong number in the given series.

5, 27, 61, 122, 213, 340, 509

- (a) 27 (b) 61  
(c) 122 (d) 509

80. Pointing to a man in a photograph, a woman said, "His brother's father is the only son of my grandfather." How is the woman related to the man in the photograph?

- (a) Mother (b) Aunt  
(c) Sister (d) Daughter

81. In an examination, Raju got more marks than Mukesh but not as many as Priya. Priya got more marks than Gaurav and Kavita. Gaurav got less marks than Mukesh but his marks are not the lowest in the group. Who is second in the descending order of marks?

- (a) Priya (b) Kavita (c) Raju (d) Gaurav

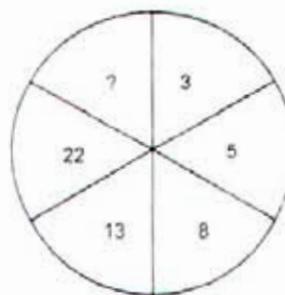
82. From the given alternatives, select the word which cannot be formed using the letters of the given word.

TRANSLATION

- (a) NATION (b) RATION  
(c) TRANSIT (d) TRANSMIT

**Directions** (Q. Nos. 83 and 84) Select the missing number from the given responses.

83.



- (a) 1 (b) 26  
(c) 39 (d) 45

84.

64	36	2
81	25	4
144	16	?

- (a) 6 (b) 8  
(c) 3 (d) 16



85. A man walks northwards and then turns left, then turns right and then left. In which direction is he moving now?

(a) West (b) North  
(c) East (d) South

86. Ashish walked 50 m towards East and took a right turn and walked 40 m. He again took a right turn and walked 50 m. How far is he from the starting point?

(a) 10 m (b) 25 m  
(c) 30 m (d) 40 m

87. Two statements are given followed by two conclusions I and II. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You are to decide which of the given conclusions, if any follow from the given statements. Indicate your answer.

**Statements** All the organised persons find time for rest.

Sunita, inspite of her very busy schedule, finds time for rest.

**Conclusions**

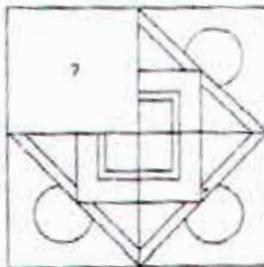
I. Sunita is an organised person

II. Sunita is an industrious person.

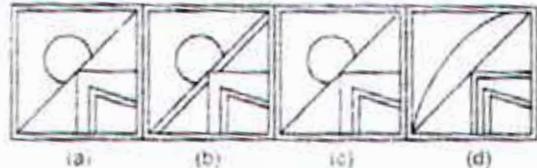
(a) Only conclusion I follows  
(b) Only conclusion II follows  
(c) Neither conclusion I nor II follows  
(d) Both conclusions I and II follow

88. Which answer figure will complete the pattern in the question figure?

**Question Figures**



**Answer Figures**

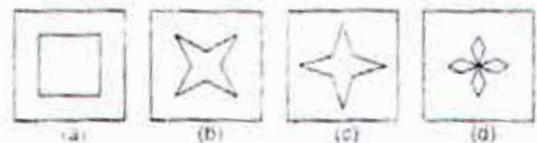


89. A piece of paper is folded and cut as shown below in the question figures. From the given figures, indicate how it will appear when opened?

**Question Figures**



**Answer Figures**

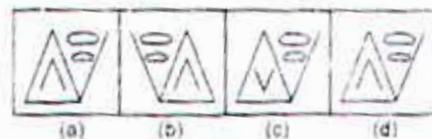


90. Which of the answer figure is exactly the mirror image of the given figure, when the mirror is held on the line AB?

**Question Figures**



**Answer Figures**





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**Directions** (Q. Nos. 91 and 92) *Some parts of the sentence have errors and some are correct. Find out which part of a sentence has an error corresponding to the appropriate option (a), (b) and (c). If a sentence is free from errors, mark the answer (d)*

91. We requested the watchman (a) to clean up the basement (b) so that the children had enough space to play. (c) No error (d)
92. Last night I dream (a) I was a sheikh on the 169th floor (b) of burj khalifa. (c) No error (d)

**Directions** (Q. Nos. 93 and 95) *Out of the four alternatives, choose the one which best expresses the meaning of the given word and mark it in the answersheet.*

93. Benevolent  
(a) Beneficial (b) Kind  
(c) Helpful (d) Supportive
94. Ancestors  
(a) Extinct tribes (b) Relatives  
(c) Forefathers (d) Old people
95. Meek  
(a) Light hearted (b) Serious  
(c) Submissive (d) Benign

**Directions** (Q. Nos. 96 and 97) *Choose the word opposite in meaning to the given word and mark it in the answer sheet.*

96. Accomplish  
(a) Fail (b) improper  
(c) Disagreeable (d) Scatter
97. Famous  
(a) Obscure (b) Eminent  
(c) Lament (d) Fabulous

**Directions** (Q. Nos. 98 and 99) *Four alternatives are given for the idiom/phrase. Choose the alternative which best expresses the meaning of the idiom/phrase and mark it in answer sheet.*

98. To take to heart  
(a) to be encouraged (b) to grieve over  
(c) to like (d) to hate

### 99. Yeoman's service

- (a) medical help (b) excellent work  
(c) social work (d) hard work

**Directions** (Q. Nos. 100 and 101) *A part of the sentence is underlined which may need improvement. Alternatives are given as (a), (b) and (c) below, which may be better option. In case no improvement is needed your answer is (d).*

100. John is **wearing** his jacket as it is very cold.  
(a) taking on (b) getting on  
(c) putting on (d) No improvement
101. The host offered me tea but I **denied** it.  
(a) refused (b) said no  
(c) rejected (d) No improvement

**Directions** (Q. Nos. 102 and 103) *Out of the four alternatives, choose the one which can be substituted for the given words/sentence.*

102. Instrument to measure atmospheric pressure  
(a) metronometer (b) compass  
(c) pedometer (d) barometer
103. Belonging to all parts of the world  
(a) common (b) universal  
(c) worldly (d) international

**Directions** (Q. Nos. 104 and 105) *In the following questions, group of four words are given. In each group, one word is correctly spelt. Find the correctly spelt word and mark it in the answer sheet.*

104.  
(a) Onvelope (b) Envelope  
(c) Envloape (d) Envelop
105.  
(a) Comitee (b) Comitteee  
(c) Committie (d) Comitted

106. The average of seven consecutive numbers is 20. The largest of these numbers is  
(a) 21 (b) 22 (c) 23 (d) 24



107. The greatest among the numbers

$$\sqrt[3]{4}, \sqrt{2}, \sqrt[3]{3}, \sqrt[4]{5}$$

- (a)  $\sqrt[3]{4}$  (b)  $\sqrt{2}$   
(c)  $\sqrt[3]{3}$  (d)  $\sqrt[4]{5}$

108. One-fifth a number is equal to  $\frac{5}{8}$  of another

number. If 35 is added to the first number, it becomes four times of the second number. The second number is

- (a) 25 (b) 40  
(c) 70 (d) 125

109. In dividing a certain number by 342, we get 47 as remainder of the same number is divided by 18, what will be the remainder?

- (a) 11 (b) 13  
(c) 17 (d) 19

110. The least number which when divided by 5, 6, 7 and 8 leaves a remainder 3 but when divided by 9 leaves no remainder, is

- (a) 1677 (b) 1683  
(c) 2523 (d) 3363

111. Sakshi can do a piece of work in 20 days. Tanya is 25% more efficient than Sakshi. The number of days taken by Tanya to do the same piece of work is

- (a) 15 (b) 16  
(c) 18 (d) 25

112. The price of a VCR is marked at ₹ 12000. If successive discounts of 15%, 10% and 5% be allowed, then at what price does a customer buy it?

- (a) ₹ 8400 (b) ₹ 8721  
(c) ₹ 8856 (d) ₹ 8850

113. Ram bought a refrigerator with 5% discount on the labelled price. Had he bought it with 20% discount, he would have saved ₹ 1500. At what price did he buy the refrigerator?

- (a) ₹ 10000 (b) ₹ 9000  
(c) ₹ 8000 (d) ₹ 9500

114. If  $\frac{x+y}{x-y} = \frac{5}{2}$ , then value of  $\frac{x}{y}$  is

- (a)  $\frac{3}{2}$  (b)  $\frac{11}{3}$   
(c)  $\frac{7}{2}$  (d)  $\frac{13}{5}$

115. A vendor bought toffees at 6 for a rupee. How many for a rupee must he sell to gain 20%?

- (a) 3 (b) 4 (c) 5 (d) 6

116. If the selling price of 50 articles is equal to the cost price of 40 articles, then the loss or gain per cent is

- (a) 20% loss (b) 20% gain  
(c) 25% loss (d) 25% gain

117. The ratio of the incomes of A and B is 5 : 4 and the ratio of their expenditures is 3 : 2. If at the end of the year, each saves ₹1600, then the income of A is

- (a) ₹ 3400 (b) ₹ 3600  
(c) ₹ 4000 (d) ₹ 4400

118. Zinc and copper are melted together in the ratio 9 : 11. What is the weight of melted mixture, if 28.8kg of zinc has been consumed in it?

- (a) 58 kg (b) 60 kg  
(c) 64 kg (d) 70 kg

119. In a stream running at 2 km/h, a motorboat goes 6 km upstream and back again to the starting point in 33 min. Find the speed of the motorboat in still water.

- (a) 11 km/h (b) 22 km/h  
(c) 12 km/h (d) 20 km/h

120. The difference between the compound interest and simple interest on a certain sum of money for 3yr at  $6\frac{2}{3}\%$  per annum is ₹ 184, then what is the sum?

- (a) ₹ 13500 (b) ₹ 12500  
(c) ₹ 11500 (d) ₹ 10500



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## Answers

### Physics

- |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (a)  | 2. (c)  | 3. (c)  | 4. (d)  | 5. (b)  | 6. (d)  | 7. (d)  | 8. (c)  | 9. (a)  | 10. (b) |
| 11. (c) | 12. (d) | 13. (d) | 14. (c) | 15. (a) | 16. (a) | 17. (c) | 18. (b) | 19. (a) | 20. (a) |
| 21. (d) | 22. (c) | 23. (a) | 24. (a) | 25. (b) | 26. (a) | 27. (c) | 28. (c) | 29. (a) | 30. (a) |
| 31. (b) | 32. (c) | 33. (c) | 34. (c) | 35. (c) | 36. (c) | 37. (b) | 38. (b) | 39. (d) | 40. (c) |
| 41. (d) | 42. (c) | 43. (c) | 44. (c) | 45. (d) | 46. (c) | 47. (b) | 48. (d) | 49. (b) | 50. (b) |
| 51. (d) | 52. (c) | 53. (c) | 54. (a) | 55. (d) | 56. (a) | 57. (a) | 58. (b) | 59. (b) | 60. (d) |

### Chemistry

- |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (b)  | 2. (a)  | 3. (c)  | 4. (a)  | 5. (a)  | 6. (c)  | 7. (d)  | 8. (c)  | 9. (c)  | 10. (a) |
| 11. (c) | 12. (d) | 13. (a) | 14. (b) | 15. (c) | 16. (a) | 17. (a) | 18. (d) | 19. (b) | 20. (a) |
| 21. (b) | 22. (c) | 23. (a) | 24. (c) | 25. (c) | 26. (a) | 27. (c) | 28. (a) | 29. (a) | 30. (d) |
| 31. (a) | 32. (b) | 33. (c) | 34. (c) | 35. (a) | 36. (c) | 37. (c) | 38. (b) | 39. (d) | 40. (c) |
| 41. (c) | 42. (a) | 43. (c) | 44. (b) | 45. (c) | 46. (c) | 47. (a) | 48. (a) | 49. (d) | 50. (d) |
| 51. (d) | 52. (b) | 53. (b) | 54. (c) | 55. (d) | 56. (a) | 57. (c) | 58. (a) | 59. (d) | 60. (d) |

### Biology

- |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (b)  | 2. (d)  | 3. (c)  | 4. (a)  | 5. (c)  | 6. (a)  | 7. (b)  | 8. (d)  | 9. (a)  | 10. (c) |
| 11. (b) | 12. (d) | 13. (b) | 14. (c) | 15. (a) | 16. (a) | 17. (c) | 18. (b) | 19. (a) | 20. (d) |
| 21. (b) | 22. (a) | 23. (c) | 24. (d) | 25. (b) | 26. (d) | 27. (c) | 28. (c) | 29. (a) | 30. (a) |
| 31. (d) | 32. (c) | 33. (c) | 34. (b) | 35. (b) | 36. (c) | 37. (b) | 38. (c) | 39. (c) | 40. (d) |
| 41. (b) | 42. (d) | 43. (b) | 44. (d) | 45. (c) | 46. (c) | 47. (c) | 48. (d) | 49. (a) | 50. (a) |
| 51. (a) | 52. (d) | 53. (d) | 54. (d) | 55. (c) | 56. (d) | 57. (d) | 58. (d) | 59. (d) | 60. (b) |

### General Aptitude & Current Issues

- |          |          |          |          |          |          |          |          |          |          |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1. (c)   | 2. (b)   | 3. (d)   | 4. (d)   | 5. (b)   | 6. (b)   | 7. (a)   | 8. (a)   | 9. (c)   | 10. (c)  |
| 11. (a)  | 12. (d)  | 13. (b)  | 14. (d)  | 15. (d)  | 16. (a)  | 17. (d)  | 18. (c)  | 19. (d)  | 20. (d)  |
| 21. (c)  | 22. (b)  | 23. (d)  | 24. (a)  | 25. (a)  | 26. (d)  | 27. (c)  | 28. (d)  | 29. (a)  | 30. (c)  |
| 31. (c)  | 32. (d)  | 33. (b)  | 34. (d)  | 35. (a)  | 36. (a)  | 37. (d)  | 38. (b)  | 39. (c)  | 40. (a)  |
| 41. (b)  | 42. (c)  | 43. (d)  | 44. (a)  | 45. (b)  | 46. (b)  | 47. (c)  | 48. (a)  | 49. (c)  | 50. (a)  |
| 51. (c)  | 52. (d)  | 53. (d)  | 54. (a)  | 55. (b)  | 56. (d)  | 57. (d)  | 58. (c)  | 59. (a)  | 60. (b)  |
| 61. (b)  | 62. (c)  | 63. (b)  | 64. (a)  | 65. (a)  | 66. (b)  | 67. (b)  | 68. (c)  | 69. (c)  | 70. (d)  |
| 71. (b)  | 72. (d)  | 73. (a)  | 74. (c)  | 75. (c)  | 76. (a)  | 77. (d)  | 78. (b)  | 79. (a)  | 80. (c)  |
| 81. (c)  | 82. (d)  | 83. (c)  | 84. (b)  | 85. (c)  | 86. (d)  | 87. (d)  | 88. (b)  | 89. (b)  | 90. (a)  |
| 91. (a)  | 92. (a)  | 93. (b)  | 94. (c)  | 95. (c)  | 96. (a)  | 97. (a)  | 98. (b)  | 99. (b)  | 100. (c) |
| 101. (a) | 102. (d) | 103. (b) | 104. (b) | 105. (b) | 106. (c) | 107. (a) | 108. (b) | 109. (a) | 110. (b) |
| 111. (b) | 112. (b) | 113. (c) | 114. (b) | 115. (c) | 116. (a) | 117. (c) | 118. (c) | 119. (b) | 120. (a) |



## Hints & Solutions

### Physics

1. According to the Huygen's principle, every point on the wave may be considered as source of secondary waves. In photoelectric effect light is considered as of particle (bundle of photons). Hence Huygen's theory does not explain photoelectric effect.

2. Here, Initial velocity

$$v_1 = 15 \text{ m/s} \quad (\text{eastwards})$$

$$\text{Time taken } t = 10 \text{ s}$$

and final velocity  $v_2 = 10 \text{ m/s}$  (northwards)

The change in velocity

$$\begin{aligned} v_{12} &= \sqrt{v_1^2 + v_2^2 - 2v_1v_2 \cos 90^\circ} \\ &= \sqrt{15^2 + 15^2} = 15\sqrt{2} \end{aligned}$$

Hence, acceleration is

$$a = \frac{v_{12}}{t} = \frac{15\sqrt{2}}{10} = \frac{3}{\sqrt{2}} \text{ northwards.}$$

3. Here, time taken by the body to reach the bottom  $t_1 = 4 \text{ s}$

$$\text{Initial distance } s_1 = s$$

$$\text{The final distance } s_2 = \frac{s}{8}$$

The distance  $s$  is given by

$$s = \frac{1}{2} at^2 = t^2$$

(where  $t^2$  is the time change one eight of distance)

$$\frac{t_1}{t_2} = \frac{\sqrt{s_1}}{\sqrt{s_2}} = \frac{\sqrt{s}}{\sqrt{\frac{s}{8}}} = \sqrt{8} = 2\sqrt{2}$$

$$t_2 = \frac{t_1}{2\sqrt{2}} = \frac{4}{2\sqrt{2}} = \sqrt{2} \text{ s}$$

4. The total energy of simple harmonic motion is given by

$$E = \text{Kinetic energy} + \text{potential energy}$$

$$\text{or } E = \frac{1}{2} m \omega^2 (a^2 - y^2) + \frac{1}{2} m \omega^2 y^2$$

$$\text{or } E = \frac{1}{2} m \omega^2 a^2$$

$$\text{Here, } E \propto a^2$$

5. Capacitance of capacitor  
 $= 6 \mu\text{F} = 6 \times 10^{-6} \text{ F}$

Initial potential  $v_1 = 10 \text{ V}$

Final potential  $v_2 = 20 \text{ V}$

The increases in the energy is given by

$$\Delta U = \frac{1}{2} C(v_2^2 - v_1^2)$$

$$\Delta U = \frac{1}{2} \times 6 \times 10^{-6} \{ (20)^2 - (10)^2 \}$$

$$\Delta U = 3 \times 10^{-6} \times 300$$

$$\Delta U = 9 \times 10^{-4} \text{ J}$$

6. Here, mass of the bullet  $m_1 = 0.1 \text{ kg}$

Speed of bullet  $v_1 = 100 \text{ m/s}$

Mass of the gun  $m_2 = 50 \text{ kg}$

According to the law of conservation of momentum is

$$m_1 v_1 = m_2 v_2$$

$$0.1 \times 100 = 50 \times v_2$$

$$v_2 = \frac{0.1 \times 100}{50} = 0.2 \text{ m/s}$$

7. When we move up the higher energetic cosmic particles coming from cosmos cause ionisation of the atmosphere the conductivity increases

8. Here, potential difference across inductance

$$V_L = 16 \text{ V}$$

Potential difference across resistance

$$V_R = 20 \text{ V}$$

The total potential across circuit

$$E_s = \sqrt{V_L^2 + V_R^2}$$

$$= \sqrt{16^2 + 20^2}$$

$$= 25.6 \text{ V}$$

9. Initial resistance  $R_1 = R$

Initial length of the wire  $l_1 = l$

Final length of the wire  $l_2 = 3l$

As the volume of the wire remains same after stretched

$$\pi r_1^2 l = \pi r_2^2 \times 3l$$

$$r_2 = \frac{r_1}{\sqrt{3}}$$

The resistance is given by

$$R = \rho \times \frac{l}{A} = \rho \times \frac{l}{\pi r^2} = \frac{1}{r^2}$$



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$$\begin{aligned} \text{Hence } \frac{R_1}{R_2} &= \frac{l_1}{l_2} \times \frac{l_2^2}{l_1^2} = \frac{l}{3l} \times \left(\frac{l_1}{\sqrt{3}l}\right)^2 \\ &= \frac{1}{3} \times \frac{1}{3} = \frac{1}{9} \\ R_2 &= 9R_1 = 9R \end{aligned}$$

10. Atomic number of nucleus = 2

The mass number =  $M$

As the atomic number  $Z$  = Number of electrons ( $e$ ) = number of protons ( $p$ )

The mass number  $M$  = Number of neutrons - Number of protons.

Hence the number of neutrons =  $M - Z$

11. The nuclear energy is converted into electrical energy in the nuclear reactions. This electrical energy then used to run the electrical generator. It is used in power station to generate electricity on large scale for running the industries.

12. Here, path difference  $\Delta x = 0.8 \text{ m}$

Frequency  $n = 120 \text{ Hz}$

Phase difference  $\phi = 0.5 \pi$

The phase difference is given by

$$\begin{aligned} \phi &= \frac{2\pi}{\lambda} \times \Delta x \\ \phi &= 0.5 \pi \\ 0.5 \pi &= \frac{2\pi}{\lambda} \times 0.8 \\ \lambda &= \frac{2\pi \times 0.8}{0.5 \pi} = 3.2 \text{ m} \end{aligned}$$

Hence, the wave velocity is given by  $v = n\lambda$   
(where  $\lambda$  is the wavelength of wave)  
 $= 120 \times 3.2 = 384 \text{ m/s}$

13. Here, capacitance of the capacitor

$$\begin{aligned} C &= 12 \text{ pF} \\ &= 12 \times 10^{-12} \text{ F} \end{aligned}$$

Voltage of the battery  $V = 50 \text{ V}$

The energy stored in capacitor is given by

$$\begin{aligned} V &= \frac{1}{2} C v^2 \\ \text{or } v &= \sqrt{\frac{2}{C} (12 \times 10^{-12}) \times (50)^2} \end{aligned}$$

Hence,  $v = 1.5 \times 10^6 \text{ J}$

14. It is clear that the cyclotron is a device which is utilized to accelerate positively charged particles like proton and neutrons.

By using a spring magnetic field, this device is made possible which bends the paths of the ions.

15. It is clear that potential difference between any two points is the amount of work done, when a unit charge moves from one point to other

$$V = \frac{\text{Work done}}{\text{Charge moved}} = \frac{W}{Q}$$

Hence, the dimensions of potential difference

$$\begin{aligned} &= \frac{\text{Dimension of work done}}{\text{Dimension of charge moved}} \\ &= \frac{[ML^2T^{-2}]}{[Q]} \\ &= [ML^2T^{-2}Q^{-1}] \end{aligned}$$

16.  $\sin C = \frac{x}{t_1}$

$$v = \frac{10x}{t_2}$$

$$\sin C = \frac{1}{\mu}$$

$$C = \sin^{-1} \left( \frac{1}{\mu} \right)$$

Refractive index  $\mu$  is given by

$$= \frac{v_2}{v_1} = \frac{x}{t_1} \times \frac{t_2}{10x} = \frac{t_2}{10t_1}$$

$$C = \sin^{-1} \left( \frac{1}{\mu} \right) = \sin^{-1} \left( \frac{10t_1}{t_2} \right)$$

17. Critical angle  $C = 30^\circ$

$$\sin C = \frac{v}{C}$$

$$\sin 30^\circ = \frac{v}{3 \times 10^8}$$

$$v = \frac{1}{2} \times 3 \times 10^8$$

$$= 1.5 \times 10^8 \text{ m/s}$$

18. Cyclotron was discovered by Earnest Lawrence of USA in 1931 AD, this instrument is used to measure magnetic resonance acceleration.

19. Initial temperature

$$T_1 = 18^\circ \text{C} = 291 \text{ K}$$

$$V_2 = \frac{V_1}{8}$$

For adiabatic expression

$$T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}$$



$$T_2 = T_1 \left( \frac{V_1}{V_2} \right)^{\gamma-2}$$

$$= 298 \times 8^{1.4-2}$$

$$= 291 \times 2.297$$

$$= 668.3 \text{ K}$$

$$= 395.4 \text{ C}$$

20.  $h = ut + \frac{1}{2}gt^2$

$$500 = 0 \times t + \frac{1}{2} \times 10t^2$$

$$5t^2 = 500$$

$$t = 10 \text{ s}$$

Time =  $\frac{\text{Height of tower}}{\text{Velocity of sound}}$

$$= \frac{500}{330} = 1.5 \text{ s}$$

Hence the sound of splash will be  
=  $t_0 + 1.3 = 11.5 \text{ s}$

21.  $l = 35 \text{ m}$

$$v = 90 \text{ m/s}$$

$$\text{emf} = Blv = 4 \times 10^{-2} \times 90 \times 35$$

$$= 0.126 \text{ V}$$

22. Half-life  $T_{1/2} = 3.6 \text{ day}$

Amount left after time  $t$

$$N = \frac{1}{32} \times N_0$$

Number of half-lives in time ( $n$ ) is given by

$$\frac{N}{N_0} = \left( \frac{1}{2} \right)^n$$

$$\frac{N}{\frac{N_0}{32}} = \left( \frac{1}{2} \right)^n$$

$$= \frac{1}{32} = \frac{1}{2^5}$$

$$n = 5 \text{ or } \frac{t}{T_{1/2}} = 5$$

Hence time of decay

$$t = 5 \times \frac{T_{1/2}}{2} = 5 \times 3.6$$

$$= 18 \text{ day}$$

23. Potential difference = 100 V

$$\lambda = \frac{h}{\sqrt{2q \text{ vrm}}}$$

$$= \frac{6.6 \times 10^{-34}}{2 \times (1.6 \times 10^{-19}) \times 100 \times 9.1 \times 10^{-31}}$$

$$= 1.2 \times 10^{-10} \text{ m}$$

$$= 1.2 \text{ \AA}$$

24.  $pV = nRT$

$$p_1V_1 = n_1RT_1$$

$$p_2V_2 = n_2RT_2$$

$$\frac{n_1}{n_2} = \frac{p_1V_1T_2}{p_2V_2T_1}$$

$$p_1 = p$$

$$V_1 = V$$

$$p_2 = 2p$$

$$V_2 = V/4$$

$$T_2 = 2T$$

$$\frac{n_2}{n_1} = \frac{2pVT}{pV \times 4 \times 2T}$$

$$= 1/4$$

$$\frac{n_1}{n_2} = \frac{4}{1}$$

25. Kinetic energy =  $\frac{1}{2}m\omega^2(a^2 - y^2)$

$$\text{Potential energy} = \frac{1}{2}m\omega^2y^2$$

$$= \frac{1}{2}m\omega^2(a^2 - y^2)$$

$$= \frac{1}{3} \times \frac{1}{2}m\omega^2y^2$$

$$\frac{4}{6}m\omega^2y^2 = \frac{1}{2}m\omega^2a^2$$

$$y^2 = \frac{3}{4}a^2$$

$$y = \frac{\sqrt{3}a}{2} = 0.866a$$

$$= 87\% \text{ of amplitude}$$

26. While the horse pulling a cart, the horse exerts a force on the ground, therefore from the third law of Newton, the ground will also exerts a force on the horse that causes the horse to move forward.

27.  $\frac{dp}{p} = \frac{dT}{T}$

$$dT = 1^\circ \text{C}$$

$dP$  is change in pressure = 0.4

$$\frac{dp}{p} = \frac{0.4}{100}$$



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$$= \frac{0.4}{100} = \frac{1}{T}$$

$$T = \frac{100}{0.4} = 250^\circ\text{C}$$

28.  $C = 4\pi\epsilon r$

$$C = \frac{1}{4 \times 10^9} \times 1$$

$$C = 2.5 \times 10^{-10} \text{ F}$$

30. Wien's displacement law

$$\lambda_m T = \text{Constant}$$

$$\frac{(\lambda_m)_2}{T_2} = \frac{(\lambda_m)_1}{T_1}$$

$$\frac{(\lambda_m)_2}{2000} = \frac{1000}{2000}$$

$$(\lambda_m)_2 = \frac{\lambda_m}{2}$$

31.  $\phi_0 = NAB \cos \theta$

$$= 20 \times 10^3 \times 5 \times \cos 60^\circ$$

$$= 20 \times 10^3 \times 5 \times \frac{1}{2}$$

$$= 50 \times 10^3$$

$$= 5 \times 10^4$$

32. From Bohr's theory, frequency of incident radiation

$$v = RC \left( \frac{1}{n_2^2} - \frac{1}{n_1^2} \right)$$

$$= 10^7 \times 10^2 \times 3 \times 10^8 \left( \frac{1}{2^2} - \frac{1}{4^2} \right)$$

$$= 3 \times 10^{15} \left( \frac{1}{4} - \frac{1}{16} \right)$$

$$= 3 \times 10^{15} \left( \frac{3}{16} \right)$$

$$= 9/16 \times 10^{15} \text{ Hz}$$

33.  $\frac{dL}{dt} = 0$

$$\frac{d}{dt} (l\omega) = 0$$

$$l \frac{d\omega}{dt} = 0$$

$$l \alpha = 0$$

where,  $\alpha = \frac{d\omega}{dt}$  = longitudinal acceleration

$$\alpha = 0$$

Hence, longitudinal acceleration of a planet is zero

34.  $f = \frac{\Delta V}{(\Delta Q)_V} = \frac{(\Delta Q)_V}{(\Delta Q)_V} = \frac{\mu C_V \Delta T}{\mu C_P \Delta T} = \frac{1}{\gamma}$

For diatomic gas  $\gamma = 7/5$

$$f = \frac{5}{7}$$

35. In interference of light energy is neither created nor destroyed, the energy that disappear at the points of destructive interference appears at the point of constructive interference and vice-versa. Thus in interference of light merely redistribution of light energy takes place.

36.  $\frac{1}{f} = (\mu_p - 1) \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$

If  $\mu_2 < \mu_1$ , then  $f_c$  and  $f_s$  have opposite signs and the nature of lens changes i.e., convex lens diverges the light rays and concave lens converges the light rays.

37. In  $\beta$ -decay, a beta minus particle ( $\beta^-$ ) is an electron emission of  $\beta$  involves transformation of a neutron into a proton, an electron and a third particle called an antineutrino ( $\bar{\nu}$ ).

$${}_0^1n = {}_0^1p + {}_{-1}^0\beta + \bar{\nu}$$

38.  $n = 1$  represent K-shell and the number of elements having K shell = 2

$n = 2$  represent L shell and the number of element having L shell = 8

$n = 3$  represent M shell and the number of elements having M shell = 18

$n = 4$  represent N shell and the number of element having N shell = 32

$$\text{Total number} = 2 + 8 + 18 + 32 = 60$$

39. Let  $\theta^{-1}$  be the angle between vector **P** and **Q** whose resultant is **R**

Here  $\mathbf{P} = \mathbf{Q}$  and  $R^2 = 3PO = 3P^2$

$$R^2 = P^2 + Q^2 + 2PQ \cos \theta$$

$$3P^2 = P^2 + P^2 + 2P^2 \cos \theta$$

$$3P^2 - P^2 = 2P^2 \cos \theta$$

$$P^2 = 2P^2 \cos \theta$$

$$1 = 2 \cos \theta$$

$$\theta = 60^\circ = \frac{\pi}{3}$$

40. Amplitude is independent of wavelength, velocity and frequency of oscillation.

41.  $W = \frac{Q^2}{2C}$

$$W' = \frac{(2Q)^2}{2C}$$



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$$W' = 4 \frac{Q^2}{2C}$$

$$W' = 4W$$

42. Net charge acquired by induction is zero. As there is only transfer of electrons from one part of body to the other

43.  $x^2 = t^2 + t$

Differentiate wrt  $x$

$$2x \frac{dx}{dt} = 2t$$

$$v = \frac{dx}{dt} = \frac{t}{x}$$

$$a = \frac{dv}{dt}$$

$$= \frac{x - t \left( \frac{dx}{dt} \right)}{x^2}$$

$$= \frac{x - \left( \frac{t^2}{x} \right)}{x^2}$$

$$a = \frac{1}{x} - \frac{t^2}{x^3}$$

44.  $E = mc^2$

If speed of light were  $\frac{2}{3}$  of its present value, then

$$E' = m \left( \frac{2}{3}c \right)^2 = 4/9 mc^2 = 4/9 E$$

Energy decreased by

$$E - E' = E - 4/9 E = 5/9 E$$

45. Alcohol is more volatile than water because its vapour pressure is 2.5 times greater than water. A liquid vapourises when its vapour pressure becomes equal to atmospheric pressure

46. The temperature of the body is same that of its surrounding, so the amount of heat absorbed by it should be equal to amount of heat radiated by it

48. Appears resistance of p-n junction in forward biased  $R_f = 10^2 \Omega$

Appears resistance of p-n junction in reverse bias  $R_r = 10^6 \Omega$

$$\frac{R_f}{R_r} = \frac{10^2}{10^6} = 10^{-4}$$

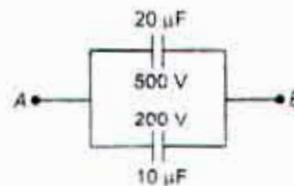
$$R_f R_r = 10^{-4} \cdot 1$$

49. Works done  $W = 2\Delta AT$

$$= 2 \times \frac{10}{100} \times \frac{1}{1000} \times 22 \times 10^{12}$$

$$= 1.44 \times 10^{-5} \text{ J}$$

50. Let the charges on capacitors be  $q_1, q_2$  then



$$q_1 = C_1 V_1, q_2 = C_2 V_2$$

Total charge  $q = q_1 + q_2$

$$= C_1 V_1 + C_2 V_2$$

Let the equivalent potential be  $V$  and since capacitor's are connected in parallel their equivalent capacitance is

$$\therefore C = C_1 + C_2$$

$$q = VC = C_1 V_1 + C_2 V_2$$

$$= V (C_1 + C_2)$$

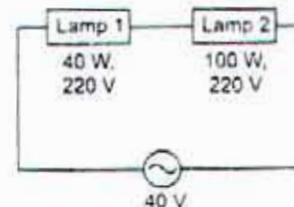
$$\Rightarrow V = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$$

Given  $C_1 = 20 \mu\text{F}$ ,  $V_1 = 500 \text{ V}$ ,  $C_2 = 10 \mu\text{F}$ ,  $V_2 = 200 \text{ V}$

$$\therefore V = \frac{20 \times 500 \times 10^{-6} + 200 \times 10^{-6}}{(20 + 10) \times 10^{-6}}$$

$$= \frac{12000 \times 10^{-6}}{30 \times 10^{-6}} = 400 \text{ V}$$

51. When current  $i$  flows, across potential  $V$ , then power  $v$  and  $V = i E$  (Ohm's law)



The currents required by the two lamps for their normal brightness are

$$i_1 = \frac{P_1}{V_1} = \frac{40}{220}$$

$$= \frac{2}{11} = 0.18 \text{ A}$$

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$$i = \frac{V}{R_1 + R_2}$$

$$= \frac{40}{1694} = 0.236$$

$$i_2 = \frac{P_2}{V_2} = \frac{100}{200} = 0.45 \text{ A}$$

The resistance of the filaments are

$$R_1 = \frac{V}{i_1} = \frac{220 \times 11}{2} = 121 \Omega$$

52. Equation of SHM  $Y = 3 \sin(0.2t)$

Comparing with  $Y = a \sin \omega t$ , we have

$$a = 3 \text{ m}, \quad \omega = 0.2 \text{ s}^{-1}$$

Mass of the particle =  $3 \text{ g} = 3 \times 10^{-3} \text{ kg}$

Therefore, kinetic energy of the particle is

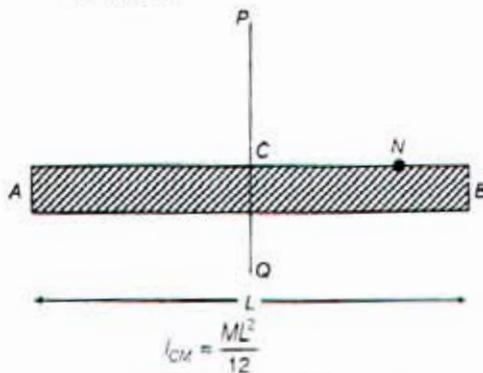
$$K = \frac{1}{2} m \omega^2 (a^2 - x^2)$$

$$= \frac{1}{2} \times 3 \times 10^{-3} \times (0.2)^2 (3^2 - 1^2)$$

$$\left( \because x = \frac{a}{3} \right)$$

$$= 0.48 \times 10^{-3} \text{ J}$$

53. Moment of inertia of the rod about a perpendicular axis  $PQ$  passing through centre of mass  $C$ .



Let  $N$  be the point which divides the length of rod  $AB$  in ratio 1 : 3. This point will be at a distance  $\frac{L}{6}$  from  $C$ . Thus, the moment of inertia

$I'$  about an axis parallel to  $PQ$  and passing through the point  $N$ .

$$I' = I_{CM} + M \left( \frac{L}{6} \right)^2$$

$$= \frac{ML^2}{12} + \frac{ML^2}{36} = \frac{ML^2}{9}$$

If  $K$  be the radius of gyration, then

$$K = \sqrt{\frac{I'}{M}} = \sqrt{\frac{L^2}{9}} = \frac{L}{3}$$

54. When lift moves down with constant acceleration  $a$  then

$$mg - w_2 = 2mg \quad \dots (i)$$

From Eq. (i) and (ii), we get

$$w_1 + w_2 = 2mg \quad \dots (iii)$$

When lift moves up with constant speed, its acceleration is zero.

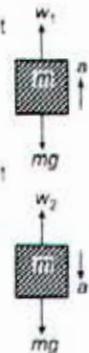
$$\text{So, } w - mg = 0$$

$$\text{or } w = mg \quad \dots (iv)$$

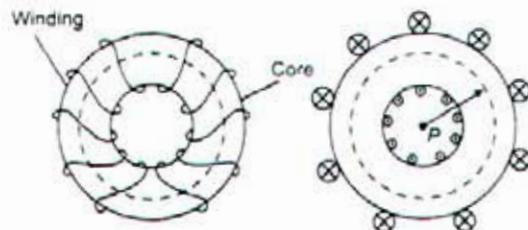
From Eq. (iii) and (iv)

$$w_1 + w_2 = 2w$$

$$\text{or } w = \frac{w_1 + w_2}{2}$$



55. A toroid can be considered as a ring shaped closed solenoid. Hence, it is like an endless cylindrical solenoid.



Consider a toroid having  $n$  turns per unit length. Magnetic field at a point  $P$  in the figure is given as  $B = \frac{\mu_0 NI}{2\pi r} = \mu_0 n I$ , where  $n = \frac{N}{2\pi r}$

Hence the magnitude of magnetic induction for a current carrying toroid of uniform cross-section is uniform over the whole cross-section

56. Isogonic lines are the lines on the magnetic map joining the places of equal declination.
57. The number of atoms per unit specimen,

$$n = \frac{\rho N_A}{A}$$

For iron,

$$\rho = 7.8 \times 10^3 \text{ kg m}^{-3}$$

$$N_A = 6.02 \times 10^{26} / \text{kg mol}, \quad A = 56$$

$$\Rightarrow n = \frac{7.8 \times 10^3 \times 6.02 \times 10^{26}}{56}$$

$$n = 8.38 \times 10^{28} \text{ m}^{-3}$$



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Total number of atoms in the bar is

$$N_0 = nV = 8.38 \times 10^{28} \\ \times (5 \times 10^{-2} \times 1 \times 10^{-2} \times 1 \times 10^{-2}) \\ N_0 = 4.19 \times 10^{23}$$

The saturated magnetic moment of bar

$$= 4.19 \times 10^{23} \times 1.8 \times 10^{-23} \\ = 7.54 \text{ Am}^2$$

58.  $B_1 = \frac{\mu_0 I}{4\pi a} (\sin \phi_1 + \sin \phi_2)$



$$\tan 30^\circ = \frac{a}{\left(\frac{l}{2}\right)}$$

$$a = \frac{l}{2\sqrt{3}}$$

$$B = \frac{\mu_0 I}{4\pi \left(\frac{l}{2\sqrt{3}}\right)} (\sin 60 + \sin 60)$$

$$B_1 = \frac{6\mu_0 I}{4\pi l}$$

$$B_{\text{total}} = 3B_1$$

$$B_{\text{total}} = 4 \times 10^{-5} \text{ T}$$

59.  $y = a \sin 2\pi \left( \frac{t}{0.04} - \frac{x}{40} \right)$

$$y = a \sin 2\pi \left( \frac{t}{T} - \frac{x}{\lambda} \right)$$

$$\frac{x}{\lambda} = \frac{x}{40}$$

$$\lambda = 40 \text{ cm}$$

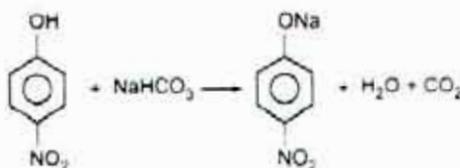
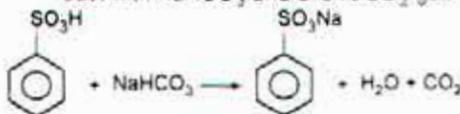
60.  $E = \frac{1}{2} CV^2$

$$= \frac{1}{2} \times (700 \times 10^{-12}) \times 50 \times 60$$

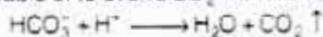
$$= 8.7 \times 10^{-7} \text{ J}$$

## Chemistry

1. Benzene sulphonic acid and *p*-nitrophenol react with  $\text{NaHCO}_3$  and evolve  $\text{CO}_2$  gas



Because benzene sulphonic acid and *p*-nitrophenol are stronger acids, so they are capable of to evolve  $\text{CO}_2$  with  $\text{NaHCO}_3$



2. Ranitidine and cimetidine are antihistamine which act as antacids while brompheniramine and terfenadine are antihistamine which act as antiallergic drugs
3. Monomers of acrilan, polystyrene, and teflon are  $\text{CH}_2 = \text{CHCN}$ ,  $\text{C}_6\text{H}_5\text{CH} = \text{CH}_2$  and

$\text{CF}_2 = \text{CF}_2$  respectively all of which are vinylic monomers while monomer units of nylon are

Nylon 6—Caprolactam

Nylon 6.6—Adipic acid and hexamethylene diamine

Nylon 6.10—Sebacic acid and hexamethylene diamine

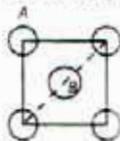
4. In all the three structures (I), (II) and (III) the configuration of OH at  $\text{C}_1$  is towards right and hence all have D-configuration
5. Linkage isomerism occurs in the compounds containing ambidentate ligands
6. In each of the given complex, Fe is in +3 state. As  $\text{C}_2\text{O}_4^{2-}$  is didentate chelating ligand, it forms chelate rings and hence is the most stable complex.
7. Due to very small value of  $K_{a_2}$ , the second ionisation will be very less and in solution, oxalate ion  $(\text{C}_2\text{O}_4)^{2-}$  will be at lowest concentration
8. For a conjugate acid-base pair:  $K_a \cdot K_b = K_w$

$$K_b = \frac{K_w}{K_a} = \frac{10^{-14}}{3.5 \times 10^{-4}} = 2.85 \times 10^{-11}$$



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9. A face of this solid would appear as



$$\text{Missing } A = \frac{1}{8} \times 2 = \frac{1}{4}$$

$$A' \text{ present} = 1 - \frac{1}{4} = \frac{3}{4}$$

$$\text{Missing } B = \frac{1}{2}$$

$$B' \text{ present} = 3 - \frac{1}{2} = \frac{5}{2}$$

$$\text{formula } A_{\frac{3}{4}} B_{\frac{5}{2}} = A_3 B_6$$

10. The reaction is



$$E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0591}{2} \log \frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]}$$

At equilibrium,  $E_{\text{cell}} = 0$

$$E^{\circ}_{\text{cell}} = \frac{0.0591}{2} \log \frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]}$$

$$\log \frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]} = \frac{2 \times E^{\circ}_{\text{cell}}}{0.0591}$$

$$(E^{\circ}_{\text{cell}} = 0.76 + 0.034 = 1.10\text{V})$$

$$= 2 \times 1.10 / 0.0591 = 37.225$$

$$\frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]} = 1.679 \times 10^{37} \approx 1$$

11. Stronger reducing metal displaces ions of weaker reducing metals from the solution. From first two reactions A is weaker reducing agent than B. B is weaker reducing agent than C.  
Reducing power  $A < B < C$   
From the next two reactions, B is stronger reducing agent than D. C is stronger reducing agent than D.  
From the last reactions, D is stronger reducing agent than A. Thus, overall reducing strength is  $A < D < B < C$ .
12. If an electron can have three values of spin quantum numbers, an orbital could occupy a maximum of 3 electrons rather than 2 under present conventions. Hence, in that case a

period could accommodate  $\frac{3}{2}$  times the element present now. Hence the atomic number of noble gases under this convention would be 3, 15, 27, 54, etc.

$$13. v = 2.18 \times 10^{11} \left( \frac{Z}{n} \right)^2 \text{ms}^{-1}$$

$$v = 2.18 \times 10^{11} \times \frac{1}{3} = 72667 \times 10^3 \text{ms}^{-1}$$

$$\text{Number of revolutions per second} = \frac{v}{2\pi r}$$

$$= \frac{72667 \times 10^3}{2 \times 314 \times \left( 0.0529 \times 10^{-3} \times \frac{32}{1} \right)}$$

$$= 2.43 \times 10^{11} \text{ revolution per second}$$

14.  $\text{Al}^{25}$  has 13 p and 12 n, i.e.  $\frac{n}{p} < 1$

Such nuclei lie below the band of stability, decay by either positron emission or electron capture of  $\text{Mg}^{25}$  as



15. Mass of solute (benzoic acid)  $w_2 = 2.0\text{g}$

Mass of solvent (benzene)  $w_1 = 25.0\text{g}$

observed  $\Delta T_f = 1.62\text{K}$

$K_f = 4.9\text{K kg mol}^{-1}$

Observed molar mass of benzoic acid,

$$M_2 = \frac{1000 \times K_f \times w_2}{\Delta T_f \times w_1}$$

$$= \frac{1000 \times 4.9 \times 2.0}{1.62 \times 25.0} = 242\text{g mol}^{-1}$$

Calculated molar mass of benzoic acid

$$= 72 + 5 + 12 + 32 + 1 = 122\text{g mol}^{-1}$$

van't Hoff factor  $i = \frac{\text{calculated molar mass}}{\text{observed molar mass}}$

$$= \frac{122}{242}$$

$$= 0.504$$

If  $\alpha$  is the degree of association of benzoic acid, then



Initial moles 1 0

After association  $(1-\alpha)$   $\frac{\alpha}{2}$



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Total number of moles of solute after association

$$= (1-\alpha) + \frac{\alpha}{2} = 1 - \frac{\alpha}{2}$$

$$i = \frac{1-\alpha/2}{1} = 0.504$$

or  $1 - \frac{\alpha}{2} = 0.504$

$$\alpha = (1 - 0.504) \times 2 = 0.996 \times 2$$

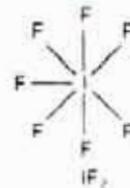
$$= 0.992 \text{ or } 99.2\%$$

16. Reduction potentials in the order  $Z > Y > X$  means that  $Z$  can be reduced most easily and  $X$  least easily i.e. their oxidising powers are  $Z > Y > X$ .

Thus  $Y$  will oxidise  $X$  but not  $Z$ .

17.  $\Lambda_m^{\circ} = \frac{\kappa \times 1000}{\text{molarity}}$
- $$= \frac{7.896 \times 10^{-2} \text{ Scm}^{-1} \times 1000 \text{ cm}^3 \text{ L}^{-1}}{0.00241 \text{ mol L}^{-1}}$$
- $$= 32.76 \text{ Scm}^2 \text{ mol}^{-1}$$
- $$\alpha = \frac{32.76}{390.5} = 0.084$$
- $$K = \frac{\alpha^2}{1-\alpha}$$
- $$= \frac{0.00241 \times (0.084)^2}{1-0.084} = 1.85 \times 10^{-5}$$

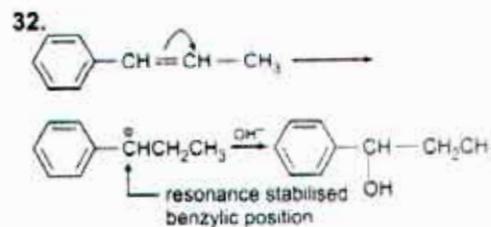
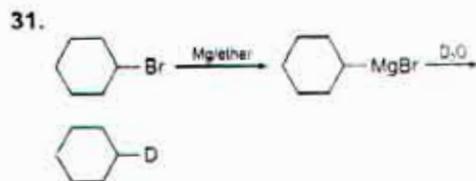
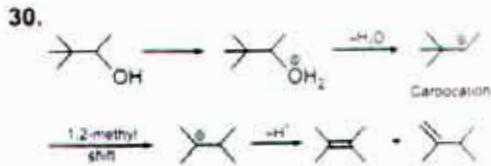
18. Rate =  $kab$ . When volume is reduced to 1/4th concentrations will become 4 times  
New rate =  $k(4a)(4b) = 16kab = 16$  times
19. Rate depends upon the slow step. Thus, step should involve 1 molecule of  $\text{Cl}_2$  and 1 molecule of  $\text{H}_2\text{S}$ . Hence A is the correct mechanism.
20. When a chalk stick is dipped in ink, adsorption of coloured substance takes place and absorption of solvent occurs.
21. Since  $\Delta_r G^\circ$  is negative for first reaction, therefore,  $+2$  oxidation state of Pb is more stable. Further, since  $\Delta_r G^\circ$  is positive for second reaction, therefore,  $+4$  oxidation state of Sn is more stable. Thus option (b) is correct.
22. In  $\text{IF}_5$ , I is  $sp^3d^2$  hybridised so, the molecule has pentagonal bipyramidal geometry.



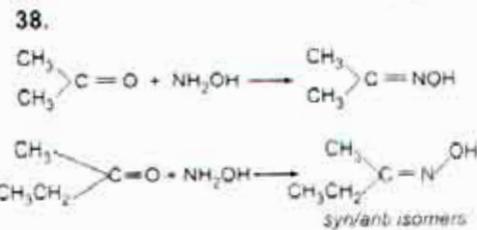
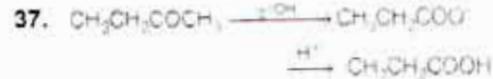
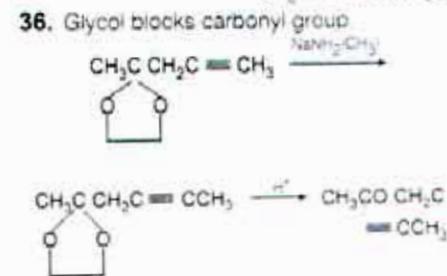
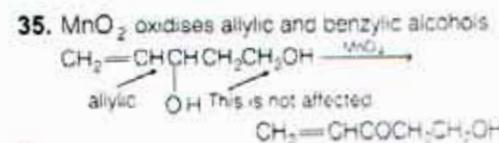
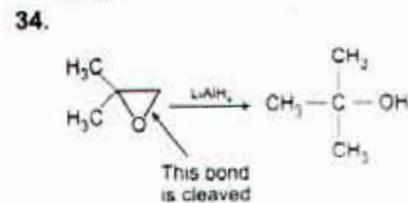
23. In  $\text{ClO}_2$ , Cl is  $sp^2$  hybridised and the bond angle is  $118^\circ$ . In  $\text{ClO}_2$ , O is  $sp^2$  hybridised. However, due to repulsions between two big sized Cl atoms, the bond angle increases from  $109^\circ 28'$  to  $111^\circ$ . In  $\text{ClO}_2$ , Cl atom is  $sp^3$  hybridised but due to  $p-p$  repulsions the angle decreases from  $109^\circ 28'$  to  $103^\circ$ . Thus, the increasing order of bond angles is  $\text{ClO}_2 < \text{Cl}_2\text{O} < \text{ClO}_2$ .
24. Availability of  $4f$  - electrons does not result in the formation of compounds in  $+4$  oxidation state for all the members of the lanthanoid series.
25. Acidic character increases with increase in oxidation state  
 $\text{Mn}_2\text{O}_7$  - acidic ( $\text{Mn} = +7$ )  
 $\text{V}_2\text{O}_5$  - amphoteric ( $\text{V} = +5$ )  
 $\text{CrO}$  - basic ( $\text{Cr} = +2$ )
26. Alkyl halides are more reactive than aryl halides. Among alkyl halides, 3° alkyl halides (III) are more reactive than 2° alkyl halides (IV). Among aryl halides, aryl halides having electron withdrawing  $-\text{NO}_2$  groups at  $o$ - and  $p$ - positions (i.e. II) are more reactive than simple aryl halides (I) thus the overall reactivity increases in the order  $\text{I} < \text{II} < \text{IV} < \text{III}$ .
27. Substitution nucleophilic bimolecular ( $\text{S}_\text{N}2$ ) involves inversion of configuration.
28.  $\text{S}_\text{N}1$  reaction is favoured for 3° alkyl halide. For a given system  $\text{BE of C-Cl} > \text{C-Br}$ . I with phenyl group gives resonance stabilised carbocation.  
Thus, increasing order is  $\text{IV} < \text{II} < \text{III} < \text{I}$ .
29.  $\text{CH}_3\text{CH}_2\text{OH}$  causes  $\text{S}_\text{N}2$  reaction giving (A) as major product where  $\text{CH}_3\text{CH}_2\text{O}^-$  (a strong nucleophile) causes elimination reaction giving (B) as major product.



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33. 1-butyne has acidic hydrogen hence, reacts with  $\text{Cu}_2\text{Cl}_2/\text{NH}_4\text{OH}$   
2-butyne without terminal hydrogen does not react



39. Diamond has the highest value of energy gap as it is an insulator

40.  $w_A = xg, m_A = 18, x_A = 1 - 0.6 = 0.4$   
 $w_B = 69g, m_B = 46, x_B = 0.6, x_A = \frac{n_A}{n_A + n_B}$

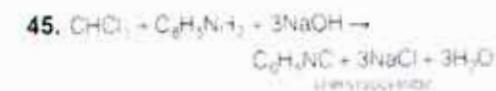
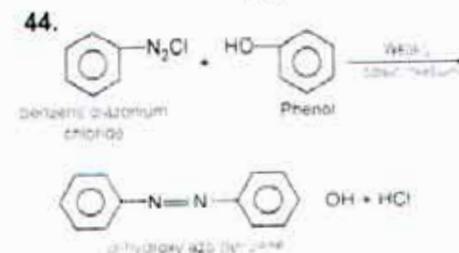
$$0.4 = \frac{w_A/m_A}{w_A/m_A + w_B/m_B} = \frac{x \cdot 18}{18 + \frac{69x}{46}}$$

$$x = 18$$

41. Living cells shrinks in hypertonic solution (plasmolysis) while bursts in hypotonic solutions (endoosmosis) There is no effect when living cells are kept in isotonic solution

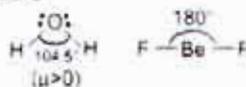
42.  $\therefore 4u = 1 \text{ He atom}$   
 $1u = \frac{1}{4} \text{ He atom}$   
 $\therefore 100u = \frac{1 \times 100}{4} = 25 \text{ atoms}$

43. Equivalent weight of metal  
 $= \frac{\text{wt. of metal}}{\text{wt. of chlorine}} \times 35.5$   
 $= \frac{(74.5 - 35.5) \times 35.5}{35.5} = 39$





46. Partial hydrolysis of cellulose gives the disaccharide cellobiose ( $C_{12}H_{22}O_{11}$ ). Cellulose resembles maltose (Which on acid catalysed hydrolysis yields two molar equivalents of D-glucose) in every respect except one the configuration of its glycosidic linkage.
47. Vitamin  $B_6$  is called pyridoxin. It is found in fruits, green vegetables, milk etc. Due to its deficiency, anaemia disease is caused.
48. The given structure is of histamine that acts as a neurotransmitter and vasodilator.
49. The structure of  $H_2O$  is angular V-shape and has  $sp^3$  hybridisation and bond angle is  $105^\circ$ . Its dipole moment value is positive or more than zero.



In  $BeF_2$  structure is linear due to  $sp$  hybridisation ( $\mu = 0$ ). Thus due to ( $\mu = 0$ )  $H_2O$  is dipolar and due to  $\mu = 0$ ,  $BeF_2$  is linear.

50. For  $KO_2$ ,  $O_2^-$  has unpaired electron, so it is paramagnetic.  
 $O_2$   $1s^2 \sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_z^2 \pi 2p_x^2 = \pi 2p_y^2$ ,  $\pi^* 2p_x^1 = \pi^* p_y^1$
51. During hydration of ions in aqueous solution, there exists an attractive force between ions and water molecules, which are polar in nature and acts as dipole. So, hydration of ions in aqueous solution is an example of ion-dipole interaction.
52. Na belongs to IA group and Mg belongs to II A group. On moving from left to right in a period, I.E. increases. Thus, I.E. of Mg is greater than I.E. of Na.
53. Electron affinity (in  $kJ \text{ mol}^{-1}$ ) of F = 332.6, Cl = 348.5, Br = 324.7 and I = 295.5. Chlorine has highest electron affinity value.  
 So, according to question the correct order will be  $Cl_2 > F_2 > Br_2$ .
54. In between two successive collisions, no force is acting on the gas molecule. Resultantly, it travels with uniform velocity during this interval and hence, it moves along a straight line.

$$55. \bar{u}_{rms} = \sqrt{\frac{3RT}{M_{(He)}}}$$

$$\bar{u}_{rms} = \sqrt{\frac{8RT}{\pi M_{(He)}}}$$

Both are at same temperature

$$\frac{\bar{u}(\text{He})}{\bar{u}_{rms}(\text{N}_2)} = \sqrt{\frac{8M(\text{N}_2)}{3\pi M_{(He)}}}$$

$$= \sqrt{\frac{8 \times 28 \times 10^{-2}}{3\pi \times 4 \times 10^{-2}}} = 2.4375$$

$$\bar{u}(\text{He}) = 2.4375 \times 515 = 1255.3 \text{ ms}^{-1}$$

$$56. \text{BE of } O_2 \text{ per molecule} = \frac{498 \times 10^3}{6.023 \times 10^{23}} \text{ J}$$

$$= 826 \times 10^{-19} \text{ J}$$

Energy required for photochemical decomposition of one molecule of

$$O_2 = 826 \times 10^{-19} \text{ J} + 2.5 \times 16 \times 10^{-19} \text{ J}$$

$$= 1.22 \times 10^{-18} \text{ J}$$

$$\lambda = \frac{hc}{E} = \frac{6.625 \times 10^{-34} \times 3 \times 10^8}{1.22 \times 10^{-18}} = 126 \text{ nm}$$

57. For a given value of  $n'$  the possible values of  $l$  are 0, 1, 2, 3, ... ( $n-1$ )

Therefore, if  $l=3$  then  $n'$  must be greater than 3.

$$58. Q = \frac{[N_2O][H_2O]}{[H_2][NO]^2} = \frac{5.4 \times 87}{0.05 \times 0.02} = 4698 \times 10^3$$

$$< K_c \quad (140 \times 10^4)$$

∴ reaction is close to equilibrium

$$59. \text{Mole of } H_2SO_4 \text{ in 50 mL stock solution}$$

$$= 50 \times 1.78 \times \frac{86}{100} \times \frac{1}{98} = 0.78$$

Since, 50 mL of the above solution is diluted to 1.0 l. Molarity of  $H_2SO_4$  in dilute solution = 0.78 M

$$[H^+] = 2 \times 0.78$$

$$= 1.56 \text{ M}$$

$$60. q_{sur} = -q_{sys} = 64 \text{ kJ}$$

$$\Delta S_{sur} = \frac{q_{sur}}{T} = \frac{640000}{300}$$

$$= 213 \text{ JK}^{-1}$$



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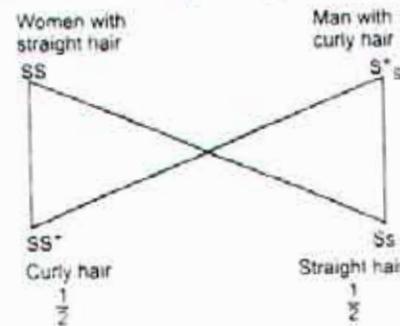
Biology

1. Kelps like *Fucus* and *Laminaria* (members of Phaeophyceae brown algae) are rich source of iodine. 25% total iodine is obtained from kelps and also contain bromine, Cu, Zn, Fe, B, Mn, Mo etc. Because of having iodine the dried kelps are used to treat goiter.
2. Due to addition of large quantities of domestic sewage and wastes oxygen levels are depleted, which are reflected in term of BOD values of water.
3. Fred Taylor, a Venus express interdisciplinary scientist, university of Oxford UK describes venus as earth's twin, but separated at birth.
4. Glyoxysomes are enzymes which play a critical role in lipid metabolism in seedling. Hence, they are supposed to be present in endosperm castor as endosperm of wheat will possess starch.
5. DNA vaccines are called third generation vaccines and are made up of a small circular piece of bacterial DNA (called a plasmid) that has been genetically engineered to produce on or two specific protein (antigen) from a pathogen.
6. Vinyl chloride is used to make Poly vinyl Chloride (PVC) plastic and vinyl products. Long term exposure to vinyl chloride through inhalation and oral exposure in human results into liver damage or cancer.
7. Miracidium larva is associated with life history of liver fluke, which is infective stage of secondary host. *Different larval stages of liver fluke are found in following sequence*

Miracidium  
↓  
Sporocyst  
↓  
Redia  
↓  
Cercaria  
↓  
Metacercaria
8. Male *Ascaris* is differentiable from female *Ascaris* tail end of male *Ascaris* is characterised by the presence of numerous genital papillae on ventral surface. There are 50 pairs of preanal papillae behind it. Sometimes two chitinous spiculate process of equal size are seen protruding out of the

cloacal aperture. These are called perial setae.

9. *Hydra* has four types of nematocysts. They are penetrants (largest), volvents (smallest), steroline glutinants and streptoline glutinants.
10. In addition to *taq* polymerase another enzyme *vent* polymerase is also used in PCR. The latter is obtained from *Thermococcus litoralis*.
11. In human being the trait curly hair ( $S^+$ ) is dominant over straight hair ( $s$ ).



12. On the basis of requirement in body the inorganic elements are of two types
  - (i) Macroelements C, H, N<sub>2</sub>, O<sub>2</sub> are called required in maximum amount.
  - (ii) Microelements iron, iodine, Mn, Cu, Zn, Fluorine etc, are required in minimum amount in the body.
13. Trigeminal nerves (V) are relatively long and mixed nerves (sensory and motor both) that arises from lateral aspects of anterior part of medulla oblongata.
14. *Streptomyces* is the largest antibiotic producing genus in the microbial world discovered so far. The number of antimicrobial compounds reported from the species of this genus per year increased almost exponentially for about two decades.
15. In pollen culture, another are used as nurse cells for successful production of embryoids.
16. Albedo is a fraction of solar energy (short wave radiation) reflected from the earth back into space. It is the measure of the reflectivity of earth surface. Ice specially snow on the top of it has high albedo must sunlight hitting the surface bound back toward space. Water is much more absorbent and less reflective.



17. Eusthenopteron was Devonian fossil fish on the direct line towards the early amphibians. It was an elongated carnivorous fish characterised by advanced nature of vertebrae and strong notochord.
18. Stomatal Index (SI) =  $\frac{S}{S+E} \times 100$   
where, S = Number of stomata  
E = Number of epidermal cells
19. Solar energy reaches an ecosystem from outside.
20. *Caenorhabditis elegans* is a microscopic (10 mm) nematode (roundworm) that normally live in soil. It has become one of the model organism in biology.
21. According to histogen theory of Hanstein (1870), the shoot apex is differentiated into three distinct meristematic zones or layers:  
(a) Dermatogen (forms epidermis)  
(b) Periblem (forms cortex and endodermis)  
(c) Plerome (forms pericycle) vascular bundles  
(d) Medullary rays and pith
22. Infectious fashene is caused by a spherical virus. The various symptoms includes translucent cephalothorax.
23. Mendel's law of inheritance 1866  
chromosome theory of inheritance 1902  
DNA, hereditary material experiment 1944-52
24. Protein are the strongest imbibants of water starch less strong, cellulose being the weakest. That is why proteinaceous pea seeds swell more than the starchy wheat seeds.
25. The distance between two z-lines is called as sarcomere, which is a functional unit of the muscle. Each sarcomere includes one complete A-band and 2 halves bands on the sides  $\left(\frac{1}{2} + A + \frac{1}{2}\right)$
26. Placoderms were the earliest jawed vertebrates appeared during the upper silurians and lower devonian period.
27. Gene silencing is a mechanism by which cells shut down large sections of chromosomal DNA. Gene silencing is done by incorporating the DNA to be silenced into a form of DNA called heterochromatin that is already silent.
28. For fixation of six  $\text{CO}_2$  molecules during Calvin cycle of photosynthesis, 18 molecules of ATP and 12 molecules of  $\text{NADPH}_2$  are required. One molecule of glyceraldehyde -3-phosphate (3-carbon molecule) is formed by fixation of 3  $\text{CO}_2$  molecules. 9 ATP and 6 NADPH molecules are required for formation of glyceraldehyde phosphate.  
 $3\text{CO}_2 + 6\text{NADPH} + 9\text{ATP}$   
Glyceraldehyde 3-phosphate +  
 $6\text{NADP}^+ 9\text{ADP} + 8\text{P}$
29. The central dogma of molecular biology was originally formulated in 1958 by the english molecular biologist Francis Harry Compton Crick (1916-2004). Stating that biological formation flows in the unidirectional pattern  
 $\text{DNA} \rightarrow \text{RNA} \rightarrow \text{Protein}$
30. BPH (Benign Prostatic Hypertrophy) is the benign growth (non-cancerous) of the prostate, which may be turned into cancer if left untreated.
31. Fragile X syndrome also known as Martin Bell syndrome, discovered by Martin and Bell in 1943. The term Fragile X is derived from the fact that the X-chromosome of affected individuals, when cultured in a medium that is deficient in folic acid exhibits breaks or gaps near the tip of long arm.
32. Nail base contain actively dividing cells.
33. Fibrous joint is present between the human skull bones. It does not allows movement because the bones are held firmly together by bundles of strong white collagen fibres. Cartilaginous joints are present between the centre of vertebrae, at the pubic symphysis and between ribs and sternum knee is the example of hinge joint. Synovial joints occurs between limb and bones.
34. Somatostatin also inhibits the release of certain hormones including thyrotropine, glucagon, insulin and cholecystokinin.
35. In batesian mimicry a scarce, palatable (edible) and unprotected organism resembles in form and shape with an abundant, relatively unpalatable and well protected organism.  
Well known examples of batesian mimicry are stick insects, leaf insects and dead leaf butterfly.
36. Decidua basalis—The portion of endometrium between the chorion and the stratum basalis of the uterus.  
Decidua parietalis—The part of endometrium not involved in implantation. Decidua umbilicus—No such structure exist in endometrium.



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37. Duration of cardiac cycle  
Atrial systole 0.1 sec  
Atrial diastole 0.7  
Ventricular systole 0.3 sec  
Ventricular diastole 0.5 sec  
Complete cardiac diastole 0.4 sec
38. Agranulocytes are leucocytes that lack granules in the cytoplasm  
Since lymphocytes are agranulocytes whereas Basophils, Neutrophils and Eosinophils are granulocytes
39. There are various theories regarding ageing like genetic clock theory  
Error theory  
Mutation theory  
Compromise theory  
'Clinker' or waste product theory  
Immunity theory  
Wear and tear theory, etc
40. In auxetic growth the volume of the body increase due to the growth of cells without any increase in the number of cells  
Such kinds of growth is seen only in nematodes rotifers and tunicates (early chordate, i.e. urochordate)
41. Biolistic technique or microprojectile bombardment have been widely used for cereal transformation. These methods rely on the acceleration of gold particles coated with plasmid DNA, into plant cells as a method of directly introducing the DNA.
42. 1 Palaeolithic age—Age of tools, stones and bones  
2 Mesolithic age—Age of animal husbandry, Language reading and writing  
3 Neolithic age—Age of agriculture knowledge and use of clothes and utensil  
4 Iron age—Present age
43. Hepatitis-B virus spreaded through blood of the patient whereas hepatitis-A and E are spreaded through contaminated water and food.
44. A higher dose of alcohol has all ill effect on the body organ. Consumption of alcohol may leads to accumulation of toxic compound  $\text{CH}_3\text{CHO}$  in liver which provide energy to synthesise fat, so liver become dry and hard and become the store house of fat (fatty liver) liver cells are replaced by fibrous tissues this state of liver is called liver cirrhosis.
- Excess intake of alcohol causes lowering in blood glucose level and also cause gastritis.
45. AABB and aabb is suitable for experiment on linkage. Linkage a tendency for certain genes that tends to be inherited together because they are present on the same chromosome. Thus parental combinations of characters are found more frequently in offspring than non-parental.
46. D and C is method of abortion. Artificial rupture of membrane is process of induction of labour whereas caesarean is surgical process of child birth for cosmetic purposes now LSCS (Lower section) caesarean section) is preferred.
47. Å (Angstrom) means  $10^{-10}$  It is an international unit used in biology to measure size of object.
48. In coconut, palms and banana the inflorescence is compound of spadix. Spadix is a type of spike with fleshy axis having both male and female flowers. It is encircled by coloured bracts called spathe.
49. The protein first hypothesis is given by Sidney Fox. He has shown that amino acid polymerise abiotically when exposed to dry heat to form proteinoids with catalytic properties. Proteinoid on contact with water form microspheres. Microspheres which are composed only of protein have a number of cellular characteristics and could have evolved into the protocell. Thomas Cech and Sidney Altman given the RNA first hypothesis.
50. Atmosphere has been divided into 5 layer from below above-Troposphere, Stratosphere, Mesosphere, Ionosphere and Exosphere.
51. Angiotensinogen  $\xrightarrow{\text{Enzyme}}$  Angiotensin
52. Quills (flight feathers) are large feathers of wings (remiges) and tail. A quill contain a shaft like structure, which is differentiated into hollow proximal calamus and distal solid reaches. Coverts are small feathers similar to quills means for filling gaps on the wing and tails.
53. Ischnura chart is made up of many coloured combination. A man with colour blindness cannot read these number accurately.
54. Coelom is internal body cavity filled with a fluids, it is lined by peritonium and probably is derived from mesoderm. It is either formed by splitting a mesoderm (know as shizocoelom).



- as in annelids) or as out growth of embryonic gut (enterocoelom as in echinoderms and chordates) so coelom (body cavity) is found between mesoderm and endoderm (body wall).
55. The excretory organ in arthropods are either green glands or Malpighian tubules. In some forms coxal glands are excretory organ. The major excretory product of arthropod is uric acid.
56. Amphicribal type vascular bundles are concentric and closed. In this type of vascular bundle xylem is surrounded by phloem. Protosteles or meristeles of pteridophytes exhibit same structure where phloem encircled xylem in same pattern.
57. In a detritus food chain, the detritus (dead animals and plants) are first eaten by some insect fungi and bacteria. These are termed as detritivores. These detritivore are eaten by their predator like big insect and other pathogen. The conversion of dead organic matter into simple inorganic form which increase the surface area for further microbial reaction is known as fragmentation which is followed by leaching → Humification → mineralisation.
58. Savannah are grassland with scattered trees and shrubs i.e. woody plants which are found in India, North Australia, central and southern Africa including east central South Africa.
59. Lysosome stain for acid phosphatase and contain hydrolytic enzymes in high content. It also play a important role in apoptosis (Programmed cell death) and ageing.
60. **A Oral contraceptive** Inhibit secretion of LH and FSH, e.g., Mala-D and Mala-N. Mala-D is commercialised whereas Mala-N is distributed free to all citizen from government hospital.
- B IUDs** Prevent fertilisation (implantation) e.g. Cu-T.
- C Implant/Norplant** Capsule implanted surgically inside skin, release hormone slowly that block ovulation.
- D Vasectomy and tubectomy** is permanent method of contraception in male and female respectively.

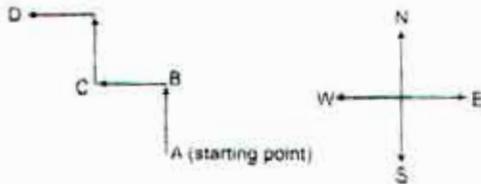
## General Aptitude & Current Issues

76. Botany is the branch of science which deals with the study of plants. Similarly, entomology is the branch of science which deals with the study of insects.
77. (d)
78. The series is ccc bbb aaa/ccc bbb aaa/c
79. The terms of the series are following the pattern of  $(2^3 - 3)$ ,  $(3^3 - 3)$ ,  $(4^3 - 3)$ ,  $(5^3 - 3)$ ,  $(6^3 - 3)$ ,  $(7^3 - 3)$ ,  $(8^3 - 3)$ .
80. Only son of woman's grandfather-woman's father-man's brother's father-man's father. So, the woman is man's sister.
81. In terms of marks obtained  
Mukesh < Raju, Raju < Priya, Gaurav < Priya, Kavita < Priya, Gaurav < Mukesh  
Since, Gaurav's marks are not the lowest, so kavita's marks are the lowest  
Sequence becomes  
Kavita < Gaurav < Mukesh < Raju < Priya
- Clearly in the descending order Raju becomes second.
82. TRANSMIT cannot be formed by the letters of the given word due to the absence of letter 'M'.
- 83.
84.  $\sqrt{64} - \sqrt{36} = 8 - 6 = 2$   
 $\sqrt{81} - \sqrt{25} = 9 - 5 = 4$   
 $\sqrt{144} - \sqrt{16} = 12 - 4 = 8$

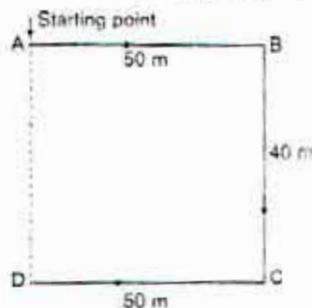


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85. The movement of the man is shown in the figure below.



86. The movement of Ashish is shown below.



It is clear from the figure that Ashish is 40 m away from the starting point.

87. Sunita has a very busy schedule. This means that she is industrious. But still she finds time for rest. This means that she is an organised person. So, both conclusion I and II follow.
91. We ordered/asked the watchman should be used as the sense shows order.
92. The event shows past time. Hence, past indefinite should be used. Hence, **last night** / **dreamt** should be used.

106. Let the numbers be  $x, x+1, x+2, x+3, x+4, x+5$  and  $x+6$ .

$$x + (x+1) + (x+2) + (x+3) + (x+4) + (x+5) + (x+6) = 20$$

$$7x + 21 = 140 \Rightarrow 7x = 119$$

$\therefore$  Largest number =  $x + 6 = 23$

107.  $\sqrt[4]{4}, \sqrt{2}, \sqrt[3]{3}, \sqrt[5]{5}$

LCM of 3 2 6 4 = 12

$$\sqrt[4]{4} = (4)^{\frac{1}{4}} = (4^{\frac{1}{12}})^{12} = (256)^{\frac{1}{12}}$$

$$\sqrt{2} = (2)^{\frac{1}{2}} = (2^{\frac{6}{12}})^{12} = (64)^{\frac{1}{12}}$$

$$\sqrt[3]{3} = (3)^{\frac{1}{3}} = (3^{\frac{4}{12}})^{12} = (81)^{\frac{1}{12}}$$

$$\sqrt[5]{5} = (5)^{\frac{1}{5}} = (5^{\frac{2.4}{12}})^{12} = (125)^{\frac{1}{12}}$$

$\therefore \sqrt[4]{4} > \sqrt[5]{5} > \sqrt{2} > \sqrt[3]{3}$

108. Let the numbers be  $x$  and  $y$ . Then,  $\frac{1}{5}x = \frac{5}{8}y$

$$\Rightarrow y = \frac{8}{25}x$$

$$\text{Now, } x + 35 = 4y \Rightarrow x + 35 = \frac{32}{25}x$$

$$\Rightarrow \frac{7}{25}x = 35 \Rightarrow x = \left(\frac{35 \times 25}{7}\right) = 125$$

$\therefore$  Second number

$$y = \frac{8}{25}x = \left(\frac{8}{25} \times 125\right) = 40$$

109. Suppose that on dividing the given number by 342, we get quotient =  $k$  and remainder = 47. Then,

$$\begin{aligned} \text{number} &= 342k + 47 \\ &= (18 \times 19k) + (18 \times 2) + 11 \\ &= 18(19k + 2) + 11 \end{aligned}$$

So, the number when divided by 18 gives remainder 11.

110. LCM of 5, 6, 7, 8 = 840

$\therefore$  Required number is of the form  $840k + 3$ .  
least value of  $k$  for which  $(840k + 3)$  is divisible by 9 is  $k = 2$

$$\therefore \text{Required number} = (840 \times 2 + 3) = 1683$$

111. Ratio of time taken by Sakshi and Tanya = 125 : 100

$$= 5 : 4$$

Suppose Tanya takes  $x$  days to do the work

$$5 : 4 :: 20 : x \Rightarrow x = \left(\frac{4 \times 20}{5}\right) = 16 \text{ days}$$

Hence, Tanya takes 16 days to complete the work.

112. Actual price = 95% of 90% of 85% of ₹ 12000

$$\begin{aligned} &= ₹ \left[ \frac{95}{100} \times \frac{90}{100} \times \frac{85}{100} \times 12000 \right] \\ &= ₹ 8721 \end{aligned}$$

113. Let the labelled price be ₹  $x$ . Then,

$$(95\% \text{ of } x) - (80\% \text{ of } x) = 1500$$

$$\Rightarrow 15\% \text{ of } x = 1500$$

$$\Rightarrow x = \frac{1500}{15} \times 100 = 10000$$

114.  $\frac{x+y}{x-y} = \frac{5}{2} \Rightarrow 2x + 2y = 5x - 5y$

$$\Rightarrow 8y = 3x$$

$$\therefore \frac{x}{y} = \frac{8}{3}$$



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115. CP of 6 toffees = ₹ 1

$$\text{SP of 6 toffees} = 120\% \text{ of ₹ } 1 = \frac{6}{5}$$

$$\text{For ₹ } \frac{6}{5} \text{ toffees sold} = 6$$

$$\text{For ₹ } 1, \text{ toffees sold} = \left(6 \times \frac{5}{6}\right) = 5$$

116. Let CP of each article be ₹ 1.

Then, CP of 50 articles = ₹ 50.

SP of 50 articles = ₹ 40

$$\therefore \text{Loss \%} = \left(\frac{10}{50} \times 100\right)\% = 20\%$$

117. Let the incomes of A and B be ₹ 5x and ₹ 4x respectively and let their expenditures be ₹ 3y and ₹ 2y respectively. Then,

$$5x - 3y = 1600 \quad \dots (i)$$

$$\text{and } 4x - 2y = 1600 \quad \dots (ii)$$

On multiplying Eq (i) by 2 and Eq (ii) by 3 and subtracting, we get  $2x = 1600 \Rightarrow x = 800$

$\therefore$  A's income = ₹ 5x = ₹ (5 × 800) = ₹ 4000

118. For 9kg zinc, mixture melted = (9 + 11)kg

For 28.8 kg zinc, mixture melted

$$= \left(\frac{20}{9} \times 28.8\right) \text{ kg} = 64 \text{ kg}$$

119. Let the speed of the motorboat in still water be x km/h.

Then, speed downstream = (x + 2) km/h.

Speed upstream = (x - 2) km/h

$$\frac{6}{x+2} + \frac{6}{x-2} = \frac{33}{60}$$

$$\Rightarrow 11x^2 - 240x - 44 = 0$$

$$\Rightarrow 11x^2 - 242x + 2x - 44 = 0$$

$$\Rightarrow (x - 22)(11x + 2) = 0$$

$$\Rightarrow x = 22$$

$\therefore$  Hence, speed of motorboat in still water = 22 km/h.

120. Required sum =  $\frac{D \times 100^3}{R^2 (R + 300)}$

$$\Rightarrow P = \frac{184 \times 100^3}{\left(\frac{20}{3}\right)^2 \left(\frac{20}{3} + 300\right)}$$

$$= \frac{184 \times 9 \times 3 \times 1000000}{92 \times 4 \times 1000}$$

$$\therefore P = ₹ 13500$$