AIIMS

Medical Entrance Exam

Solved Paper 2012

Physics

1. If the earth stops moving around its polar axis then what will be effect on body placed at south axis?

(a) Remain same
(b) Increase
(c) Decrease but not zero
(d) Decrease zero

2. In air the value of the total electric flux emitted from unit positive charge is

(a) ε_0 (b) $(\varepsilon_0)^{-1}$
(c) $(4\pi\varepsilon_0)^{-1}$ (d) $4\pi\varepsilon_0$

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3. A rod AB is 1m long. The temperature of its one end A is maintained at 100°C and other end B at 10°C, the temperature at a distance of 60 cm from point B is

(a) 64°C (b) 36°C
(c) 46°C (d) 72°C

4. In designing, a beam for its use to support a load. The depression at centre is proportional to (where, Y is Young's modulus)

(a) Y^2 (b) Y
(c) $\frac{1}{Y}$ (d) $\frac{1}{Y^2}$

5. A balloon is filled at 27°C and 1atm pressure by 500 m^3 He. At –3°C and 0.5 atm pressure, the volume of He will be

(a) 700 m^3
(b) 900 m^3
(c) 1000 m^3
(d) 500 m^3

6. The particle of mass 50 kg is at rest. The work done to accelerates it by 20 m/s in 10 s is

(a) 10^3 J (b) 10^4 J
(c) 2×10^3 J (d) 4×10^4 J

7. The moment of inertia of a circular loop of radius R, at a distance of $R/2$ around a rotating axis parallel to horizontal diameter of loop is

(a) MR^2 (b) $\frac{1}{2}MR^2$
(c) $2MR^2$ (d) $\frac{3}{4}MR^2$

8. The ratio of radius of two bubbles is 2 : 1. What is the ratio excess pressure inside them?

(a) 1 : 2 (b) 1 : 4
(c) 2 : 1 (d) 4 : 1

9. In the capacitor of capacitance C, charge Q and energy W is stored. If charge is increased upto $2Q$, the energy stored will be

(a) $\frac{W}{4}$ (b) $\frac{W}{2}$
(c) $2W$ (d) $4W$

10. The unit of thermal conductivity is

(a) $Wm^{-1}K^{-1}$ (b) JK^{-1}
(c) WmK (d) JK

11. Photon and electron are given same energy (10^{-20} J). Wavelength associated with photon and electron are λ_p and λ_e, the correct statement will be

(a) $\lambda_p > \lambda_e$ (b) $\lambda_p < \lambda_e$
(c) $\lambda_p = \lambda_e$ (d) $\frac{\lambda_e}{\lambda_p} = c$

12. The half-life of radioactive element is 600 yr. The fraction of sample that would remain after 3000 yr is

(a) 1/2 (b) 1/16
(c) 1/8 (d) 1/32

13. A particle moves along with x-axis. The position x of particle with respect to time t from origin given by $x = b_0 + b_1 t + b_2 t^2$. The acceleration of particle is

(a) b_0 (b) b_1
(c) b_2 (d) $2b_2$

14. Root mean square speed of the molecules of ideal gas is v. If pressure is increased two times at constant temperature, then the rms speed will become

(a) $\frac{v}{2}$ (b) v
(c) $2v$ (d) $4v$

15. 1 mole of gas occupies a volume of 200 mL at 100 mm pressure. What is the volume occupied by two moles of gas at 400 mm pressure and at same temperature?

(a) 50 mL (b) 100 mL
(c) 200 mL (d) 400 mL

16. A charged particle travels along a straight line with a speed v in a region where both electric field **E** and magnetic field **B** are present. It follows that

(a) $|\mathbf{E}| = v|\mathbf{B}|$ and the two fields are parallel
(b) $|\mathbf{E}| = v|\mathbf{B}|$ and the two fields are perpendicular
(c) $|\mathbf{B}| = v|\mathbf{E}|$ and the two fields are parallel
(d) $|\mathbf{B}| = v|\mathbf{E}|$ and the two fields are perpendicular

17. What will be the wave velocity, if the radar gives 54 waves/min and wavelength of the given wave is 10 m?

(a) 4 m/s (b) 6 m/s
(c) 9 m/s (d) 5 m/s

18. A transformer of 100% efficiency has 200 turns in the primary coil and 40000 turns in secondary coil. It is connected to a 220 V main supply and secondary feeds to a 100 kΩ resistance. The potential difference per turn is

(a) 1.1 V (b) 25 V
(c) 18 V (d) 11 V

19. A thin convex lens of refractive index 1.5 has 20 cm focal length in air. If the lens is completely immersed in a liquid of refractive index 1.6, its focal length will be

(a) − 160 cm (b) − 100 cm
(c) + 10 cm (d) + 100 cm

20. SI unit of permittivity is

(a) $C^2m^2N^2$ (b) $C^2m^{-2}N^{-1}$
(c) $C^2m^2N^{-1}$ (d) $C^{-1}m^2N^{-2}$

21. A spherical drop of capacitance 1 μF is broken into eight drops of equal radius. Then, the capacitance of each small drop is

(a) $\frac{1}{2}$ μF (b) $\frac{1}{4}$ μF
(c) $\frac{1}{8}$ μF (d) 8 μF

22. A simple harmonic oscillator consists of a particle of mass m and an ideal spring with spring constant k. The particle oscillates with a time period T. The spring is cut into two equal parts. If one part oscillates with the same particle, the time period will be

(a) $2T$ (b) $\sqrt{2}\,T$
(c) $\frac{T}{\sqrt{2}}$ (d) $\frac{T}{2}$

23. The coefficient of viscosity for hot air is

(a) greater than the coefficient of viscosity for cold air
(b) smaller than the coefficient of viscosity for cold air
(c) same as the coefficient of viscosity for cold air
(d) increase or decrease depending on the external pressure

24. An artificial satellite moving in a circular orbit around the earth has a total (kinetic + potential) energy E_0. Its potential energy is

(a) $-E_0$ (b) $1.5\,E_0$
(c) $2E_0$ (d) E_0

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25. A thin hollow sphere of mass m is completely filled with a liquid of mass m. When the sphere rolls with a velocity v, kinetic energy of the system is (neglect friction)

(a) $\frac{1}{2}mv^2$ (b) mv^2

(c) $\frac{4}{3}mv^2$ (d) $\frac{4}{5}mv^2$

26. A non-conducting body floats in a liquid at 20°C with $\frac{2}{3}$ of its volume immersed in the liquid. When liquid temperature is increased to 100°C, $\frac{3}{4}$ of body's volume is immersed in the liquid. Then the coefficient of real expansion of the liquid is (neglecting the expansion of container of the liquid)

(a) $15.6 \times 10^{-4}°C^{-1}$

(b) $156 \times 10^{-4}°C^{-1}$

(c) $1.56 \times 10^{-4}°C^{-1}$

(d) $0.156 \times 10^{-4}°C^{-1}$

27. Two slabs A and B of different materials but of the same thickness are joined end to end to form a composite slab. The thermal conductivities of A and B are K_1 and K_2 respectively. A steady temperature difference of 12°C is maintained across the composite slab. If $K_1 = \frac{K_2}{2}$, the temperature difference across slabs A is

(a) 4°C (b) 6°C

(c) 8°C (d) 10°C

28. In short wave communication waves of which of following frequencies will be reflected back by the ionospheric layer having electron density 10^{11} per m^3?

(a) 2 MHz (b) 10 MHz

(c) 12 MHz (d) 18 MHz

29. A body of mass 4 kg moving with velocity 12 m/s collides with another body of mass 6 kg at rest. If two bodies stick together after collision, then the loss of kinetic energy of system is

(a) zero (b) 288 J

(c) 172.8 J (d) 144 J

30. A marble block of mass 2 kg lying on ice when given a velocity of 6 m/s is stopped by friction in 10 s. Then the coefficient of friction is

(a) 0.01 (b) 0.02

(c) 0.03 (d) 0.06

31. A body of mass 0.25 kg is projected with muzzle velocity 100 m/s from a tank of mass 100 kg. What is the recoil velocity of the tank?

(a) 5 m/s (b) 25 m/s

(c) 0.5 m/s (d) 0.25 m/s

32. A rocket with a lift-off mass 3.5×10^4 kg is blast upward with an initial acceleration of 10 m/s^2. Then, the initial thrust of the blast is

(a) 1.75×10^5 N (b) 3.5×10^5 N

(c) 7.0×10^5 N (d) 14.0×10^5 N

33. A step down transformer is used on a 1000 V line to deliver 20 A at 120 V at the secondary coil. If the efficiency of the transformer is 80%, the current drawn from the line is

(a) 3 A (b) 30 A

(c) 2.3 A (d) 2.4 A

34. What kV potential is to be applied on X-ray tube so that minimum wavelength of emitted X-rays may be 1 Å ($h = 6.6 \times 10^{-34}$ J-s)

(a) 12.42 kV (b) 12.84 kV

(c) 11.98 kV (d) 10.78 kV

35. Hydrogen atom excites energy level from fundamental state to $n = 3$. Number of spectrum lines according to Bohr is

(a) 4 (b) 3

(c) 1 (d) 2

36. A black body at a temperature of 2600 K has the wavelength corresponding to maximum emission 1200 Å. Assuming the moon to be perfectly black body the temperature of the moon, if the wavelength corresponding to maximum emission is 5000 Å is

(a) 7800 K (b) 6240 K

(c) 5240 K (d) 3640 K

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37. The heat required to increase the temperature of 4 moles of a monoatomic ideal gas from 273 K to 473 K at constant volume is

(a) 200 R (b) 400 R
(c) 800 R (d) 1200 R

38. A solid sphere rolls without slipping on the roof. The ratio of its rotational kinetic energy and its total kinetic energy is

(a) 2/5 (b) 4/5
(c) 2/7 (d) 3/7

39. 6 Ω and 12 Ω resistors are connected in parallel. This combination is connected in series with a 10 V battery and 6 Ω resistor. What is the potential difference between the terminals of the 12 Ω resistor?

(a) 4 V (b) 16 V
(c) 2 (d) 8 V

40. Charge passing through a conductor of cross-section area $A = 0.3\ m^2$ is given by $q = 3t^2 + 5t + 2$ in coulomb, where t is in second. What is the value of drift velocity at $t = 2$ s? (Given, $n = 2 \times 10^{25} / m^3$)

(a) 0.77×10^{-5} m/s (b) 1.77×10^{-5} m/s
(c) 2.08×10^{5} m/s (d) 0.57×10^{5} m/s

Directions (Q. Nos. 41-49) *Each of these questions consist of two statements each printed as assertion and reason. While answering these questions you are required to choose any one of the following responses.*

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion
(b) If the Assertion and Reason are true but Reason is not correct explanation of Assertion
(c) If Assertion is true but, Reason is false
(d) If Assertion is false but, Reason is true

41. Assertion When a body is dropped or thrown horizontally from the same height, it would reach the ground at the same time.

Reason Horizontal velocity has no effect on the vertical direction.

42. Assertion Two similar trains are moving along the equatorial line with the same speed but in opposite direction. They will exert equal pressure on the rails.

Reason In uniform circular motion the magnitude of acceleration remains constant but the direction continuously changes.

43. Assertion A table cloth can be pulled from a table without disloading the dishes.

Reason To every action there is an equal and opposite reaction.

44. Assertion Soft steel can be made red hot by continued hammering on it, but hard steel cannot.

Reason Energy transfer in case of soft is large as in hard steel.

45. Assertion The centre of mass of an electron and proton, when released moves faster towards proton.

Reason Proton is heavier than electron.

46. Assertion A planet moves faster, when it is closer to the sun in its orbit and *vice-versa*.

Reason Orbital velocity in orbit of planet is constant.

47. Assertion A large force is required to drawn apart normally two glass plates enclosing a thin water film.

Reason Water works as glue and sticks two glass plates.

48. Assertion The water rises higher in a capillary tube of small diameter than in the capillary tube of large diameter.

Reason Height through which liquid rise in capillary tube inversely proportional to the capillary tube.

49. Assertion If the bob of a simple pendulum is kept in a horizontal electric field, its period of oscillation will remain same.

Reason If bob is charged and kept in horizontal electric field, then the time period will be decreased.

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50. Assertion A thermoelectric refrigerator is based on the Peltier effect.

Reason A thermocouple may be used as a radiation detector.

51. Assertion The pattern and position of fringes always remain same even after the introduction of transparent medium in a path of one of the slit.

Reason The central fringe is bright or dark depends upon the initial phase difference between the two coherence sources.

52. Assertion Balmer series lies in the visible region of electromagnetic spectrum.

Reason $\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right)$,

where, $n = 3, 4, 5...$

53. Assertion Corpuscular theory fails in explaining the velocities of light in air and water.

Reason According to corpuscular theory, light should travel faster in denser media than in rarer media.

54. Assertion Susceptibility is defined as the ratio of intensity of magnetisation I to magnetic intensity H.

Reason Greater the value of susceptibility smaller the value of intensity of magnetisation I.

55. Assertion It is not possible to have interference between the waves produced by two violins.

Reason For interference of two waves the phase difference between the waves must remain constant.

56. Assertion A metallic shield in the form of a hollow shell may be build to block an electric field.

Reason In a hollow spherical shield, the electric field inside it is zero at every point.

57. Assertion The molecules of a monoatomic gas has three degrees of freedom.

Reason The molecules of a diatomic gas has five degrees of freedom.

58. Assertion To observe diffraction of light the size of obstacle/aperture should be of the order of 10^{-7} m.

Reason 10^{-7} m is the order of wavelength of visible light.

59. Assertion The resolving power of a telescope is more if the diameter of the objective lens is more.

Reason Objective lens of large diameter collects more light.

60. Assertion A beam of charged particles is employed in the treatment of cancer.

Reason Charged particles on passing through a material medium loss their energy by causing ionisation of the atoms along their path.

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Chemistry

1. Which one of the following enzymes is present in animals like cow, buffaloes etc., to digest compounds like paper, cloth etc?

(a) Ureaze
(b) Cellulase
(c) Silicones
(d) Sucrase

2. Which one of the following is employed as antihistamine?

(a) Omeprazole
(b) Chloramphenicol
(c) Dipher yl hydramine
(d) Northindrone

3. Dunston's test is used for identification of

(a) glycerol (b) acetone
(c) glycol (d) ethanol

4. Which one of the following structures represents the neoprene polymer?

(a) $\left[\begin{array}{l}\text{CH—CH}_2\\ \quad|\\ \quad\text{C}_6\text{H}_5\end{array}\right]_n$

(b) $\left[\begin{array}{l}\text{CH}_2\text{—C=CH—CH}_2\\ \quad\quad|\\ \quad\quad\text{Cl}\end{array}\right]_n$

(c) $\left[\begin{array}{l}\text{CH}_2\text{—CH}\\ \quad\quad|\\ \quad\quad\text{CN}\end{array}\right]_n$

(d) $\left[\begin{array}{l}\text{CH}_2\text{—CH}\\ \quad\quad|\\ \quad\quad\text{Cl}\end{array}\right]_n$

5. Etherates are
(a) ethers
(b) solution in ether
(c) complexes of ethers with Lewis acid
(d) complexes of ethers with Lewis base

6. 1C electricity deposits
(a) 10.8 g of Ag
(b) electrochemical equivalent of Ag
(c) half of electrochemical equivalent of Ag
(d) 96500 g of Ag

7. The reduction potential at pH = 14 for the Cu^{2+}/Cu couples is [Given, $E^\circ_{Cu^{2+}/Cu} = 0.34$ V; $K_{sp}\ Cu(OH)_2 = 1 \times 10^{-19}$]
(a) 0.34 V (b) – 0.34 V
(c) 0.22 V (d) – 0.22 V

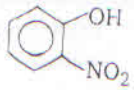
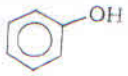
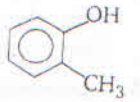
8. Freon used as refrigerant is
(a) $CF_2{=}CF_2$ (b) CH_2F_2
(c) CCl_2F_2 (d) CF_4

9. Of the following, the oxime of which shows geometrical isomerism is
(a) acetone
(b) diethyel ketone
(c) formaldehyde
(d) benzaldehyde

10. Which has the highest nucleophilicity?
(a) F^- (b) OH^-
(c) $-CH_3$ (d) $-NH_2$

11. What is the correct relationship between the pHs of isomolar solutions of sodium oxide (pH_1), sodium sulphide (pH_2), sodium selenide (pH_3) and sodium telluride (pH_4)?
(a) $pH_1 > pH_2 \approx pH_3 > pH_4$
(b) $pH_1 < pH_2 < pH_3 < pH_4$
(c) $pH_1 < pH_2 < pH_3 \approx pH_4$
(d) $pH_1 > pH_2 > pH_3 > pH_4$

12. The vapour pressure of two liquids P and Q are 80 and 60 torr respectively. The total vapour pressure of solution obtained by mixing 3 moles of P and 2 moles of Q would be
(a) 140 torr (b) 20 torr
(c) 68 torr (d) 72 torr

13. Which one of the following compounds is most acidic?
(a) $Cl—CH_2—CH_2—OH$ (b) 
(c)  (d) 

14. A reaction occurs spontaneously if
(a) $T\Delta S < \Delta H$ and both ΔH and ΔS are + ve
(b) $T\Delta S > \Delta H$ and both ΔH and ΔS are + ve
(c) $T\Delta S = \Delta H$ and both ΔH and ΔS are + ve
(d) $T\Delta S > \Delta H$ and ΔH is + ve and ΔS is – ve

15. The aqueous solution containing which one of the following ions will be colourless?
(Atomic number of Sc = 21, Fe = 26, Ti = 22, Mn = 25)
(a) Sc^{3+} (b) Fe^{2+}
(c) Ti^{3+} (d) Mn^{2+}

16. Four successive members of the first row transition elements are listed below with their atomic numbers. Which one of them is expected to have the highest third ionization enthalpy?
(a) Vanadium ($Z = 23$)
(b) Chromium ($Z = 24$)
(c) Iron ($Z = 26$)
(d) Manganese ($Z = 25$)

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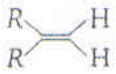
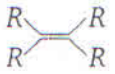
17. Which one of the following alkenes will react faster with H_2 under catalytic hydrogenation conditions?

(a)  (b) 

(c) (d)

(R = Alkyl substituent)

18. For a first order reaction $A \longrightarrow B$, the reaction rate at reactant concentration of 0.01 M is found to be 2.0×10^{-5} mol $L^{-1}s^{-1}$. The half-life period of the reaction is

(a) 220 s (b) 30 s
(c) 300 s (d) 347 s

19. Which one of the following is the electron deficiens molecule?

(a) B_2H_6 (b) C_2H_6
(c) PH_3 (d) SiH_4

20. Which one of the following would have a permanent dipole moment?

(a) BF_3 (b) SiF_4
(c) SF_4 (d) XeF_4

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21. Which one of the following undergoes nucleophilic substitution exclusively by S_N1 mechanism?

(a) Benzyl chloride (b) Ethyl chloride
(c) Chlorobenzene (d) Isopropyl chloride

22. The rate of reaction between two reactants A and B decreases by a factor of 4, if the concentration of reactant B is doubled. The order of this reaction with respect to reactant B is

(a) –1 (b) –2
(c) 1 (d) 2

23. In a face centred cubic lattice, a unit cell is shared equally by how many unit cells?

(a) 8 (b) 4
(c) 2 (d) 6

24. A solution of urea (mol. mass 56 g mol^{-1}) boils at 100.18°C at the atmospheric pressure. If K_f and K_b for water are 1.86 and 0.52 K kg mol^{-1} respectively, the above solution will freeze at

(a) –6.54°C (b) 6.54°C
(c) 0.654°C (d) –0.654°C

25. Which one of the following is an inner orbital complex as well as diamagnetic in behaviour? (Atomic number of Zn = 30, Cr = 24, Co = 27, Ni = 28)

(a) $[Zn(NH_3)_6]^{2+}$
(b) $[Cr(NH_3)_6]^{3+}$
(c) $[Co(NH_3)_6]^{3+}$
(d) $[Ni(NH_3)_6]^{2+}$

26. Electrolytic reduction of nitrobenzene in weakly acidic medium gives

(a) aniline
(b) nitrosobenzene
(c) N-phenylhydroxylamine
(d) *p*-hydroxyaniline

27. Which one of the following oxides is expected to exhibit paramagnetic behaviour?

(a) CO_2 (b) SO_2
(c) ClO_2 (d) SiO_2

28. The correct order of acid strength is

(a) $HClO < HClO_2 < HClO_3 < HClO_4$
(b) $HClO_4 < HClO < HClO_2 < HClO_3$
(c) $HClO_2 < HClO_3 < HClO_4 < HClO$
(d) $HClO_4 < HClO_3 < HClO_2 < HClO$

29. In the equation,

$$4M + 8CN^- + 2H_2O + O_2 \longrightarrow 4[M(CN)_2]^- + 4OH^-$$

Identify the metal M.

(a) Copper (b) Iron
(c) Gold (d) Zinc

30. The decomposition of a certain mass of $CaCO_3$ gave 11.2 dm^3 of CO_2 gas at STP. The mass of KOH required to completely neutralise the gas is

(a) 56 g (b) 28 g
(c) 42 g (d) 20 g

31. Calculate the wavelength of light required to break the bond between two chlorine atoms in a chlorine molecule. The Cl—Cl bond energy is 243 kJ mol^{-1} ($h = 6.6 \times 10^{-34}$ Js; $c = 3 \times 10^8 ms^{-1}$, Avogadro's number $= 6.02 \times 10^{-23}$ $mole^{-1}$)

(a) 4.91×10^{-7} m (b) 4.11×10^{-6} m
(c) 8.81×10^{-31} m (d) 6.26×10^{-21} m

32. The pressure and temperature of 4 dm^3 of carbon dioxide gas are doubled. Then volume of carbon dioxide would be

(a) 2 dm^3 (b) 3 dm^3
(c) 4 dm^3 (d) 8 dm^3

33. Equal volumes of three acid solutions of pH 3, 4 and 5 are mixed in a vessel. What will be the H^+ ion concentration in the mixture?

(a) 1.11×10^{-4} M (b) 3.7×10^{-4} M
(c) 3.7×10^{-3} M (d) 1.11×10^{-3} M

34. Purple of cassius is a/an

(a) colloidal sol of gold
(b) colloidal sol of silver
(c) colloidal sol of platinum
(d) oxyacid of gold

35. Insulin production and its action in human body are responsible for the level of diabetes. This compound belongs to which of the following categories?

(a) A coenzyme (b) A hormone
(c) An enzyme (d) An antibiotic

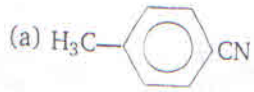
36. Which base is present in RNA but not in DNA?

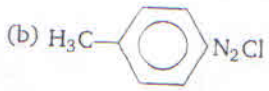
(a) Uracil (b) Cytosine
(c) Guanine (d) Thymine

37. Which one of the following methods is neither meant for the synthesis nor for the separation of amines?

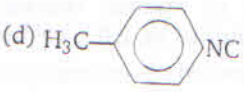
(a) Curtius reaction
(b) Wurtz reaction
(c) Hofmann method
(d) Hinsberg method

38. The reaction of chloroform with alcoholic KOH and *p*-toluidine form

(a) 

(b) 

(c)

(d) 

39. Pyruvic acid is obtained by

(a) oxidation of acetaldehyde cyanohydrin
(b) oxidation of formaldehyde cyanohydrin
(c) oxidation of acetone cyanohydrin
(d) None of the above

40. Rate of the reaction,

is fastest when Z is

(a) Cl (b) NH_2
(c) OC_2H_5 (d) $OCOCH_3$

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Directions (Q. Nos. 41-60) *These questions consist of two statements each printed as assertion and reason. Whole answering these questions you are required to choose any one of the following responses.*

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion
(c) Assertion is true but Reason is false
(d) Both Assertion and Reason are false

41. Assertion Mercury vapour is shining silvery appearance.

Reason Mercury is a metal with shining silvery appearance.

42. Assertion F_2 has high reactivity.

Reason F — F bond has low bond dissociation enthalpy.

43. Assertion BF_3 molecule is planar but NF_3 is pyramidal.

Reason N atom is smaller than B.

44. Assertion The free gaseous Cr atom has six unpaired electrons.

Reason Half-filled *s*-orbital has greater stability.

45. Assertion Meniscus of a liquid disappears at critical temperature.

Reason Density of a liquid and its gaseous phase become equal at the critical temperature.

46. Assertion Molar entropy of vaporisation of water is different from ethanol.

Reason Water is more polar than ethanol.

47. Assertion For the reaction;

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Unit of $K_c = L^2\ mol^{-2}$

Reason Equilibrium constant,

$$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$$

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48. Assertion Small quantity of soap is used to prepare a stable emulsion.

Reason Soap lowers the interfacial tension between oil and water.

49. Assertion Both *o*-hydroxy benzaldehyde and *p*-hydroxy benzaldehyde have same molecular weight and show H-bonding.

Reason Melting point of *p*-hydroxy benzaldehyde is more.

50. Assertion Precipitation of soap is made by the addition of salt (NaCl).

Reason Presence of common ion suppresses the dissociation of weak acid.

51. Assertion van-Arkel method is used to prepare samples of some metals.

Reason It involves reaction of CO with metals to form volatile carbonyls which decompose on heating to give pure metal.

52. Assertion EDTA is a hexadentate ligand.

Reason Denticity of a ligand is given by number of lone pairs donated to central atom by a ligand.

53. Assertion Sodium carbonate extract of a salt containing sulphide ions gives a violet colour with appropriate reagent.

Reason The reagent sodium nitroprusside gives violet colour due to the formation of sodium thionitroprusside.

54. Assertion H_2O_2 under goes disproportionation on heating.

Reason It gives H_2O and O_2 on heating.

55. Assertion IE_1 of nitrogen is lower than IE_1 of oxygen.

Reason Across a period effective nuclear charge decreases.

56. Assertion The term anomers of glucose refers to isomers of glucose that differ in configuration at carbon one (C –1).

Reason Anomers of glucose are cyclic diastereomers differ in configuration at C –1 existing in two forms α-and β-respectively.

57. Assertion The presence of nitro group facilitates nucleophilic substitution reactions in aryl halides.

Reason The intermediate carbanion is stabilised due to the presence of nitro group.

58. Assertion Alkyl benzene is not prepared by Friedel-Craft's alkylation of benzene.

Reason Alkyl halides are less reactive than acyl halides.

59. Assertion Benzyl bromide when kept in acetone water produces benzyl alcohol.

Reason The reaction follows S_N2 mechanism.

60. Assertion Isobutanal does not give iodoform test.

Reason It does not have α-hydrogen.

Biology

1. Energy flow in an ecosystem is
   (a) unidirectional (b) bidirectional
   (c) multi-directional (d) All of these

2. Who proposed a five-kingdom classification and named kingdoms as Monera, Protista, Fungi, Plantae and Animalia?
   (a) Herbert Copeland (b) RH Whittaker
   (c) Carl Woese (d) Carolus Linnaeus

3. Which of the following organisms completely lack cell wall, they are the smallest living cells known and can survive without oxygen?
   (a) Mycoplasma (b) Euglenoids
   (c) Slime moulds (d) All of these

4. What is the correct order of the stages of cellular respiration?
   (a) Krebs' cycle electron— transport— chain glycolysis
   (b) Electron transport chain — Krebs' cycle — glycolysis
   (c) Glycolysis — Krebs' cycle — electron transport chain
   (d) Glycolysis — electron transport chain — Krebs' cycle

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5. A mixture containing DNA fragments, a, b, c and d, with molecular weights of $a + b = c$, $a > b$ and $d > c$, was subjected to agarose gel electrophoresis. The positions of these fragments from cathode to anode sides of the gel would be
   (a) b, a, c, d (b) a, b, c, d
   (c) c, b, a, d (d) b, a, d, c

6. Which of the following DNA sequences qualifies to be designated as a palindrome?
   (a) 5'– GACCAG – 3' in one strand
   (b) 3'– GACCAG – 5' in one strand
   (c) 5'– GACGAG– 3' 3'– CTGGTC – 5'
   (d) 5'– AGCGCT – 3' 3'– TCGCGA – 5'

7. IUCN stands for
   (a) Indian Union for Conservation of Nature
   (b) International Union for Conservation of Nature
   (c) Indian Union for Chemical Nomenclature
   (d) International Union for Conservation of Nutrients

8. Tendrils in plants are an example of
   (a) convergent evolution
   (b) radiation
   (c) divergent evolution
   (d) co-evolution

9. Haemoglobin is
   (a) an oxygen carrier in human blood
   (b) a protein used as food supplement
   (c) an oxygen scavenger in root nodules
   (d) a plant protein with high lysine content

10. Stomatal opening is affected by
    (a) nitrogen concentration, carbon dioxide concentration and light
    (b) carbon dioxide concentration, temperature and light
    (c) nitrogen concentration, light and temperature
    (d) carbon dioxide concentration, nitrogen concentration and temperature

11. Taxonomic hierarchy refers to
    (a) step-wise arrangement of all categories for classification of plants and animals
    (b) a group of senior taxonomists, who decide the nomenclature of plants and animals
    (c) a list of botanists or zoologists, who have worked on taxonomy of a species or group
    (d) classification of a species based on fossil record

12. Which of the following induces parturition?
    (a) Vasopressin (b) Oxytocin
    (c) GH (d) TSH

13. Excess carbohydrates and proteins are stored in the body as
    (a) amino acids (b) fats
    (c) starch (d) monosaccharides

14. Both sickle cell anaemia and Huntington's chorea are
(a) bacteria-related diseases
(b) congenital disorders
(c) pollutant-induced disorders
(d) virus-related diseases

15. Which one of the following pairs in not correctly matched?
(a) Vitamin-B_{12} — Pernicious anaemia
(b) Vitamin-B_6 — Loss of appetite
(c) Vitamin-B_1 — Beri-beri
(d) Vitamin-B_2 — Pellagra

16. The exchange of segments of non-sister chromatids between chromosomes of a homologous pair termed as
(a) transformation
(b) translocation
(c) crossing over
(d) chromosomal aberration

17. Okazaki is known for his contribution to the understanding of
(a) transcription (b) translation
(c) DNA replication (d) mutation

18. The beginning of understanding genetic transformation by bacteria was made by
(a) Frederick Griffith
(b) Hershey and Chase
(c) Watson and Crick
(d) TH Morgan

19. The source of *taq* polymerase used in PCR is a
(a) thermophilic fungus
(b) mesophilic fungus
(c) thermophile bacterium
(d) halophilic bacterium

20. A pea plant parent having violet-coloured flowers with unknown genotype was crossed with a plant having white-coloured flowers. In the progeny, 50% of the flowers were violet and 50% were white. The genotypic constitution of the parent having violet-coloured flowers was
(a) homozygous (b) merozygous
(c) heterozygous (d) hemizygous

21. If the total amount of adenine and thymine in a double-stranded DNA is 45%, the amount of guanine in this DNA will be
(a) 22.5% (b) 27.5%
(c) 45% (d) 55%

22. Typhoid fever is caused by a species of
(a) *Streptococcus* (b) *Staphylococcus*
(c) *Salmonella* (d) *Mycobacterium*

23. HIV is a member of a group of viruses called
(a) bacteriophages (b) geminiviruses
(c) lysogenic viruses (d) retroviruses

24. The number of linkage group(s) present in *Escherichia coli* is
(a) one (b) two
(c) four (d) seven

25. Natural cytokinins are sythesized in tissue that are
(a) senescent
(b) dividing rapidly
(c) storing food material
(d) differentiating

26. Resemblance of one organism to another for protection and hiding is
(a) mimicry (b) predation
(c) adaptation (d) camouflage

27. Spirochaetes is are
(a) a class of insects (b) a class of viruses
(c) bacteria (d) fungi

28. The metachromatic granules are
(a) present in plants cell at metaphase stage
(b) inclusion bodies in bacteria
(c) produced in insects during metamorphosis
(d) chromatophores in animals skin

29. Clamp connection is found in
(a) Basidiomycetes (b) Ascomycetes
(c) Saccharomycetes (d) Haplomycetes

30. AUG codes for
(a) valine (b) histidine
(c) phenylalanine (d) methionine

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31. Fluid mosaic model of plasma membrane was given by
(a) Robertson
(b) Robert Hooke
(c) Singer and Nicholson
(d) Gorter and Grendel

32. Cell respiration is carried out by
(a) ribosome (b) mitochondria
(c) chloroplast (d) Golgi bodies

33. In the *lac*operon model, lactose molecules function as
(a) inducers, which bind with the operator gene
(b) repressors, which bind with the operator gene
(c) inducers, which bind with the repressor protein
(d) corepressors, which bind with repressors protein

34. A recessive mutant is one which is
(a) not expressed
(b) rarely expressed
(c) expressed only in homozygous and hemizygous state
(d) expressed only in heterozygotis state

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35. Humoral immunity system is mediated by
(a) B-cells (b) T-cells
(c) NK-cell (d) plasma cells

36. It two pea plants having red (dominant) coloured flowers with unknown genotypes are crossed, 75% of the flowers are red and 25% are white. The genotypic constitution of the parents having red coloured flowers will be
(a) both homozygous
(b) one homozygous and other heterozygous
(c) both heterozygous
(d) both hemizygous

37. If the total amount of adenine and thymine in a double-stranded DNA is 60%, the amount of guanine in this DNA will be
(a) 15% (b) 20%
(c) 30% (d) 40%

38. The protein products of the following *Bt* toxin genes *cry* I *Ac* and *cry* II *Ab* are responsible for controlling
(a) bollworm (b) roundworm
(c) moth (d) fruit fly

39. In a flowering plant, the pollen tube first arrives in
(a) egg
(b) an antipodal cell
(c) a synergid
(d) central cell

Directions (Q. Nos. 40-60) *These questions consist of two statements each printed as assertion and reason. Whole answering these questions you are required to choose any one of the following five responses.*
(a) If both Assertion and Reason are true and reason is correct explanation of Assertion
(b) If both Assertion and Reason are true but reason is not the correct explanation of Assertion
(c) If Assertion is true but Reason is false
(d) If both Assertion and Reason are false

40. Assertion Only a single functional female gamete is formed from each primary oocyte cell.
Reason Meiosis in each primary as oocyte gives rise to only one cell, which function ovum.

41. Assertion Cytochrome oxidase enzyme contain copper.
Reason Cyanide combines with the copper of cytochrome oxidase and prevents O_2 combining with it.

42. Assertion Recognition site should be preferably single and responsive to commonly used restriction enzyme.
Reason In pBR322 alien DNA is ligated generally in the area of *Bam* HI site of tetracyline resistance gene.

43. Assertion Generally, a woman do not conceive during lactation period.
Reason The hormone prolactin initiates and maintain lactation in a woman.

44. Assertion Allelopathy is a form of ammensalism that occurs in plants.

Reason Association of rooting plants with fungal hyphae is an important example ammensalism.

45. Assertion Bats and whales are classified as mammals.

Reason Bats and whales have four chambered heart.

46. Assertion Histamine is related with allergic and inflammatory reactions.

Reason Histamine is a vasodilator.

47. Assertion For a recipient to receive blood from a donar, the recipients plasma must not have an antibody, cause the donor's cells to agglutinate.

Reason The possibility of blood clumping does not depend on anti A and anti B antibody and blood type.

48. Assertion Monocot stem has collateral open vascular bundle.

Reason Open vascular bundle is without vascular cambium.

49. Assertion Presence of flavin nucleotide is essential for the activity of some enzymes.

Reason Flavin nucleotide is an activator of these enzyme.

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50. Assertion Due to excessive use of fertilizers, the available water to the plants becomes hypotonic in relation to cell sap.

Reason The water molecules as a result diffuse out of the cells due to endosmosis.

51. Assertion The nuclear envelope acts as an interface between the genetic component of the cell and the cytoplasm.

Reason It thus protects DNA against the mutagenic effect of cytoplasmic enzyme.

52. Assertion Waxy and cutin coating on plant parts reduce the transpiration.

Reason These adaptation are found in xerophytes.

53. Assertion Light is very important factor in transpiration.

Reason It induces stomatal opening and darkness closing. Therefore, transpiration increases in light and decreases in dark.

54. Assertion Mitochondria help in photosynthesis.

Reason Mitochondria have enzymes for dark reaction.

55. Assertion Aflatoxins are produced by *Aspergillus* flowers.

Reason These toxins are useful to mankind.

56. Assertion Histones are basic protein of major importance in packaging of eukaryotic DNA. DNA and histone comprise chromatine forming bulk of eukaryotic chromosome.

Reason Histones are five major types H_1, H_2A, H_2B, H_3 and H_4.

57. Assertion Photosynthetically C_4-plants are less efficient than C_3-plants.

Reason The operation of C_4-pathway requires the involvement of only bundle sheath cells.

58. Assertion λ SD and marijuan are clinically used as analgesics.

Reason Both these drugs suppress brain function.

59. Assertion Organ transplantation patients are given immunosppressive drugs.

Reason Transplanted tissue has antigens, which stimulate the specific immune response of the recepient.

60. Assertion Person suffering from haemophilia fail to produce blood cloting factor VIII.

Reason Prothrombin producing platelets in such persons are found in very low concentration.

General Knowledge

1. At high altitudes the boiling point of water lowers because
(a) atmospheric pressure is low
(b) atmospheric pressure is high
(c) temperature is low
(d) None of the above

2. The wildlife week is celebrated from
(a) 2-8 October (b) 1-7 June
(c) 16-22 April (d) 14-20 January

3. Saraswati Samman is given annually for outstanding contribution to
(a) literature (b) education
(c) fine arts (d) classical music

4. The headquarters of UNESCO is at
(a) Rome (b) Geneva
(c) Paris (d) New York

5. 'CDMA'-technology used in mobile phones stand for
(a) Computer Developed Management Application
(b) Code Division Mobile Application
(c) Code Division Multiple Access
(d) Code Division Mobile Application

6. Mixed Economy means
(a) where agriculture and industry are given equal importance
(b) where public sector exists along with the private sector innational economy
(c) where globalization is transferred with heavy dose of swadeshi in National Economy
(d) where the centre and the states are equal partners in economic planning and development

7. Who coined the term 'Hindu rate of Growth' for Indian Economy?
(a) AK Sen
(b) Kirit S Parikh
(c) Raj Krishna
(d) Montek Singh Ahluwalia

8. By virtue of which Act, dyarchy was introduced in India?
(a) Indian Council Act, 1909
(b) Government of Indian Act, 1919
(c) Government of India Act, 1955
(d) Indian Independece Act, 1947

9. The principle that disguishes Jainsim from Buddhism is the
(a) practice of the eight-fold path
(b) rejection of the infallibility of the Vedas
(c) attribution of a soul to all beings and things
(d) belief in rebirth

10. Which one of the following fairs is not correctly matched?
(a) Kautilya--Arthashastra
(b) Hala–Gathasaptasati
(c) Banbhatta–Buddhacharita
(d) Kalidasa–Abhijnanasakuntalam

11. Tides are comblied and they vary from place to place because of
(a) the movement of moon in relation to earth
(b) uneven distribution of water over the globe
(c) irregularities in the configuration of oceans
(d) All of the above

12. Who is the known as father of Biology?
(a) Aristotle
(b) Darwin
(c) Lamark
(d) Lamark and Treviranus

13. Study of fruit is called
(a) Spermology (b) Anthology
(c) Pedology (d) Pomology

14. The computer's processor consists of the following parts
(a) CPU and Main Memory
(b) Hard Disk and Floppy Drive
(c) Main Memory and Storage
(d) Operating System and Applications

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15. A pure substance can only be
(a) compound
(b) an element
(c) an element or compound
(d) a heterogeneous mixture

16. First National park developed in India is
(a) Gir (b) Kaziranga
(c) Jim Corbett (d) None of these

17. Who has been designated as the 'Man of the Decade' by Time Magazine?
(a) Nelson Mandela (b) Ronold Reagan
(c) Dalai Lama (d) None of these

18. The First-Earth summit was held at
(a) Buenos Aires (b) Rio de Jeneiro
(c) Dar-es-salam (d) None of these

19. Who is the author of the book 'Naked Triangle'?
(a) RK Narayan (b) Khushwant Singh
(c) Balwant Gargi (d) Amrita Pritam

20. With which game does Davis cup is associated?
(a) Hockey (b) Table Tennis
(c) Lawn Tennis (d) Polo

Answers

Physics

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

Chemistry

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

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Biology

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

General Knowledge

1. (a)	2. (a)	3. (d)	4. (c)	5. (c)	6. (b)	7. (c)	8. (b)	9. (c)	10. (c)
11. (d)	12. (a)	13. (d)	14. (c)	15. (c)	16. (c)	17. (d)	18. (b)	19. (c)	20. (c)

Hints *with* Solutions

Physics

1. Variation in g due to rotation of earth

$$g' = g - \omega^2 R \cos^2 \lambda$$

At poles, $\lambda = 90°$ in the above expression, we get

$$g_{pole} = g - \omega^2 R \cos^2 90°$$

$$\therefore \quad g_{pole} = g$$

i.e., there is no effect of rotational motion of the earth on the value of g at poles.

2. According to Gauss' law,

Electric flux $\phi = \frac{q}{\varepsilon_0}$

$$\phi = \frac{1}{\varepsilon_0}$$

$$\phi = (\varepsilon_0)^{-1}$$

3. Let the temperature at distance 60 cm from point B is θ

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where, K = coefficient of thermal conductivity

A = area of rod

$$\frac{KA(100-\theta)}{40} = \frac{KA(\theta-10)}{60}$$

or $$\frac{100-\theta}{2} = \frac{\theta-10}{3}$$

or $$300 - 3\theta = 2\theta - 20$$

or $$5\theta = 320$$

or $$\theta = 64°\,C$$

4. $\delta = \frac{wl^3}{4Ybd^3}$

or $$\delta \propto \frac{1}{Y}$$

5. $\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$

or $$V_2 = \frac{p_1V_1T_2}{p_2T_1}$$

$$\therefore \quad V_2 = \frac{1 \times 500 \times (273-3)}{0.5 \times (273+27)}$$

$$V_2 = \frac{1 \times 500 \times 270}{0.5 \times 300}$$

$$V_2 = 900\ m^3$$

6. $v = u + at$

$$20 = 0 + a \times 10$$

$$20 = a \times 10$$

$$a = 2\ m/s^2$$

Then, $$s = ut + \frac{1}{2}at^2$$

$$s = 0 + \frac{1}{2} \times 2 \times 10 \times 10$$

$$s = 100\ m$$

Work done $W = F \times s$

or $W = ma \times s$

$\therefore$ $W = 50 \times 2 \times 100$

$W = 10000 = 10^4\ J$

7. According to theorem of parallel axis

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

$$I = \frac{1}{2}MR^2 + \frac{MR^2}{4}$$

$$I = \frac{3}{4}MR^2$$

8. The excess pressure inside the bubble

$$p = \frac{4T}{r}$$

Then, $$p_1 = \frac{4T}{r_1} \quad \ldots (i)$$

$$p_2 = \frac{4T}{r_2} \quad \ldots (ii)$$

From Eqs. (i) and (ii)

$$\frac{p_1}{p_2} = \frac{\frac{4T}{r_1}}{\frac{4T}{r_2}} = \frac{r_2}{r_1}$$

$$\frac{p_1}{p_2} = \frac{1}{2}$$

9. From formula,

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

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

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

$$\Rightarrow \quad W' = 4W$$

10. Thermal conductivity

$$= \frac{\Delta Q}{t A \Delta\theta} = \frac{\text{Jm}}{\text{m}^2\text{sK}} = \text{Wm}^{-1}\text{K}^{-1}$$

11. Wavelength of photon will be greater than that of electron because mass of photon is less than that of electron $\Rightarrow \lambda_p > \lambda_e$

12. We know that

$$n = \frac{1}{T}$$

Given, $t = 3000$ yr

$$T = 600 \text{ yr}$$

$$n = \frac{3000}{600} = 5$$

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

$$\frac{N}{N_0} = \left(\frac{1}{2}\right)^5 = \frac{1}{32}$$

13. Distance, $x = b_0 + b_1 t + b_2 t^2$

Velocity $v = \left(\frac{dx}{dt}\right)$

$$= b_1 + 2b_2 t$$

Acceleration, $\alpha = \frac{d^2x}{dt^2} = 2b_2$

14. RMS speed of gas molecules does not depends on the pressure of gas (if temperature remains constant) because $p \propto \rho$. If pressure is increased n times density will also increase by n time but V_{rms} remains constant.

15. Given, $p_1 = 100$ mm, $V_1 = 200$ mL and $p_2 = 400$ mm

From Boyle's law

$$p_1V_1 = p_2V_2$$

$$V_2 = \frac{p_1V_1}{p_2}$$

$$= \frac{100 \times 200}{400}$$

$$V_2 = 50 \text{ mL}$$

Volume of 2 mole gas $= 2 \times 50$

$$= 100 \text{ mL}$$

16. Force due to magnetic field is

$$F = qvB \sin\theta$$

When, $\theta = 90°$

$$F = qvB \quad \ldots(i)$$

Force due to electric field E is

$$F = qE \quad \ldots(ii)$$

Equating Eqs. (i) and (ii), we get

$$|\mathbf{E}| = v|\mathbf{B}|$$

17. Given, $n = \frac{54}{60}$ Hz, $\lambda = 10$ m

Velocity $v = n\lambda = \frac{54}{60} \times 10 = 9$ m/s

18. From transformer ratio

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

$$\Rightarrow \quad V_s = \frac{V_p \times N_s}{N_p}$$

$$= \frac{220 \times 40000}{200} = 44000 \text{ V}$$

Potential difference per turn is

$$\frac{V_s}{N_s} = \frac{44000}{40000} = 1.1 \text{ V}$$

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19. From lens formula

$$\frac{1}{f} = ({}_a\mu_g - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$= (1.5 - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \ldots(i)$$

Also, ${}_l\mu_g = \frac{\mu_g}{\mu_l} = \frac{1.5}{1.6}$

$$\therefore \quad \frac{1}{f'} = ({}_l\mu_g - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

$$\frac{1}{f'} = \left(\frac{1.5}{1.6} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \ldots(ii)$$

Dividing Eq. (i) by Eq. (ii), we get

$$\frac{f}{f'} = \frac{\left(\frac{1.5}{1.6}\right)}{(1.5 - 1)} = -\frac{1}{16 \times 0.5}$$

$$f' = -16 \times 0.5 \times f$$

$$= 16 \times 0.5 \times 20$$

$$\Rightarrow \quad f' = -160 \text{ cm}$$

20. From Coulomb's law

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2} \quad \text{or} \quad \varepsilon_0 = \frac{q_1 q_2}{4\pi F r^2}$$

$\therefore$ Units of ε_0 (permittivity)

$$= \frac{C^2}{N\text{-}m^2} = C^2N^{-1}\ m^{-2}$$

21. Let R and r be the radii of bigger and each smaller drop respectively.

$$\therefore \quad \frac{4}{3}\pi R^3 = 8 \times \frac{4}{3}\pi r^3$$

$$\Rightarrow \quad R = 2r \qquad \ldots(i)$$

The capacitance of a smaller spherical drop is

$$C = 4\pi\varepsilon_0 r \qquad \ldots(ii)$$

The capacitance of bigger drop is

$$C' = 4\pi\varepsilon_0 R$$

$$= 2 \times 4\,\pi\varepsilon_0 r \qquad (\because R = 2r)$$

$$= 2C \qquad [\text{from Eq. (ii)}]$$

$$\therefore \quad C = \frac{C'}{2}$$

$$= \frac{1}{2}\mu F \qquad (\because C' = 1\mu F)$$

22. Mass of the particle = m

Spring constant = k

The time period of oscillator, $T = 2\pi\sqrt{\frac{m}{k}}$

As $k \propto \frac{1}{l}$ (where l = length of spring)

$$\because \quad k' = 2k$$

$$\therefore \quad T' = 2\pi\sqrt{\frac{m}{2k}} = \frac{1}{\sqrt{2}}T$$

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24. Potential energy = 2 × (Total energy) = $2E_0$

Because we know $U = -\frac{GMm}{r}$

$$E_0 = -\frac{GMm}{2r}$$

25. Total energy = KE + rotational KE

$$= \frac{1}{2}(2m)v^2 + \frac{1}{3}mv^2$$

$$= \frac{4}{3}mv^2$$

26. Coefficient of real expansion

$$\gamma_R = \frac{V_2 - V_1}{V_1(t_2 - t_1)}$$

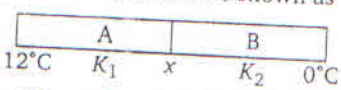
Here, $V_2 = \frac{3}{4}$, $V_1 = \frac{2}{3}$

and $(t_2 - t_1) = (100 - 20) = 80\,°C$

$$\therefore \quad \gamma_R = \frac{\left(\frac{3}{4} - \frac{2}{3}\right)}{\frac{2}{3}(80)} = \frac{1}{640}$$

$$= 15.6 \times 10^{-4}\,°C^{-1}$$

27. The given situation can be shown as



Rate of flow of heat will be equal in both the slabs

$$\therefore \quad (12 - x)K_1 = K_2(x - 0)$$

$$12 - x = 2x \qquad \left(\because K_1 = \frac{K_2}{2}\right)$$

$$\Rightarrow \quad x = 4\,°C$$

The temperature difference across slab

$$A = (12 - x) = (12 - 4)$$

$$= 8\,°C$$

28. The perceived frequency of sky wave for reflection from an ionospheric layer is $\nu_c = 9n^{1/2}$

Where, n is the number density of electrons/m^3.

Given, $n = 10^{11}/m^3$

$$\nu_c = 9 \times (10^{11})^{1/2}$$

$$= 2.8\ \text{MHz}$$

$$= 2\ \text{MHz}$$

29. Loss in KE $= \frac{m_1 m_2}{2(m_1 + m_2)}(u_1 - u_2)^2$

$$= \frac{4 \times 6}{2 \times 10}(12 - 0)^2$$

$$= 172.8\ J$$

30. $v = u - at$

$$0 = u - \mu gt$$

$$\mu = \frac{u}{gt} = \frac{6}{10 \times 10} = 0.06$$

31. Using law of conservation of momentum, we get

$$100 \times v = 0.25 \times 100$$

$$v = 0.25\ m/s$$

32. Initial thrust must be

$$m(g+a) = 3.5\times10^7\ (10+10)$$
$$= 7\times10^5\ \text{N}$$

33. $\eta = \dfrac{\text{Output}}{\text{Input}}$

$$\frac{80}{100} = \frac{20\times20}{1000\times i}$$
$$i = \frac{20\times120\times100}{1000\times80} = 3\ \text{A}$$

34. $\lambda_{min} = \dfrac{12375}{V}\overset{\circ}{\text{A}} = \dfrac{12375}{1}\overset{\circ}{\text{A}}$

$$= 12.375\ \text{kV} = 12.42\ \text{kV}$$

35. Number of spectral lines

$$N_E = \frac{n(n-1)}{2}$$
$$= \frac{3(3-1)}{2} = 3$$

36. From Wien law

$$\lambda_1 T_1 = \lambda_2 T_2$$
$$T_2 = \frac{\lambda_1 T_1}{\lambda_2}$$
$$= \frac{1200\times2600}{5000}$$
$$T_2 = 624\ \text{K}$$

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37. Specific heat for a monoatomic gas

$$C_V = \frac{3}{2}R$$

$\therefore$ Heat $\quad dQ = \mu C_V \Delta T$

$$dQ = 4\times\frac{3}{2}\times R\ (473-273)$$
$$= 4\times\frac{3}{2}\times R\times200$$

$\therefore$ $\quad dQ = 4\times300\,R \qquad (\because \mu = 4)$

$$= 1200\,R$$

38. Kinetic energy of sphere

$$K_{r_0} = \frac{1}{2}I\omega^2$$

$\therefore$ Moment of inertia of sphere, $I = \dfrac{2}{5}MR^2$

$\therefore$ Rotational kinetic energy of sphere

$$K_{r_0} = \frac{1}{2}MR^2\omega^2$$

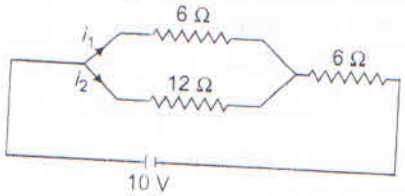
Total energy of sphere

$$K_{r_0} = \frac{1}{2}I\omega^2 + \frac{1}{2}Mv^2$$
$$= \frac{1}{2}\times\frac{2}{5}MR^2\omega^2 + \frac{1}{2}MR^2\omega^2$$
$$= MR^2\omega^2\left(\frac{1}{5}+\frac{1}{2}\right)$$
$$= \frac{7}{10}MR^2\omega^2$$

Total energy of sphere $K_{t_0} = \dfrac{7}{10}MR^2\omega^2$

$\therefore$ $\quad \dfrac{K_{r_0}}{K_{t_0}} = \dfrac{\frac{1}{5}MR^2\omega^2}{\frac{7}{10}MR^2\omega^2} = \dfrac{2}{7}$

39.



$$R = \frac{6\times12}{6+12} = \frac{6\times12}{18} = 4\ \Omega$$

Total resistance, $\quad R_{eq} = 6+4 = 10\ \Omega$

Current, $i = \dfrac{V}{R} = \dfrac{10}{10} = 1\ \text{A}$

The current in 12 Ω resistor is

$$i_2 = i\left(\frac{R_1}{R_1+R_2}\right) = 1\times\left(\frac{6}{6+12}\right)$$
$$i_2 = \frac{1}{3}$$

The potential difference in 12 Ω resistor

$$V = i\,2R = \frac{1}{3}\times12 = 4\ \text{V}$$

40. $A = 0.3\ \text{m}^2$,

$$n = 2\times10^{25}/\text{m}^3$$
$$q = 3t^2 + 5t + 2$$
$$i = \frac{dq}{dt} = 6t + 5 = 17$$
$$i = neAv_d$$

Drift velocity,

$$v_d = \frac{i}{neA}$$

$$= \frac{17}{2\times10^{25}\times1.6\times10^{-19}\times0.3}$$

$$= \frac{17}{0.96\times10^{-6}}$$

$$= 1.77\times10^{-5}\ \text{m/s}$$

41. Both body will take same time to reach the earth because vertical downward component of velocity for both the bodies will be zero and time of decent $t = \sqrt{\frac{2k}{g}}$. Horizontal velocity has no effect on the vertical direction.

42. Due to earth axial rotation, the speed of the trains relative to earth will be different and hence the centripetal forces on them will be different. Thus their effective weights $mg - \frac{mv^2}{r}$ and $mg + \frac{mv^2}{r}$ will be different. So they exert different pressure on the rails.

43. According to law of inertia (Newton's first law), when cloth is pulled from a table, the cloth came in state of motion but dishes remains stationary due to inertia. Therefore, when we pull the cloth from table the dishes remains stationary.

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44. The rise in temperature of the soft steel is an example of transferring energy into a system by work and having it appear as an increase in the internal energy of the system. This works well for the soft steel because it is soft. This softness results in a deformation of the steel under below of the hammer. Then the point of application of the force is displaced by the hammer and positive work is done on the steel with the hard steel, less deformation occur, thus, there is less displacement of point of application of the force and less work done on the steel the soft steel is therefore better in absorbing energy from the hammer by means of work and its temperature rises more rapidly.

45. The position of centre of mass of electron and proton remains at rest. As their motion is due to internal force of electrostatic attraction, which is conservative force. No external force is acting on the two particles, therefore centre of mass remains at rest.

46. As the distance from centre of earth decreases, acceleration due to gravity and at the centre of earth it becomes zero. $g' = g\left(1 - \frac{d}{R}\right)$. If $d = R$ then $g' = 0$

47. The two glass plates stick together due to surface tension.

48. The height of capillary rise is inversely proportional to radius (or diameter) of capillary tube

$$h \propto \frac{1}{r}$$

So, for smaller r the value of h is higher.

49. When the bob is placed in an electric field, the time period of simple pendulum will remain same as the bob is not charged. If simple pendulum having charged bob is placed in a horizontal electric field then the period will be decreased because there will be a increase in restoring force.

50. A thermocouple, which is also called thermoelectric detector can be used to detect temperatures. It is also true that working of thermoelectric refrigerator is based on the Peltier effect.

51. If a transparent medium of thickness t and refractive index μ is introduced in the path of one of the slits, then effective path in air is increased by an amount $(\mu - 1)t$ due to introduction of plate. Therefore, the zeroth fringe shifts to a new position where the two optical paths are equal. In such case fringe width remains unchanged.

52. The wavelength in Balmer series is given by

$$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right),\ n = 3, 4, 5$$

$$\frac{1}{\lambda_{max}} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$$

$$\frac{1}{\lambda_{max}} = \frac{36}{5R} = \frac{36}{5\times1.097\times10^7} = 6563\,\text{Å}$$

and $\frac{1}{\lambda_{min}} = R\left(\frac{1}{2^2} - \frac{1}{\infty^2}\right)$

$$\frac{1}{\lambda_{min}} = \frac{4}{R} = \frac{4}{1.097 \times 10^7} = 3646\,\text{Å}$$

The wavelength 6563Å and 3646Å lie in visible region.

Therefore, Balmer series lies in visible region.

53. According to Newton's corpuscular theory of light, the light should travel faster in denser media than in rarer media. It is contrary to present theory of light which explains that light travels faster in air (rarer) than in water (denser).

54. From the relation susceptibility of the material is

$$\chi_m = \frac{I}{H} \Rightarrow \chi_m \propto I$$

Thus, it is obvious that greater the value of susceptibility of a material greater will be the value of intensity of magnetisation *i.e.*, more easily it can be magnetised.

55. Since the initial phase difference between the two waves coming from different violins changes, therefore, the waves produced by two different violins does not interfere because two waves interfere only when the phase difference between them remains constant throughout.

56. In a hollow spherical shield, the charge is present only on its surface but charge is zero at every point inside the hollow sphere. Hence, the metallic shield in the form of hollow shell may be bulk to block an electric field.

57. A monoatomic gas molecule (like He) consists of a single atom. It can have translational motion in any direction in space. Thus, it has 3 translational degrees of freedom.

$f = 3$ (All translational)

It can also rotate but due to its small moment of inertia rotational kinetic energy is neglected.

The molecules of a diatomic gas (like O_2, CO_2, H_2) cannot only move bodily but also rotate about any one of the three coordinate axes. Hence, it can have two rotational degrees of freedom.

Thus, a diatomic molecule has 5 degrees of freedom : 3 translational and 2 rotational.

58. For diffraction to occur, the size of an obstacle/aperture is comparable to the wavelength of light wave.

59. Resolving power of telescope $= \frac{a}{1.22}\lambda$

where, a is the diameter of objective lens and λ is the wavelength of light used. It is obvious that on increasing a more light is collected by objective lens and so, the image formed is more bright. Thus, resolving power of telescope increases.

60. A radiation consists of a beam of charged particles. When radiation is used for cancer treatment, then on falling upon the cancerous tissues, it destroys the cancer cells.

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Chemistry

1. Chemically paper and cloth consist of cellulose. In plant eating animals digestion of cellulose takes place in presence of enzyme cellulase.

2. Diphenyl hydramine is employed as antihistamine.

3. Dunstan's test is used for identification of glycerol.

4. Neoprene is a ploymer of chloroprene which is chemically 2- chlorobuta - 1, 3 - diene.

$$n\,CH_2{=}\underset{\underset{Cl}{|}}{C}{-}CH{=}CH_2 \longrightarrow \left[CH_2{-}\underset{\underset{Cl}{|}}{C}{=}CH{-}CH_2\right]_n$$

chloroprene — neoprene

5. Etherates are complexes of ethers with Lewis acid.

$$R{-}O{-}R + \underset{\text{Lewis acid}}{BF_3} \longrightarrow \underset{R}{\overset{R}{\diagdown}}\ddot{O} \rightarrow BF_3$$

etherate

6. From Faraday's first law, $w = ZQ$

when $Q = 1\,C$

$w = Z$ = electrochemical equivalent

7. Given, pH = 14;

$\therefore$ $pOH = 0$

and $[OH^-] = 1\ M$

$[Cu^{2+}][OH^-]^2 = K_{sp} = 1 \times 10^{-19}$

$[Cu^{2+}] = 1 \times 10^{-19}\ M$

For the half reaction, $Cu^{2+} + 2e^- \longrightarrow Cu$

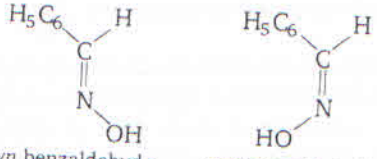
$$E_{Cu^{2+}/Cu} = E^\circ_{Cu^{2+}/Cu} - \frac{0.0591}{2} \log \frac{1}{[Cu^{2+}]}$$

$$= 0.34 - \frac{0.0591}{2} \log 10^{19} = -0.22\ V$$

8. Freon used as refrigerant is CCl_2F_2.

$$CCl_4 + 2\,HF \xrightarrow{Sb_2F_5} \underset{\text{freon}}{CF_2Cl_2} + 2HCl$$

9. $\underset{\text{benzaldehyde}}{C_6H_5CHO} + NH_2OH \longrightarrow$



syn benzaldehyde oxime

anti benzaldehyde oxime

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10. Electronegativity $\propto \frac{1}{\text{nucleophilicity}}$

least electronegative

$-\overset{-}{C}H_3$ has the highest nucleophilicity.

11. The correct order of pH of isomolar solution in sodium oxide (pH_1), sodium sulphide (pH_2), sodium selenide (pH_3) and sodium telluride (pH_4) is $pH_1 > pH_2 > pH_3 > pH_4$ because in aqueous solution, they are hydrolysed as follows

$$Na_2O + 2H_2O \longrightarrow \underset{\text{strong base}}{2NaOH} + \underset{\text{water}}{H_2O}$$

$$Na_2S + 2H_2O \longrightarrow \underset{\text{strong base}}{2NaOH} + \underset{\text{weak acid}}{H_2S}$$

$$Na_2Se + 2H_2O \longrightarrow \underset{\text{strong base}}{2NaOH} + \underset{\text{weak acid}}{H_2Se}$$

$$Na_2Te + 2H_2O \longrightarrow \underset{\text{strong base}}{2NaOH} + \underset{\text{weak acid}}{H_2Te}$$

Order of neutralisation of NaOH

$$H_2Te > H_2Se > H_2S > H_2O$$

Order of acidic strength

$$H_2Te > H_2Se > H_2S > H_2O$$

Hence, their aqueous solutions have the following order of basic character due to neutralisation of NaOH with H_2O, H_2S, H_2Se and H_2Te.

$$Na_2O > Na_2S > Na_2Se > Na_2Te$$

(∵ pH of basic solution is higher than acidic or least basic solution).

12. Mole fraction of $P = \frac{3}{3+2} = \frac{3}{5}$

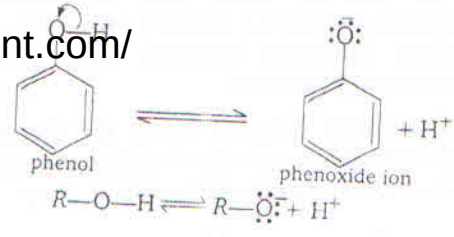
Mole fraction of $Q = \frac{2}{3+2} = \frac{2}{5}$

Hence, total vapour pressure = (Mole fraction of P × Vapour pressure of P) + (mole fraction of Q × Vapour pressure of Q)

$$= \left(\frac{3}{5} \times 80 + \frac{2}{5} \times 60\right) = 48 + 24$$

$= 72$ torr

13. Phenols are much more acidic than alcohols due to the stabilisation of phenoxide ion be resonance.



phenol — phenoxide ion

$R-O-H \rightleftharpoons R-\ddot{O}:^- + H^+$

not stabilised due to absence of resonance

ortho-nitrophenol is most acidic because in it $-NO_2$ electron attracting group is attached on *ortho*-position which helps in stabilizing of negative charge on the oxygen of phenoxide ion. Hence, due to this reason acidic character of phenol is increased, while on attachment of $-CH_3$ group (electron donating group) acidic strength of phenol is decreased in cresol due to destabilization of phenoxide ion.

14. The spontaneity of reaction is based upon the negative value of ΔG. ΔG is based upon T, ΔS and ΔH according to following equation (Gibbs-Helmholtz equation)

$$\Delta G = \Delta H - T\Delta S$$

If the magnitude of $\Delta H - T\Delta S$ is negative, then the reaction is spontaneous.

when $T\Delta S > \Delta H$ and ΔH and ΔS are +ve, then ΔG is negative.

15. (a) $_{21}Sc^{3+} = 1s^2, 2s^2 2p^6, 3s^2 3p^6$

It is colourless due to absence of unpaired electrons in *d*-subshell.

(b) $26\,Fe^{2+} = 1s^2,\ 2s^2\ 2p^6,\ 3s^2 3p^6 3d^6$

It is colourless due to presence of four unpaired electrons in *d*-subshell.

(c) $_{22}Ti^{3+} = 1s^2,\ 2s^2 2p^6, 3s^2 3p^6 3d^1$

It is coloured due to presence of one unpaired electron in *d*-subshell.

(d) $_{25}Mn^{2+} = 1s^2,\ 2s^2 2p^6, 3s^2 3p^6 3d^5$

It is coloured due to 5 unpaired electrons in *d*-subshell.

16. $_{23}V = 1s^2 2s^2 2p^6, 3s^2 3p^6 3d^3, 4s^2$

$_{24}Cr = 1s^2 2s^2 2p^6, 3s^2 3p^6 3d^5, 4s^1$

$_{26}Fe = 1s^2 2s^2 2p^6, 3s^2 3p^6 3d^6, 4s^2$

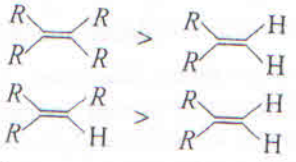
$_{25}Mn = 1s^2 2s^2 2p^6, 3s^2 3p^6 3d^5, 4s^2$

Third electron which is removed in third ionisation enthalpy belongs to 3*d*-subshells. It means in all elements, shell and subshells are same therefore, third ionisation energy is based upon stability of *d*-subshell. Hence, Mn shows highest third ionisation energy.

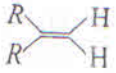
17. Stability of alkene

$$\propto \frac{1}{\text{Heat of hydrogenation of alkene}}$$

Greater the number of alkyl groups attached to the doubly bonded carbon atoms, more stable is the alkene. Hence, given alkene follow the following order of stability.



Hence, faster hydrogenation occurs in



18. For first order reaction,

$$A \longrightarrow B$$

rate = $k \times [A]$

Given, rate = 2.0×10^{-5} mol $L^{-1}s^{-1}$

$[A]$ = Conc. of A = 0.01 M

So, $2.0 \times 10^{-5} = k \times 0.01$

$$k = \frac{2.0 \times 10^{-5}}{0.01}\ s^{-1}$$

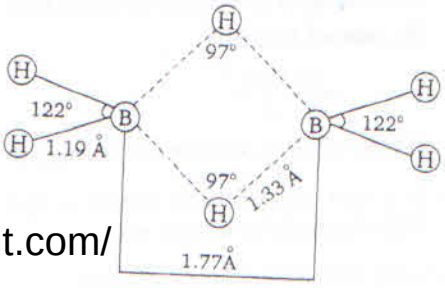
$$= 2.0 \times 10^{-3} s^{-1}$$

For first order reaction

$$T_{1/2} = \frac{0.693}{k} = \frac{0.693}{2.0 \times 10^{-3}}$$

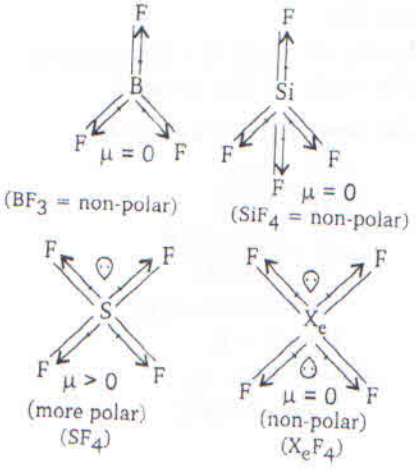
$$= 346.5 \approx 347\ s$$

19. B_2H_6 is electron deficient molecule because boron atom has three half-filled orbitals in excited state. The structure of B_2H_6 is represented as follows



In it, two electrons of B—H bond are involved in formation of three centre bond, these bonds are represented as dotted line.

20.



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21. Aliphatic S_N1 reaction is carried out in two steps. In first step carbocation is formed and its formation is based on the stability of carbocation.

$$C_6H_5\overset{+}{C}H_2 > CH_3—\overset{+}{C}H—CH_3 > CH_3—\overset{+}{C}H_2$$

In second step, nucleophile is attracted towards carbocation to give final products. Hence, order of S_N1 reaction is

$$C_6H_5\overset{+}{C}H_2 > CH_3—\overset{+}{C}H—CH_3 > CH_3—\overset{+}{C}H_2$$

The aryl halides *e.g.*, chlorobenzene are less reactive as compared to alkyl halides towards nucleophilic reagents in either S_N2 or S_N1 reaction because carbon-halogen bond in the aryl halide is strong (due to its double bond character).

22. $A + B \longrightarrow$ Product

$$\text{Rate} \propto [A][B]^{-2} \quad \ldots(i)$$

The rate decreases by factor 4 if the concentration of reactant '*B*' is doubled.

So, rate $\propto [A][2B]^{-2}$

$$\propto \frac{[A][B]^{-2}}{4} \quad \ldots(ii)$$

Hence, order of reaction *wrt* reactant *B* is –2.

23. In a face centred cubic lattice, a unit cell is shared equally by six unit cells.

24. $\because \Delta T_f = K_f \times$ molality of solution

and $\Delta T_b = K_b \times$ molality of solution

$$\therefore \quad \frac{\Delta T_f}{\Delta T_b} = \frac{K_f}{K_b}$$

Given that

$\Delta T_b = T_2 - T_1 = 100.18 - 100 = 0.18\,°C$

K_f for water $= 1.86\,K\ kg\ mol^{-1}$

K_b for water $= 0.52\,K\ kg\ mol^{-1}$

$$\therefore \quad \frac{\Delta T_f}{0.18} = \frac{1.86}{0.512}$$

or $$\Delta T_f = \frac{1.86 \times 0.18}{0.512}$$

$$= 0.6539 \approx 0.65$$

$$\Delta T_f = T_1 - T_2$$

$$0.654 = 0\,°C - T_2$$

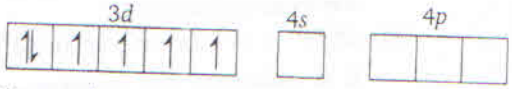
$$\therefore \quad T_2 = -0.654°C$$

($T_2 \rightarrow$ Freezing point of aqueous urea solution).

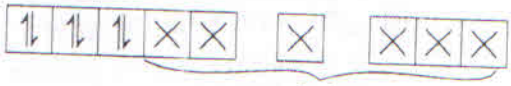
25. In $[Co(NH_3)_6]^{3+}$, oxidation state of Co = + 3 and its coordination number is six.

So, $_{27}Co = 1s^2, 2s^2, 2p^6, 3s^2 3p^6 3d^7, 4s^2$

$Co^{3+} = 1s^2 2s^2 2p^6, 3s^2 3p^6 3d^6$



In complex ion



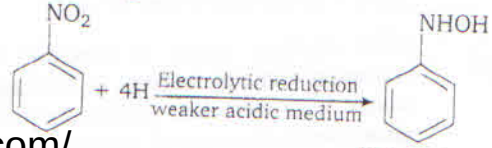
d^2sp^3-hybridisation

Thus, $[Co(NH_3)_6]^{3+}$ shows inner orbital complex as well as diamagnetic in behaviour (due to absence of upaired electron).

$[Zn(NH_3)_6]^{2+} \rightarrow sp^3d^2$ hybridisation (outer) and diamagnetic.

$[Cr(NH_3)_6]^{3+} \rightarrow d^2sp^3$ hybridisation (inner) and paramagnetic.

26.



N-phenyl hydroxyl amine

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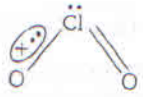
27. ClO_2 shows paramagnetic character due to presence of unpaired electron in its structure.



28. Correct order of acid strength is

$$\underset{+1}{HClO} < \underset{+3}{HClO_2} < \underset{+5}{HClO_3} < \underset{+7}{HClO_4}$$

($\because$ acid strength $\propto$ oxidation number).

29. Least reactive metals like silver and gold are obtained by cyanide process. In this process the impure metal is treated with NaCN (solution) and air is passed. Metal is converted into soluble complex as

$$4Au + 8CN^- + 2H_2O + O_2 \rightarrow 4[Au(CN)_2]^-$$

soluble complex + $4\,OH^-$

30. Weight of 11.2 dm^3 of CO_2 gas at STP

$$= \frac{44}{2} = 22\,g$$

$$KOH + CO_2 \longrightarrow KHCO_3$$

56 g 44 g

KOH required for complete neutralisation of 22 g $CO_2 = \frac{56}{44} \times 22 = 28\,g$

31. Energy required to break one Cl — Cl bond

$$= \frac{\text{Bond energy per mole}}{\text{Avogadro's number}}$$

$$= \frac{243 \times 10^3}{6.023 \times 10^{23}}\ J$$

Let the wavelength of the photon required to break one Cl — Cl bond be λ.

$$\lambda = \frac{hc}{E} = \frac{6.6 \times 10^{-34} \times 3 \times 10^8 \times 6.023 \times 10^{23}}{243 \times 10^3}$$

$$= \frac{119.255 \times 10^{-34} \times 10^{31} \times 10^{-3}}{243}$$

$$= 4.91 \times 10^{-7}\ m$$

32. $\because \frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$

$$\frac{p_1 \times 4}{T_1} = \frac{2p_1 \times V_2}{2T_1}$$

$$2V_2 = 8$$

$$V_2 = 4\ dm^3$$

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33. $M = \frac{M_1V_1 + M_2V_2 + M_3V_3}{V}$

For Ist solution (pH = 3) $[H_3O^+] = 10^{-3}$ M

For IInd solution (pH = 4) $[H_3O^+] = 10^{-4}$ M

For IIIrd solution (pH = 5) $[H_3O^+] = 10^{-5}$ M

Total $[H_3O^+] = \frac{10^{-3} + 10^{-4} + 10^{-5}}{3}$

$[H_3O^+] = 0.00037$

$[H_3O^+] = 3.7 \times 10^{-4}$ M

34. It is a colloidal sol of gold.

35. Insuline is a proteinaceous hormone. It is secreted by pancreas and controls the metabolism of glucose and maintains glucose level in the blood.

36. RNA contains cytosine and uracil as pyrimidine bases while DNA has cytosine and thymine as pyrimidine bases. Both RNA and DNA have the same purine bases *i. e.*, guanine and adenine.

37. Wurtz reaction is not used to prepare alkanes from alkyl halides.

$$2R — X + 2Na \xrightarrow{\text{Dry ether}} \underset{\text{alkane}}{R — R} + 2NaX$$

38. H_2N—C$_6$H$_4$—CH_3 + $CHCl_3$ + alc.KOH ⟶

p-toluidine

CN—C$_6$H$_4$—CH_3 + 3KCl + $3H_2O$

It is an example of carbylamine reaction.

39. $CH_3 — \underset{\underset{O}{\|}}{C} — H + HCN \longrightarrow CH_3 — \underset{\underset{OH}{|}}{\overset{\overset{CN}{|}}{CH}}$

acetaldehyde — acetaldehyde cyanohydrin

$$\xrightarrow[H_3O^+]{} CH_3 — \underset{\underset{OH}{|}}{CH} — COOH \xrightarrow{[O]}$$

$CH_3 — \overset{\overset{COOH}{|}}{C}{=}O$

pyruic acid

40. Cl^- is the best leaving group being the weakest nucleophile out of NH_2^-, Cl^-, $\bar{O}C_2H_5$ and CH_3COO^-.

41. Mercury vapours are invisible as no metallic bonding is possible in vapour state.

42. Fluorine is the most reactive of all halogens due to its low bond dissociation enthalpy.

43. In BF_3, boron is sp^2-hybridised, so it is trigonal planar. In NF_3, nitrogen is sp^3-hybridised. But due to the presence of one lone pair it becomes pyramidal from tetrahedral.

Pyramidal

44. The free gaseous Cr atom has six unpaired electrons due to following electronic configuration (atomic number = 24) $= [Ar]3d^5 4s^1$. This is because half-filled *d*-orbital is more stable as compared to incompletely filled *d*-orbital. So, one electron jumps from $4s^2$-orbital to 3*d*- orbital.

45. At critical temperature, it is not possible to state whether the substance is in the gaseous form or in the liquid form. Infact, both the states become indistinguishable at the critical point. The surface of separation between liquid and gas disappears. At this point, the various physical properties such as density, refractive index etc., have identical values for the states.

46. Molar heat of vaporisation of water is more than ethanol because of presence of stronger H–bonding in water as compared to ethanol due to which large amount of energy is required to break H–bond in H_2O. Ethanol is a volatile liquid due to weak H–bond.

47. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

$$K_C = \frac{[NH_3]^2}{[N_2][H_2]^3} = \frac{[\text{mol L}^{-1}]^2}{[\text{mol L}^{-1}][\text{mol L}^{-1}]^3}$$

$$= \text{mol}^{-2}\,\text{L}^2$$

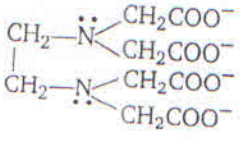
48. Reason is the correct explanation of assertion.

49. *o*-hydroxy benzaldehyde shows chelation or intramolecular H–bonding while *p*-hydroxy benzaldehyde shows intermolecular H–bonding.

50. Salting out action of soap is based on the principle of solubility product. Common ion effect is for weak electrolytes (either acids or bases).

51. van–Arkel method involes use of I_2 to form volatile iodide of metals which on decomposition gives pure metals.

52. EDTA has six sites to donate electron.



53. $Na_2S + Na_2[Fe(NO)(CN)_5] \longrightarrow Na_4[Fe(NOS)(CN)_5]$ (violet)

54. $H_2\overset{1-}{O}_2 \longrightarrow H_2\overset{2-}{O} + \frac{1}{2}\overset{0}{O}_2$

55. IE_1 of nitrogen is higher than that of IE_1 of oxygen due to the removal of an electron from stable orbital *i. e.*, $2p^3$ ($_7N = 1s^2\ 2s^2 2p^3$).

Across a period effective nuclear charge increases with increase in atomic number because electrons enter in the same shell.

56.

α–position (—OH at C_1 is towards right)

β–position (—OH at C_1 is towards left)

57. Nitro group is an electron withdrawing group (–*I* groups). It stabilise the carbanion because it disperse the negative charge on the carbon by attracting electrons or negative charge. So, both the statements are true and correct explanation.

58. Alkyl benzene is not prepared by Friedel-Craft's alkylation because the monoalkyl product undergo alkylation to produce polyalkylated benzene. The reason that acyl halide are more reactive than alkyl halide is also true but reason is not the correct explanation for assertion.

59. On keeping benzyl bromide in acetone water, it produces benzyl alcohol because benzyl bromide is hydrolysed easily by acetone water. Also this reaction proceed by S_N2 mechanism.

60. Iodoform test is given by compound which either have $CH_3\underset{OH}{\underset{|}{C}}H-$ group or $H_3C-\overset{O}{\overset{\|}{C}}-$ group. Isobutanal is

$H_3C-\underset{CH_3}{\underset{|}{CH}}-CHO$. It has one α-H atom. Therefore, it cannot give iodoform test.

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Biology

1. Energy flow is always unidirectional and it follows IInd law of thermodynamics. Energy is transferred from one trophic level to another trophic level but does not revert back.

2. RH Whittaker in year 1969 divided all organism into five kingdom these are

Monera → Kingdom of prokaryotes
Protista → Kingdom of unicellular eukaryotes
Fungi → Kingdom of unicellular decomposers.
Plantae → Kingdom of multicellular producers.
Animalia → Kingdom of multicellular consumers.

3. Myoplasma is the smallest living cell which is devoid of cell wall.

4. The correct order of stages of cellular respiration are

Glycolysis → Krebs' cycle → Electron transport system

5. The positions of these DNA fragments on the electrophoresis gel depends upon relative molecular weight.

The fragment with lowest molecular weight will appear farther from the wall and fragment with higher molecular weight will appear near the wall. So on the basis of information given. Molecular weight of *d* is maximum and molecular weight of *b* is minimum. So, the order of fragment will be

(*b*, *a*, *c*, *d*).

6. Palindromic sequences is the sequence in which sequences of bases is same when read in both orientations

e.g., 5′—AGCGCT—3′
3′—TCGCGA—5′

7. IUCN stands for

International Union for the Conservation of Nature.

8. Tendrils in plants are an example of divergent evolution because tendril is a modified axillary branch which modifies itself to support the plant.

9. Haemoglobin is a Fe-S protein, which carries O_2 in human blood. It is a tetrameric protein having 2 α and 2 β chain. Fe^{2+} present in the haem structure binds to the CO_2.

10. Stomatal opening is affected by carbon dioxide concentration light and temperature.

11. Taxonomic hierarchy refers to the step-wise arrangement of all categories for classification of plants and animals.

12. Oxytocin is released from the anterior portion of pitiatary gland which induces parturition.

13. Excess carbohydrates and proteins are stored in body as starch.

14. Both sickle-cell anaemia and Hutingtons disease are congenital disorders. sickle-cell anaemia is the X-linked trait in which one β-chain of haemoglobin is different. 6th amino acid of β-chain is valine instead of glutamic acid. Due to this patients haemoglobin level is reduced to half of the normal and person becomes anaemic.

Huntingtons disease is also due to presence of repetetive motifs, which occurs due to repetition of few residues.

15.

Vitamin		Deficiency diseases
Vitamin- B_{12}	—	Pernicious anaemia
Vitamin- B_6	—	Scaly skin, cracks at the corner of mouth
Vitamin- B_1 (thiamine)	—	Beri-beri
Vitamin- B_2 (Riboflavin)	—	Pellagra

16. Exchange of segments of non-sister chromatids between the chromosomes of a homologous pair is termed as crossing over.

Translocation is the process of exchange of segments of two non-homlogous pair of chromosomes.

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Chromosomal aberration is the alteration in the chromosome number or structural changes within the chromosome.

Transformation is the process of transfer of DNA from one bacterial cell to another.

17. Okazaki fragments are the small DNA fragments, which are synthesized from DNA polymerase III on the lagging strand. It is plays an important role to understand the non-conservative nature of DNA replication.

18. The understanding of genetic transformation in bacteria was made by **Frederick F Griffth.**

19. ***Taq* polymerase** used in PCR is obtained from thermophilic bacteria *Thermus aquaticus*.

20. The genotypic constitution of parent having violet coloured flowers is heterozygous condition.

♂ × ♀

Vv vv

(violet) (white)

F_1- Vv Vv vv vv

Violet flowers White flowers

1:1 condition

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21. In a DNA segment amount of adenine is equal to thymine. According to given information adenine and thymine constitutes 45% of DNA. So, guanine and cytosine will constitute 55%. Amount of guanine is equal to cytosine so amount of guanine in DNA will be 55/2 = 27.5%

22. Typhoid fever is caused by species of *Salmonella typhi*.

23. HIV is a member of viruses called retroviruses. It contain ssRNA when it infects the host cell ssRNA is transcribed into cDNA and integrate into DNA.

24. E.coli contain single chromosome. So, the number of linkage groups in E.coli is 1.

25. Natural cytokinins are synthesized in tissue that are rapidly dividing.

26. Resemblance of one organism to anotehr for protection and hiding is camouflage.

27. Spirochaetes are the class of bacteria these are thick cell walled structure.

28. The metachromatic granules are the type of inclusion bodies present in bacteria.

29. Clamp connection is found in Ascomycetes.

30. AUG is a initiation codon which codes for methionie

Valine → GUU

Histidine → CAU

Phenylalanine → UUU or UUC

31. Fluid mosaic model of plasma membrane was given by Singer and Nicholson in year 1972. The biological membrane are considered to be a quasified structure in which the lipids and integral proteins are arranged in a mosaic manner.

Gorter and Grantal measured the lipid content of haemolyzed eythrocytes and concluded that cell membrane are chiefly formed of phospholipids arranged to form a bimolecular lipid sheet.

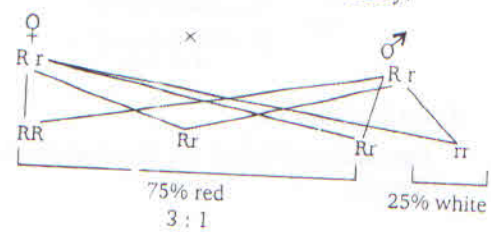
32. Cell respiration is carried out by mitochondria. Krebs' cycle take place in mitochondrial matrix and electron transport chain occurs in the inner mitochondrial membrane.

33. In a lac operon the lactose molecules function as inducer, which binds to the repress or protein.

34. A recessive mutant is one which is expressed only in homozygous or hemizygous stage.

35. Humoral immunity system is mediated by B-cells. T-cells and natural killer cells are involved in cell medicated immunity.

36.



The genotypic constitution of parents having red coloured flowers will be both heterozygous condition.

37. Adenine + Thymine = 60%

The amount of guanine + cytosine = 40%

So, the amount of guanine in this DNA will be = 20%

38. Toxin genes *cry* I *Ac* and *cry* II *Ab* are responsible for controlling ***Leptidopteran*** insercts. These are responsible for controlling bollowrom.

39. In flowering plant, pollen tube first arrives in a synergid cell.

40. Secondary oocyte again divides by second meiotic division and again give rise to two unequal sized cell. Larger of these two is known ovum (functional female gamete) and smaller one is called second polar body. Sometimes first polar body also divides simultaneously with secondary oocyte and give rise to two polar bodies. Thus in a complete oogenesis three polar bodies and one functional female gamete or ovum through a meiotic division is formed.

41. The final stage of [illegible] cytochrome oxidase which contain copper. This stage can be specifically inhibited by cyanide or carbon monoxide cyanide combines with copper and prevents O_2 combining with it.

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42. The recognition site in vector should be many and responsive to many restriction anzymes so that combination of enzymes could be used in cleaning.

43. Milk secretion is maintained as long as breast feeding and hence, hromone production continues. A woman does not conceive during the lactation period becaused lactation stimulates prolactin swecretion, which inhibits GnRH secretion and ovulation is inhibited.

44. Allelopathy is a phenomenon associated with plants in which one plant produce some chemical substance, which inhabits the growth of other plant species. In ammensalism one species suffer and other remain unaffected.

45. Bats and whales are the members of class-Mammalia (L-mamma = breast). The bats are the only mammals, which have wings and can really fly, while whales are the largest animals in existence. Both bats and whales have four chambered heart but birds and crocodiles also have four chambered heart.

46. Histamine is released by mast cells in case of allergic and inflammatory reaction. Histamine acts as a vasodilator.

47. The possibility of blood clumping depends on anti A or anti B antibody, *i.e.*, antibody A reacts with antigen A and antibody B react with antigen B and renders highly stickness to each other the RBCs containing a particular antigen clump together.

48. In monocot stem, the vascular bundle is collateral and closed. The vascular bundle without cambium is called closed vascular bundle.

49. The flavin nucleotide is co-enzyme, *i.e.*, loosely attached non-protein organic group, which can easily separate from the apoenzyme. Co-enzyme function in group transfer reaction is isomerisation and oxidation reduction reaction.

50. Due to excessive use of fertilizers, the available water to plants become hypertonic in relation to the cell sap. As a result the H_2O molecule diffuse out of the cell due to exosmosis.

51. The nuclear envelop acts as an interface between the genetic component of the cell and the cytoplasm. It protects the DNA against mutagenic effect of cytoplasmic, enzyme.

52. Xerophyte is a group of specific plants, which have adaptic for xeric habitats, *i.e.*, these plants occur in soil which do not have sufficient amount of water. These plants have developed some specific structure such as thick cuticle, sunken stomata waxy coating. Hair surface for minimizing the process of

transpiration which is a main source of water loss in form of vapours in mesophytes.

53. Light induces opening of stomata and increase the temperature, both these factor help in increase of transpiration while darkness causes closure of stomata and reduces the rate of transpiration. Transpiration depends on closure and opening of stomata.

54. The process of photosynthesis take place in chloroplast (green chlorophyll containing cytoplastmic cell organelles of plant cell) and not in mitochondria. The mitochondria are sites of aerobic respiration. Here, Krebs' cycle and electron transport system occures.

55. Aflatoxin is a mycotoxin produced by the fungus *Aspergillus flavus* a common mold. Contaminated food is the main sources of infection.

This toxin causes alfatoxines is which may lead ro haemorrhize cirrosis of liver and cancer of liver in human beings.

56. Chromosomes contain DNA and histones. DNA with histone octomer form nucleosome, which comprises a major part of chromatin. Histone are of five types H_1, H_2A, H_2B, H_3 and H_4.

57. Photosynthetically C_4-plants are more efficient than C_3-plants because these have Kranz anatomy. (Connective undifferentiated mesophyll around vascular bundles with chloroplast containing bundle sheath cells). Bundle sheath chloroplast are larger agranal and without PS-II activity and perform C_3 cycle.

58. LSD (Lysergic Acid Diethylamide) can be obtained from *Claviceps purpurea* (fungus) and marijuna obtained from *Cannabis sativa*. Both these drugs are hallucinogens and do not used as analgesices. Hallucinogens are chemicals which do not suppresses brain function instead alters a persons thoughts feeling and perception.

59. Immunosuppressive drugs prevent the production of antibodies. These drugs are used during organ transplantation to prevent, rejection by a recipient body of a organ transpianted from a donor.

60. Haemophilia is a hereditary diseases in which bloood fail to clot due to the absence of factor VIII. It is called haemophilia a haemophilia-B or christmas disease occurs to factor IX (plasma thromboplastin component) deficiency).

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