Max. Time : $3\frac{1}{2}$ hrs. Max. Marks : 200

PART I. PHYSICS

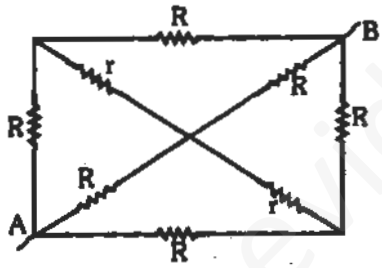
1. A metal rod of length L is clamped at a distance L/4 from one end. It is set into longitudinal vibrations by pulling on length-wise with a resin cover cloth piece. The wavelength for fundamental mode of vibration will be

(a) L/4 (b) 3L/4 (c) L (d) L/2

2. A thin equiconvex lens has focal length 10 cm, refractive index 1.5. One of its faces is now silvered, and it is seen that an object placed at distance U in front of it, has its image coinciding the object. The value of U is

(a) 20 cm (b) 10 cm
(c) 5 cm (d) 20 cm

3. Six resistors each of resistance R and two resistors each of resistance r are connected in the network shown below. The equivalent resistance between A and B is



(a) 3R + r (b) 6R + 2r
(c) 2R/3 (d) $\frac{R}{3}+\frac{r}{3}$

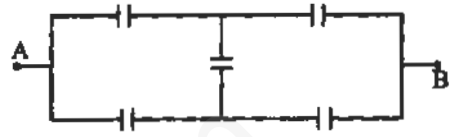
4. A circular loop of radius r carries a current i. It is equivalent to a magnetic dipole of magnetic moment

(a) $\pi r^2 i$ (b) i r (c) $2\pi ir$ (d) $\frac{i}{r2}$

5. Power factor in a series R-L-C resonant circuit is

(a) 0.5 (b) 0.707
(c) 1 (d) zero

6. In the network given below all the five capacitors have the same capacitance C each. Then the capacitance between the terminal A and B will be



(a) $\frac{C}{5}$ (b) 5 C (c) C (d) $\frac{5}{2}C$

7. The stationary wave produced in a stretched string is given by

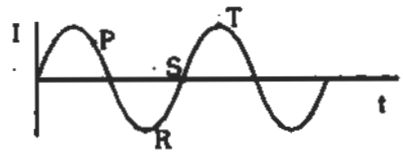
$$Y = A \cos\left(\frac{2\pi x}{\lambda}\right) \sin\left(\frac{2\pi t}{T}\right)$$

The corresponding progressing wave has an amplitude equal to

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

8. A sinusoidal a.c. flows in an inductor as shown in the graph below :-

Then the p.d. across the inductor is a maximum at the instant indicated on the graph by the point



(a) S (b) P (c) R (d) T

9. Which of the following relations between weber, second, ampere and volt is correct ?

(a) weber/second = volt
(b) weber × second = volt
(c) weber/second = ampere
(d) weber × second = ampere

10. A circular coil of radius R carries a current in it. The magnetic field along its axis decreases as we move away from its centre. The space rate of fall of this field is constant at distance equal to

(a) 2 R (b) R
(c) 3 R (d) R/2

11. A soap film is formed on a wire ring held vertically and allowed to drain. A diffuse source of white light is observed by reflection in the soap film. In this connection indicate the wrong statement:

(a) The colours are due to refraction of light by the wedge-shaped film
(b) The thickness of the film is of the same order as the wavelength of visible light
(c) The band of colours move downwards as the film drains.
(d) Just before the film breaks, it may appear black at the top.

12. The specific charge of an electron is

(a) 5.7×10^{7} Coulomb/kg
(b) 1.76×10^{11} Coulomb/kg
(c) 1.6×10^{-19} Coulomb/gm
(d) 1.6×10^{-19} Coulomb.

13. Vectors $3\vec{i} - 2\vec{j} + \vec{k}$ and $2\vec{i} + 6\vec{j} + m\vec{k}$ will be perpendicular to each other if

(a) m = 8 (b) m = 6
(c) m = 3 (d) m = 1.

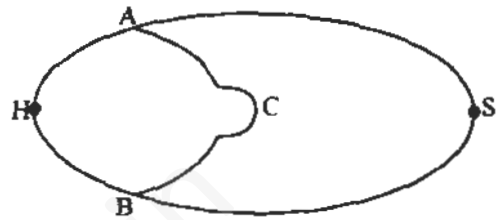
14. "Newton-second" is the unit of

(a) energy (b) momentum
(c) angular momentum
(d) velocity.

15. In the S.I. system the unit of energy is

(a) electron-volt (b) joule
(c) calorie (d) erg.

16. Two rods of the same length L but cross-section in the ratio $S_B/S_A = 4$ are joined at a heater H and a heat sink S as shown. The rate of heat flow to S is found to be R_o. If points of A and B at distances L/3 each from H are now joined by a conductor C of length L and the cross-section of C is such that 3c = 2S/A, the new rate of heat flow to S will be (see figure)



(a) $\frac{6}{5} R_o$ (b) $\frac{13}{12} R_o$
(c) R_o (d) $\frac{7}{5} R_o$.

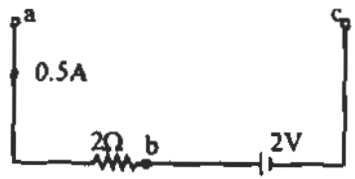
17. Most of the comets moving round the sun have orbits of the shape of

(a) a hyperbola (b) a parabola
(c) an elongated ellipse
(d) a circle.

18. Kirchoff's laws are applicable to

(a) A.C only (b) D.C only
(c) Both (a) and (b)
(d) Intermittant currents only.

19. In the given diagram, a current of 0.5 A is caused to pass through a resistor as shown. The emf of the cell is 2 V, and its internal resistance is zero. Indicate the wrong statement :



(a) the p.d. between a and c is 1.0 V
(b) the p.d between a and b is 1.0 V

(c) b is at a higher potential than c
(d) a is at a higher potential than c.

20. In LCR circuit if $\frac{1}{LC} > \frac{R^2}{4L^2}$, the circuit is

(a) oscillatory (b) dead beat
(c) critically damped
(d) none of the above.

21. To use a transistor as an amplifier

(a) the emitter-base junction is forward biased and collector-base junction is reverse biased
(b) both junctions are reverse biased
(c) both junctions are forward biased
(d) it does not matter how the transistor is biased, it always works as an amplifier.

22. An oscilloscope measures the

(a) Peak to peak value of AC voltage
(b) RMS value of AC voltage
(c) D.C. value of a voltage
(d) None of the above.

23. De Broglie wavelength λ is proportional to

(a) $\frac{1}{\sqrt{E}}$ for photons and 1/E for particles
(b) 1/E for photons and $\frac{1}{\sqrt{E}}$ for particles
(c) 1/E for both photons and particles in motion
(d) $\frac{1}{\sqrt{E}}$ for both photons and particles.

24. A given semiconductor has electron concentration of 8×10^{13} per cm^3 and a hole concentration of 5×10^{12} per cm^3. What is the resistivity of this sample if the electron mobility is 23,000 cm^2/V and hole mobility is 100 cm^2/V?

(a) 3.395×10^{-4} ohm × cm
(b) 3.395 ohm × cm
(c) 5×10^{-6} ohm × cm
(d) 45×10^{-6} ohm × cm.

25. What angle θ to the horizon will be formed by the surface of petrol in the tank of a motor car moving horizontally with a constant acceleration of 2.44 m/s^2?

(a) θ = 14° (b) θ = 45°
(c) θ = 30°. (d) θ = zero

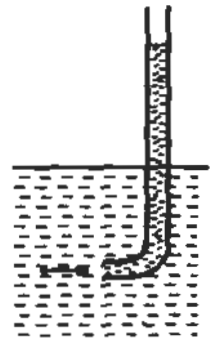
26. Unit of "Pascal" is the same as

(a) 10^6 dyne/cm^2 (b) 1 poundal/$inch^2$
(c) 1 newton/$metre^2$ (d) 1 dyne/cm^2.

27. A car accelerates from rest at a constant rate a for sometime after which it decelerates at a constant rate b to come to rest. If the total time of travel is t, then the maximum velocity reached in this interval is

(a) $\frac{ab}{(a+b)}t$ (b) $\frac{ab}{(a-b)}t$
(c) $\frac{at^2}{(a+b)}$ (d) $\frac{tb^2}{(a+b)}$.

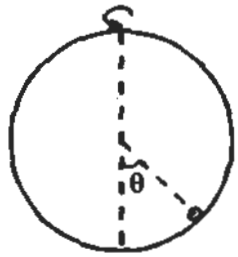
28. A narrow bent tube open at both ends is lowered from a bridge over a stream into the stream as shown in the figure. Water rises in the tube to a height of 15 cm above water level. The speed of water current must be



(a) 1.7 metre/sec (b) 1.5 cm/sec
(c) 1.2 cm/sec (d) 15 cm/sec.

29. A spherical bowl of radius R rotates about the vertical diameter with angular velocity ω. the bowl contains a small object inside and in absence of friction, this object takes up a position inside the bowl such that its radius vector

makes an angle θ with the vertical (see figure). Then



(a) $\omega = \sqrt{g/r\cos\theta}$ (b) $\omega = 2\pi g/r$

(c) $\omega = \sqrt{\frac{g\cos\theta}{r}}$ (d) $\omega = \sqrt{r\cos\theta \times g}$.

30. A dry clean steel needle of diameter *d* and density ρ when carefully placed on the surface of water remains floating. If T is the surface tension of water, then maximum value for the diameter *d* of the needle for enabling it to float will be

(a) $d = \sqrt{\frac{8\rho\pi}{Tg}}$ (b) $d = \sqrt{\frac{4\rho\pi}{Tg}}$

(c) $d = \sqrt{\frac{8T}{\rho\pi g}}$ (d) data incomplete.

31. In S H M with amplitude *a*, the potential energy and kinetic energy are equal to each other at *displacement*

(a) $a/\sqrt{2}$ (b) a/4 (c) a/3 (d) a/2.

32. The acceleration α of a particle starting from rest varies with time *t* according to the relation $\alpha = kt + c$, where c and k are constants. The velocity v of the body after time t will be

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

(c) $\frac{1}{2}(kt^2 + ct)$ (d) $kt^2 + ct$

33. A particle simultaneously participates in two mutually perpendicular oscillations; $x = 2\sin\omega t$, and $y = 2\cos\omega t$. The trajectory of motion will be

(a) a straight line (b) a parabola

(c) a circle (d) none of these

34. A steel wire of length 1.5 *meter* has density = 7.7×10^3 kg/m^3 and Young's modulus = 2.2×10^{11} N/m^2. It is subjected to a tension which produces an elastic strain of 1 %. *Its fundamental* frequency of vibration must be

(a) 256 Hz (b) 178 Hz

(c) 170 Hz (d) 200 Hz.

35. *Indicate* the only correct statement in the following

(a) The maximum amount of heat that can be converted into mechanical energy is 100 %

(b) The maximum amount of mechanical energy that can be converted into heat is 100 %

(c) By opening the door of a working refrigerator in a room, you can cool the surrounding air

(d) In an adiabatic expansion of a gas, the product of pressure and volume increases.

36. Two gases O_2 and H_2 are at the same temperature. If E_o is the average kinetic energy of a molecule of oxygen sample, and E_H is the average kinetic energy of a molecule of hydrogen sample, then

(a) $E_o = \frac{1}{16}E_H$ (b) $E_o = 16\,E_H$

(c) $E_o > E_H$ (d) $E_o = E_H$.

37. Which one of the following is not a "Black-body"?

(a) A highly polished black car

(b) Uniform temperature enclosure

(c) Platinum black (d) The sun.

38. A *beam of monochromatic* light of wavelength λ is refracted from air into water of refractive index 4/3. The wavelength of light beam inside water will be

(a) $\frac{9}{16}\times\lambda$ (b) $3\lambda/4$ (c) $\lambda \times \frac{4}{3}$ (d) λ.

39. Four perfect polarising plates are stacked so that the axis of each is turned 30° clockwise to the preceding plate, the last plate therefore being *crossed with the first*. A beam of unpolarised light of intensity I passes

through the stack perpendicularly. The transmitted beam has intensity

(a) $\frac{27}{128}$ I (b) $\frac{81}{256}$ I (c) $\frac{1}{8}$ I (d) $\frac{27}{64}$ I

40. Two sounds in a gas differ in their loudness level by 20 db. What is the ratio of the amplitudes of the pressure oscillations ?

(a) 10 : 1 (b) 10^4 : 1

(c) $\sqrt{10}$: 1 (d) 100 : 1.

41. Speed of Electro Magnetic wave depends

(a) only upon the electric properties of the medium

(b) only upon the magnetic properties of the medium

(c) both upon the electric and magnetic properties of the medium

(d) mechanical and thermal properties of the medium.

42. If μ_o represents the magnetic permeability constant in free space and Σ_o is the permitivity in vacuum, and C the speed of light in vacuum, then

(a) $\Sigma_o = \sqrt{\mu_o C}$ (b) $\Sigma_o^{-2} = \mu_o C^{-1}$

(c) $\Sigma_o^{-1} = \mu_o^{-1} C^{-2}$ (d) $\Sigma_o = \mu_o^{-1} C^{-2}$.

43. In a nuclear reactor,

(a) the thick concrete shield is used to slow down the speed of neutrons

(b) heavy water or graphite is used to moderate the activity of the reactor

(c) the chain reaction is controlled by rods of uranium whose going in reduces the rate

(d) out of U^{238} and U^{235}, the natural uranium has less than 1 % of dU^{235}.

44. In a hot wire ammeter the deflection angle θ of the pointer is related with the current I as

(a) $I \alpha \theta^2$ (b) $I \alpha \sqrt{\theta}$

(c) $I \alpha \tan \theta$ (d) $I \alpha \theta$.

45. Television signals reach us only through ground waves. The range R is related to the height h of the transmitter antenna as

(a) $R \alpha h^{1/3}$ (b) $R \alpha h^{1/2}$

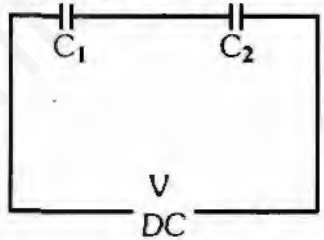
(c) $R \alpha h^2$ (d) $R \alpha h$.

46. Which energy-state of triply ionized beryllium (Be^{+3}) has the same orbital radius as that of state of hydrogen atom

(a) n = 8 state (b) n = 5 state

(c) n = 4 state (d) n = 2 state.

47. A capacitor of capacitance $C_1 = 1\ \mu F$ can withstand a maximum voltage $V_1 = 6.0$ KV while another capacitor of capacitance $C_2 = 2.0\ \mu F$ withstands the maximum voltage $V_2 = 4.0$ KV. What maximum will the system of these two capacitances withstand when connected in series as shown below.



(a) 5.0 KV (b) 9.0 KV

(c) 2.0d KV (d) 10.0 KV.

48. A battery is connected across a resistance wire of uniform cross-section. If another resistance wire is connected in parallel, then the intensity of electric field in the first wire will

(a) be halved (b) be doubled

(c) become zero (d) remain unchanged.

49. Transistor is a

(a) current operated device

(b) voltage operated device

(c) both current and voltage operated device

(d) none of the above.

50. Satisfactory explanation of the phenomenon of photo electric effect is based on

(a) Planck's quantum theory

(b) Einstein's theory of relativity
(c) Huygen's wave theory
(d) Newton's corpuscular theory.

§ ***(Directions) Q51 to 60 consists of two statements, one labelled the 'Assertion (A)' and the other labelled the Reason (R)'. Examine these statements carefully and decide if the statements Assertion (A) and the Reason (R) are individually true and if so, whether the reason is a correct explanation of the assertion. Select your answers to these questions from the codes given below***

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

	Assertion	Reason
51.	A pulsar is a source of radio waves that varies in intensity at regular intervals	A pulsar is a rotating neutron star
	(a) (b) (c) (d)	
52.	Activity of 10^8 undecayed radioactive nuclei of half life 50 days is equal to that of 1.2×10^8 number of undecayed nuclei of same other material with half life 60 days.	Activity is proportional to half life
	(a) (b) (c) (d)	
53.	A laser beam of 0.2 watt power can drill holes through a metal sheet whereas a 1000 watt torch light cannot	The frequency of laser light
	(a) (b) (c) (d)	
54.	In a radioactive disintegration an electron is emitted by the nucleus	Electrons are always present inside nucleus
	(a) (b) (c) (d)	
55.	We always see the same face of the moon	The period of rotation of the moon about its axis and its period of revolution about the earth are equal
	(a) (b) (c) (d)	
56.	In an electric bulb, the filament is in the form of a coiled coil	A coiled coil filament occupies less space and is, therefore, not cooled significantly by the convection currents in the bulb
	(a) (b) (c) (d)	
57.	Wood is a bad conductor of electricity	Wood has a large number of free electrons
	(a) (b) (c) (d)	
58.	A sail boat cannot be propelled by air blown at the sail from a big fan attached to the boat	Action of the air from the fan and reaction of the sail, both act on the boat
	(a) (b) (c) (d)	
59.	Cooling inside a refrigerator is not proper when a thick layer of ice deposits on the freezer	Ice is a bad conductor of heat
	(a) (b) (c) (d)	

60. Even a small bird hitting a flying aeroplane can cause heavy damage to it
(a) (b) The bird imparts a large impulse and a large force during the short time of impact (c) (d)

Part II. CHEMISTRY

1. Bohr's model of the structure of atom is not in conformity with
(a) Heisenberg's uncertainty principle
(b) Hund's rule of maximum multiplicity
(c) Aufbau principle
(d) Paulis exclusion principle

2. The first ionization energy of hydrogen is 2.179×10^{-18} J The second ionization energy of helium atom will be
(a) 8.716×10^{-18} J (b) 4.358×10^{-18} J
(c) 5.45×10^{-17} J (d) 1.09×10^{-18} J

3. The spectrum of He may be expected to be similar to that of
(a) H (b) Li^+ (c) He^+ (d) Na.

4. Among the following species, the one thet does not exist is
(a) $[SiCl_6]^{2-}$ (b) $[CCl_6]^{2-}$
(c) $[GeCl_6]^{2-}$ (d) $[SnCl_6]^{2-}$.

5. The conjugate acid of NH^{2-} is
(a) N^{3-} (b) $> NH^{2-}$
(c) NH_3. (d) NH_4^+

6. Transition metals are often paramagnetic owing to the presence of
(a) valency electrons in the outer two electrons shells
(b) unpaired electrons in their atoms
(c) vacant *d* orbitals in the *n* th orbit
(d) electrons in *d* orbitals of the (*n*-1) orbit.

7. High pressure and high temperature will be favourable conditions for a high equilibrium yield in the reactions
(a) $2Cl_2O_7(g) \longrightarrow 2Cl_2(g) + 7O_2(g) + 126.8$ kcal
(b) $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g) + 22.08$ kcal
(c) $Cl_2(g) + 2O_2(g) \longrightarrow 2ClO_2(g) - 49.4$ kcal
(d) $2NF_3(g) \longrightarrow N_2(g) + 3F_2(g) - 54.4$kcal

8. Among the oxy-acids of chlorine, the strongest oxidizing agent is
(a) $HClO_4$ (b) $HClO_3$
(c) $HClO_2$ (d) HClO

9. When dry silver chloride is fused with sodium carbonate, silver is obtained as
(a) free metal (b) Ag_2C_2
(c) Ag_2O (d) Ag_2CO_3

10. Which one of the following tetrachlorides does not undergo hydrolysis
(a) $SnCl_4$ (b) $GeCl_4$
(c) $SiCl_4$ (d) CCl_4

11. The unit of dipole moment is
(a) curie (b) debye
(c) faraday (d) none of these.

12. Among the following acids, the one that can act as both an oxidizing agent and a reducing agent is
(a) HNO_2 (b) $HClO_4$
(c) HNO_3 (d) H_2SO_4.

13. The osmotic pressure of a dilute solution increases when
(a) more of solute is added
(b) more of solvent is added
(c) temperature is increased
(d) any one of the change is made.

14. Which of the following statements about boron halides is WRONG ?
(a) They form tetrahedral molecules
(b) They react with ethers to form addition compounds
(c) They all hydrolyse in water
(d) They are all strong Lewis acids.

15. The As_2S_3 colloid will be most readily coagulated by

(a) $MgCl_2$ (b) $AlCl_3$
(c) Na_2SO_4 (d) Na_3PO_4

16. The [OH] in a solution is 1×10^{-8}. The pH of the solution is
(a) 10.0 (b) 8.0
(c) 6.0 (d) 4.0.

17. Equal weights of hydrogen and methane are mixed in an empty container at 25° C. The fraction of the total pressure exerted by hydrogen is
(a) 16/17 (b) 1/9
(c) 8/9 (d) 1/2.

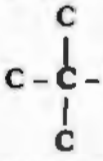
18. Heat of neutralization of HCl by NaOH is 13.7 kcal per equivalent , and by NH_4OH is 12.27 kcal. The heat of dissociation of NH_4OH is
(a) –25.97 kcal (b) 25.97 kcal
(c) –1.43 kcal (d) 1.43 kcal.

19. That the conventional representation of oxygen molecule

$$:\ddot{O}: \quad :\ddot{O}:$$

is wrong is suggested by the fact that
(a) oxygen is a colourless gas
(b) oxygen atoms join to form the triatomic ozone molecule
(c) oxygen is paramagnetic
(d) oxygen is highly reactive.

20. The alkane with the carbon chain



could not be named
(a) 2 - methyl isobutane
(b) neopentane
(c) 2, 2 - dimethylpropane
(d) tetramethyl methane.

21. Given the enthalpy of formation of CO_2 (g) is –94.0 kJ, of CaO (s) is –152 kJ, and the enthalpy of the reaction

$$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$$

is 42 kJ, the enthalpy of formation of $CaCO_3$ (s) is
(a) –288 kJ (b) + 202 kJ
(c) –202 kJ (d) –42 kJ.

22. Acidic hydrogen is present in
(a) arenes (b) ethyne
(c) ethene (d) ethane.

23. In the series of reactions

$$CH_3 \cdot COOH \xrightarrow{NH_3} A$$

$$A \xrightarrow{Heat} B \xrightarrow{P_2O_5} C$$

the end product C is
(a) CH_4 (b) acetonitrile
(c) CH_3OH (d) methyl cyanate.

24. Dry distillation of a mixture of the calcium salts of acetic acid and propionic acid will yield
(a) methyl ethyl ketone
(b) acetic acid (c) acetone
(d) acetaldehyde.

25. Among the following compounds, the one that DOES NOT dissolve in conc. H_2SO_4 even on warming is
(a) aniline (b) benzene
(c) hexane (d) ethylene.

26. A nucleophilic reagent is
(a) CO_2 (b) BF_3
(c) $dAlCl_3$ (d) NH_3.

27. Lucas reagent consists of
(a) am. Cu_2Cl_2
(b) conc. HCl + anhydrous $ZnCl_2$
(c) $NaNO_2$ + dil HCl
(d) acidified $KMnO_4$.

28. Natural rubber is vulcanized by heating it with
(a) carbon disulphide (b) sulphur
(c) carbon black (d) zinc oxide.

29. Cannizaro's reaction is given by
(a) benzaldehyde
(b) trimethylacetaldehyde
(c) formaldehyde (d) all of the above.

30. The salt A forms a colourless solution. When $NaHCO_3$ was added to the aqueous solution of A_1 there was no change observed. However when the mixed solution was boiled, it became milky. The salt A contains the cation

(a) Mg^{2+} (b) Ca^{2+}

(c) either Ca^{2+} or Mg^{2+}

(d) K^+

31. The function of anhydrous $AlCl_3$ in the FriedelCraft reaction is to

(a) produce a nucleophile

(b) produce an electrophile

(c) absorb hydrogen chloride

(d) absorb water.

32. The ultimate product of the hydrolysis of starch is

(a) maltose (b) sucrose

(c) fructose (d) glucose.

33. For testing nitrogen in organic compounds, they are fused with sodium metal, extracted with water, and treated with $FeSO_4$ soln. and acidified. The presence of nitrogen is indicated by a blue or green colour or precipitate. This test is not given by

(a) urea (b) hydrazine

(c) phenylhydrazine (d) anthranilic acid.

34. The use of NH_4Cl in the detection of third group radicals is to

(a) decrease the solubility of the hydroxides of the group III cations

(b) counter the activity of any interfering anions

(c) prevent the precipitation of group IV cations as hydroxides

(d) ensure complete precipitation of the third group cations.

35. DDT is prepared by condensing chlorobenzene with

(a) hexachloroethane

(b) chloroform (c) chloral

(d) methyl chloride.

36. The best indicator for titrating 0.1 N Na_2CO_3 against 0.1 N HCl is

(a) methyl red (b) litmus

(c) phenolphthalein (d) universal indicator.

37. The standard enthalpy of formation of CO is –110 kJ and of CO_2 is –394 kJ, the heat of combustion when one mole of graphite burns is

(a) –504 kJ (b) –394 kJ

(c) –284 kJ (d) –110 kJ.

38. Aldehydes and ketones may be distinguished by using

(a) saturated solution of $NaHSO_3$

(b) 2 : 4 dinitrophenylhydrazine

(c) Tollen's reagent (d) Baeyer's reagent.

39. Cyclisation of n - heptane will give

(a) toluene (b) naphthalene

(c) benzene (d) all the above.

40. A sample of chloroform for use as anaesthetic is tested with

(a) Fehling solution

(b) Ammonical Cu_2Cl_2 soln.

(c) $AgNO_3$ soln. (d) $BaCl_2$ soln.

41. The protons and neutrons in the nuclei of atoms undergo inter-conversions through the exchange of

(a) electrons or β- particle

(b) charged mesons

(c) photons (d) positrons.

42. The percentage of gold in 18-carat gold is

(a) 90 (b) 75 (c) 50 (d) 25.

43. Liquid hydrogen is being seriously considered as automobile fuel. It is because liquid hydrogen

(a) is an abundant and cheap fuel

(b) is non-corrosive

(c) is a pollution-free fuel

(d) has a high calorific value.

44. One a.m.u is equal to

(a) 1.66×10^{-8} g (b) 1.66×10^{-4} g

(c) 1.66×10^{-16} g (d) 1.66×10^{-24} g.

45. The normality of conc. HCl used in the laboratory is

(a) 10 N (b) 8 N
(c) 4 N (d) 2 N.

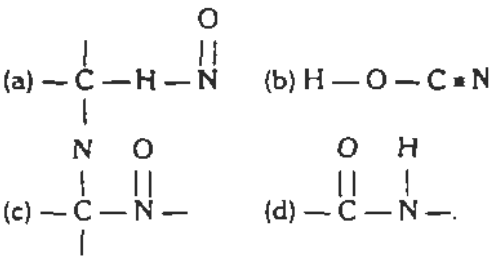
46. Which of the following will have the least hundred rotation about the carbon - carbon bond

(a) Ethyne (b) Ethene
(c) Ethane (d) Hexachloroethane.

47. Units for the rate constant ,k, of the zero order rate equation are

(a) $L^2\ mol^{-2}\ sec^{-1}$ (b) $L\ mol^{-1}\ sec^{-1}$
(c) sec^{-1} (d) $mol\ L^{-1}\ sec^{1}$.

48. Proteins are characterized by the linkage



49. Among the following sulphides, the one that does not dissolve in dil HNO_3 is

(a) CdS (b) CuS
(c) PbS (d) HgS.

50. Which of the following ions is not isoelectronic with the other three ?

(a) CO_3^{2-} (b) NO_3^-
(c) SO_3^{2-} (d) BO_3^{3-}.

§ ***(Directions) Q51 to 60 consists of two statements, one labelled the 'Assertion (A)' and the other labelled the Reason (R)'. Examine these statements carefully and decide if the statements Assertion (A) and the Reason (R) are individually true and if so, whether the reason is a correct explanation of the assertion. Select your answers to these questions from the codes given below***

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

	Assertion	Reason	
51.	Both 12 g of carbon and 27 g of aluminium will have 6.12×10^{23} atoms	Gram atomic mass of an element contains Avogadro number of atoms	(a) (b) (c) (d)
52.	Sucrose is sweetest in taste	Sucrose is converted by the enzyme invertase present in living systems to glucose and fructose	(a) (b) (c) (d)
53.	Potassium cannot be obtained by the electrolysis of fused KCl in $CaCl_2$, melts	Metallic potassium is soluble in the melt (molten $CaCl_2$) and hence the cell for electrolysis gets short circuited	(a) (b) (c) (d)
54.	Electron are ejected from a certain metal when either blue or violet light strikes the metal surface. However only violet light cause electron ejection from a second metal	The electrons in the first metal require less energy for ejection	

(a) (b) (c) (d)

55. Cyclobutane is less stable than cyclopentane

The bond angles in cyclobutane and cyclopentane are 90° and 108° , respectively

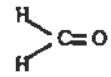
(a) (b) (c) (d)

56. Benzoyl chloride is used for the preparation of derivative of tertiary amines

It forms solid benzoyl derivatives

(a) (b) (c) (d)

57. In formaldehyde, all the four atoms are in the same plane



The carbon atom in formaldehyde is sp^3 hybridized

(a) (b) (c) (d)

58. A spectral line will be seen for a $2p_x - 2p_y$ transition

Energy is released in the form of wave of ligh when the electron drops from $2p_x$ to $2p_y$ orbita

(a) (b) (c) (d)

59. It is very difficult to subject vinyl chloride to nucleophilic substitution as compared to ethyl chloride

The vinyl group is electron donating in viny chloride

(a) (b) (c) (d)

60. The configuration of boron atom cannot be $1s^2 2s^3$

Hund's rule demands that the configuratio should display maximum multiplicity

(a) (b) (c) (d)

PART III. BIOLOGY

1. The cell bodies of the motor neurons are located in the spinal cord in

(a) intermediolateral cell column
(b) dorsal root ganglia
(c) dorsal horn (gray matter)
(d) ventral horn (gray matter).

2. The developing embryo is a hollow sphere of cells, one cell thick during the _____ stage

(a) cleavage (b) polar body
(c) gastrula (d) blastula.

3. A hog breeder would use a backcross to

(a) determine if a particular hog is genotypically pure
(c) eliminate chances of congenital malformations
(c) maintain a pure line of desirable traits
(d) produce a bigger and healthier strain.

4. Characteristics which are common to the Arthropod, Mollusk, Echinoderm and Chordate lines are a (an)

(a) segmentation and a coelom
(a) endoskeleton and a coelom
(c) compound eye and segmentation
(d) coelom and a parietal eye.

5. Mesoderm, one of the germ layers, gives rise to a group of structures in animals. Which group includes structures of exclusively mesodermal origin ?

(a) skin, brain, bladder, vagina
(b) muscle, outer layer of digestive tract, cartilage, bone
(c) bone, lens of the eye, pars distalis, gall bladder
(d) trachea, lungs, stomach, skin.

6. Characteristics of epithelial tissues may include

(a) absorption (b) secretion
(c) protection (d) all of the above.

7. The contractile vacuole of protozoa functions to

(a) remove surplus water
(b) secrete proteins
(c) regulate the pH of the internal milieu
(d) digest food materials.

8. A mink breeder finds that 50 % of the offspring are aa. What genotype were their parents ?

(a) AA x aa (b) Aa x Aa
(c) aa x aa (d) Aa x aa.

9. The primitive condition of the cyclostomata is indicated by their

(a) asexual reproduction
(b) jawless mouth
(c) possession of scales
(d) toothless jaws

10. The vital centers for control of heart rate, respiratory rate, and blood pressure are located in the

(a) cerebellum (b) medulla
(c) pons (d) midbrain.

11. The stimulus that induces migration in animals is

(a) chemotrophic (b) hydroperiodic
(c) geotrophic (d) photoperiodic.

12. All of the following may be considered as secondary sex characteristics of the male EXCEPT

(a) increase in sex drive
(b) external genitalia
(c) pattern of hair and beard growth
(d) development of a deeper voice.

13. The reflex arc is of utmost importance to human beings. Which of the following is NOT a component of the reflex arc?

(a) synapse (b) medulla
(c) ventral horn cell (effector)
(d) dendrite (receptor)

14. Filtration in the kidneys results mainly from

(a) blood pressure (b) reabsorption
(c) blood flow (meters/sec.).
(d) osmotic phenomenon.

15. Which of the following structures are NOT considered modifications of the cell membrane ?

(a) desmosomes
(b) terminal bars
(c) basement membrane
(d) microvilli.

16. An aggregation of nerve cell bodies inside the CNS (central nervous system) is typically called a

(a) colony (b) nissl zone
(c) clone (d) nucleus.

17. The most numerous leukocytes are the

(a) eosinophils (b) monocytes
(c) lymphocytes (d) neutrophils.

18. Administration of which of the following compound (s) increases clotting time

(a) dicumarol (b) aspirin
(c) heparin (d) all of the above.

19. In ant lions the gene for dull teeth is dominant D. The recessive gene d produces sharp teeth. Another gene T, when homozygous, produces dark-brown coats. Its allele t, when homozygous, produces albino coats. The heterozygote Tt is chocolate colored. If a chocolate-colored, dull-toothed male whose father was sharp toothed is mated to a chocolate, sharp-toothed female, what is the probability that an albino, sharp-toothed offspring will be produced ?

(a) 8/16 (b) 12/16 (c) 4/16 (d) 2/16.

20. Blood-sucking insects usually carry parasites in their

(a) lungs (b) blood
(c) salivary glands (d) tentacles.

21. Rh-related hemolytic anemia of the newborn (erythroblastosis foetalis) may result when the

(a) mother is Rh negative and the foetus is Rh positive

(b) father and mother are Rh positive, but the fetus is Rh negative
(c) mother is Rh positive and the foetus in Rh negative
(d) father, mother, and fetus are all Rh positive.

22. During the follicular phase of a normal menstrual cycle ovarian changes occur which are due to pituitary secretions of
(a) oxytocin (b) LH only
(c) FSH and LH (d) vasopressin.

23. Body temperature is regulated by the
(a) pons (b) medulla
(c) thalamus (d) hypothalamus.

24. The experiments of Millar and Urey enhanced the validity of Oparin's theory on the origin of life. They essentially
(a) discharged electricity into a medium consisting of water vapor, methane, ammonia, and hydrogen
(b) were able to produce simple viruses
(c) were able to produce a simple form of living organism after placing DNA in mixture of hydrogen and oxygen and irradiating it
(d) were able to produce bacteria.

25. Which of the following patterns would you expect to find in the blood one hour after a rich meal ?

	Blood Sugar	Insulin
(a)	high	low
(b)	low	low
(c)	high	high
(d)	no change	no change.

26. Vigorous exercise will cause muscle fatigue which is primarily due to
(a) a sodium and potassium imbalance
(b) the accumulation of carbon dioxide
(c) the accumulation of lactic acid
(d) the accumulation of ADP

27. Man can become infected with trichinosis by
(a) eating poorly cooked beef
(b) eating poorly cooked pork
(c) wading in polluted water or eating raw fish
(d) cutting himself while dressing wild game.

28. The state of a continuously mild or partial contraction of a muscle is denoted as
(a) tonus (b) tetanus
(c) a twitch (d) a reflex contraction.

29. Which of the following type (s) of lens (es) is used to correct the vision of a near-sighted individual ?
(a) biconcave (b) biconvex
(c) convex (d) all of the above.

30. When a physician informs a patient that his blood pressure reading is 160/90, she refers respectively to
(a) systolic pressure of the right ventricle
(b) systolic pressure of the aorta and diastolic pressure in the superior vena cava
(c) systolic and diastolic pressures of the brachial artery
(d) blood pressure in the veins of the arm.

31. A sustained contraction is called
(a) tetany (b) recovery period
(c) tonus (d) contraction period.

32. The functional role an organism plays in a community is referred to as its
(a) niche (b) home range
(c) habitat (d) ecosystem.

33. Bile, which is important in the digestion of fats, is produced by the
(a) liver (b) duodenum
(c) stomach (d) lacteals.

34. A patient awaiting selective surgery presents the following symptoms. Which of them indicate (s) a heightened activity of the sympathetic portion of his autonomic nervous system ?
(a) pale skin (b) sweaty palms
(c) a yearning for water due to a dry mouth
(d) all of the above.

35. If a cell is viewed under low power and then under high power, and no fine adjustment is necessary to see it clearly, the microscope is considered
(a) parfocal (b) bifocal

(c) achromatic (d) apochromatic.

36. In an auto accident the driver suffers complete sectioning of several anterior (ventral) roots of spinal nerves. What would be the result of such a lesion to the regions supplied by those spinal nerves ?

(a) loss of sensation

(b) loss of sensation and motor activity

(c) loss of temperature and pain sensation

(d) loss of motor activity.

37. The plasma membrane of plant and animal cells

(a) may not be seen by any microscope

(b) contains two layers of lipid between layers of protein

(c) is not selectively permeable.

(d) can only be visualized with the aid of the electron microscope.

38. Follicle-stimulating hormone is to estrogen as luteinizing hormone is to

(a) vasopressin (b) testosterone

(c) progesterone (d) androgen.

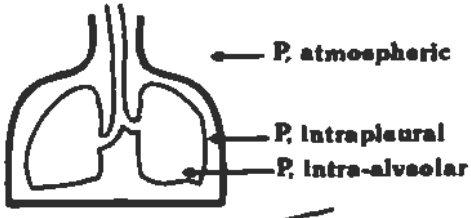
39. Nitrogen comprises 78 percent of the atmosphere; the source of this atmospheric nitrogen in due to

(a) denitrification by bacteria in the soil

(b) combustion of wood and fossil fuels

(c) volcanic activity (d) all of the above.

§ ***Use the following diagram to answer question (40 - 42)***



$$\text{Air Flow} = \frac{\text{Driving Pressure}}{\text{Airway Resistance}}$$

$$F = \frac{DP}{R}$$

40. During inspiration, intra-alveolar pressure (Palv)

(a) equals intrapleural pressure

(b) equals atmospheric pressure

(c) transiently goes below intrapleural pressure

(d) transiently goes above atmospheric pressure.

41. The alveolar ventilation per minute refers to the amount of fresh air which reaches the alveoli of the lungs per minute. Alveolar ventilation per minute equals the

(a) (tidal volume - anatomic dead space) × frequency of breathing

(b) tidal volume × frequency of breathing

(c) anatomic dead space × frequency of breathing

(d) physiologic dead space × frequency of breathing.

42. The driving pressure (ΔP) in breathing which causes air to flow into the lungs is

(a) atmospheric pressure minus the intra-alveolar pressure

(b) the intrapleural pressure (Ppl)

(c) the intrapleural pressure minus the intra-alveolar pressure

(d) the intra-alveolar (intrapulmonary) pressure (Palv).

§ ***Genetic ratios are probability ratios. If, for example, we mate (B = black dominant; b = gray recessive) two heterozygous black cows (Bb) and 4 offspring are produced, the ratio of 3 black and 1 gray should be possible. However, what are the chances of all black and all gray litters ?***

43. In order for it to be determined whether the phenotype is heterozygous or homozygous you would cross with a dominant phenotype of the above an animal with a genotype

(a) bb (b) Bb

(c) BB (d) none of the above

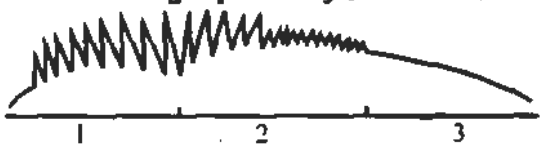
44. To produce all black cows our chances are

(a) 9/16 (b) 1/4
(c) 3/4 (d) 81/256.

45. To produce all gray cows our chances are

(a) 9/16 (b) 3/4
(c) 1/256 (d) 81/256.

§ ***The following graph illustrates several phenomena that develop while a muscle is being repetitively stimulated :***



Match the numbered area of the graph with the appropriate lettered phenomenon.

46. (1) ---------- (a) Treppe or staircase phenomenon
47. (2) ---------- (b) Fatigue
48. (3)---------- (c) Physiological contracture.

49. _ _ _ _ _ _ _ gives origin to the skeletal system

(a) Endoderm (b) Mesoderm
(c) Ectoderm
(d) Ectoderm and Endoderm

50. Of the following, which is not considered a membranous organelle ?

(a) lysosome (b) mitochondrion
(c) ribosome (d) golgi body

§ ***Directions : Questions (51 to 60). Consists of two statements, one labelled the 'Assertions (A)' and the other labelled the Reason (R)'. Examine these statements carefully and diode if the statements Assertion (A) and the Reason (R) are individually true and if so, whether the Reason is a correct explanation of the Assertion. Select your answers to these questions from the codes given below.***

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is not a correct explanation of A
(c) A is true but R is false
(d) A is false but R is true.

	Assertion	Reasoning
51.	Persons of AB blood group are universal acceptors because	They can receive blood from persons of all blood groups
	(a) (b) (c) (d)	
52.	A woman of blood group AB when married to an O group man will never get an AB group child because	Blood groups O gene is dominant over A, B, or AB
	(a) (b) (c) (d)	
53.	Malaria can be Contained with the introduction of larvicidal fish, Gambusia, in ponds, tanks and puddles.	Gambusia is highly specific in devouring larvas of female anopheles mosquitoes.
	(a) (b) (c) (d)	
54.	Parturition is the process of giving birth to the young	Relaxine is an ovarian hormone that is responsible for the loosening of the public symphysis at the time of parturition.
	(a) (b) (c) (d)	
55.	The gestation period of a hen is 21 days	The optimum temperature required during this period of 21 days is **37°C**

(a) (b) (c) (d).

56. During the period of water deprivation on the desert, the camel utilizes water stored in the hump on its back.

(a) (b) (c) (d)

Fatty substance occurring in the hump of the camel following metabolism yield water called 'metabolic water'.

57. There are more colour blind men than woman throughout the world

(a) (b) (c) (d).

Colour blindness is a sex-linked disease resulting from a recessive gene on the Y chromosomes.

58. In coronary heart disease there is impairment of heart muscle

(a) (b) (c) (d).

Reduced blood supply

59. *Mitochondria are believed to originate by growth and division of previously existing ones.*

(a) (b) (c) (d).

They contain DNA and Ribosomes.

60. *AIDS is considered to be one of the deadliest diseases.*

(a) (b) (c) (d).

Its virus destroys suppresser T lymphocytes.

Part IV. General Knowledge

1. Dodge is the name of

(a) Motor-car (b) Hotel
(c) Term in sports (d) None of the above.

2. How did Liaquat Ali Khan, Prime Minster of Pakistan, die in 1951 ?

(a) Hanged after a trial
(b) By illness (c) Assassinated
(d) None of these.

3. Bard of Avon is a nickname given to

(a) G.B. Shaw (b) Shakespeare
(c) Winston Churchill
(d) Shelley.

4. Cuttack is located on the bank of

(a) Godavari (b) Mahanadi
(c) Kaveri (d) None of the above.

5. Who was the recipient of Jawaharlal Nehru Award for Peace & International understanding for the year 1990 ?

(a) Olaf Palme (b) Yassar Arafat
(c) Dr. Helumt Kohl
(d) Javier Perez de Cuellar.

6. Which State leads in India in the production of glassware

(a) U.P. (b) Tamil Nadu
(c) Karnataka (d) Maharashtra.

7. Which of the following rivers is not a tributary of the Ganga?

(a) Kosi (b) Yamuna
(c) Gomti (d) Teesta.

8. The Mazgaon Dock has recently constructed

(a) Off-shore drilling platforms
(b) Submarines (c) Naval ships
(d) None of the above.

9. Which of these pairs is correct ?

(a) Jai Shankar Parsad - Kamayani
(b) Nank Singh - Guide
(c) Rabindra Nath Tagore - Panchtantra
(d) Vishnu Sharma - Geetanjali.

10. Who created the character Malaprop in 'The Rivals'

(a) Dickens (b) Sheridian
(c) Marlowe (d) None of these.

11. Who discovered transistor ?

(a) Galileo (b) W. Shockley
(c) Sholes (d) None of these.

12. Who was the first Indian to have received Nobel prize.

(a) Rabindranath Tagore
(b) C.V. Raman
(c) Jai Shanker Prasad
(d) Gopal Krishan Gokhle.

13. The first Indian film was made in the year

(a) 1933 (b) 1912
(c) 1935. (d) 1901

14. What was the name of the town established by Akbar

(a) Agra (b) Delhi
(c) Fatehpur Sikri (d) Nizamabad.

15. First telegraph line in India came into operation in

(a) 1854 (b) 1851
(c) 1852 (d) 1850.

16. The British Prime Minister during whose period India achieved independence was

(a) Clement Attlee (b) Harold Wilson
(c) Anthony Eden (d) Winston Churchill.

17. Tungabhadra Project involves the states of

(a) Andhra Pradesh and Karnataka
(b) Andhra Pradesh and Tamil Nadu
(c) Karnataka and Maharashtra
(d) Andhra Pradesh and Orissa.

18. What is the name of the official newspaper of Chinese Communist Party

(a) Red Flag (b) Pravada
(c) Izvestia (d) Peoples Daily.

19. The biggest airport in the world at Dallas is situated in

(a) U.S.A (b) U.K.
(c) Germany (d) France.

20. Tick the country to whom Alexander Graham Bell, the inventor of telephone, belonged

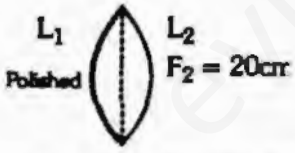
(a) Italy (b) England
(c) Germany (d) U.S.A.

ANSWER WITH HINTS & EXPLANATIONS

PHYSICS

1.(c)

2.(c) Here image will be formed at its new focal length



This lens can be divident into two planoconvex lenses ; L_1 & L_2

As we know, focal length of planoconvex lens if its convex surface is polished is

$$F_1 = \frac{R}{2\mu}$$

$$= \frac{R}{2 \times 1.5} = F_1 = \frac{20}{3} \text{ cm}$$

Where R= 20cm & μ = 1.5

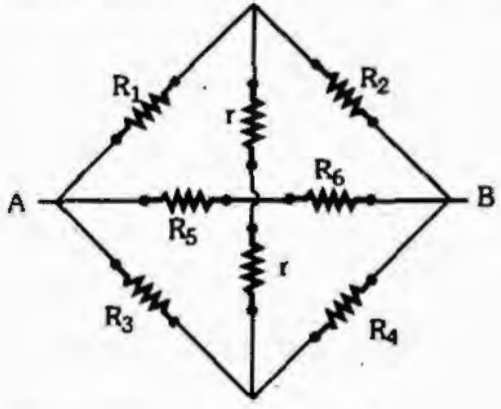
Now, $F_2 = 20\text{cm}$

So, $$\frac{1}{F} = \frac{1}{F_1} + \frac{1}{F_2}$$

$$\frac{1}{F} = \frac{3}{20} + \frac{1}{20} = \frac{4}{20}$$

and $$F = \frac{20}{4} = 5 \text{ cm}$$

3.(c) R_1 and R_2 are in series, similarly R_3 and R_4 are in series, R_5 and R_6 are also in series. All having eaual value of resistance i.e., R



This complete setup is in parallel.

So, $$\frac{1}{R_{(effective)}} = \frac{1}{2R} + \frac{1}{2R} + \frac{1}{2R}$$

$$\frac{1}{R_{(effective)}} = \frac{1+1+1}{2R} = \frac{3}{2R}$$

$$R_{effective} = \frac{2R}{3}$$

Here, no current will flow in 2r(r+r), because this will behave as null point circuit.

4.(a)

Here, r is radius of loop

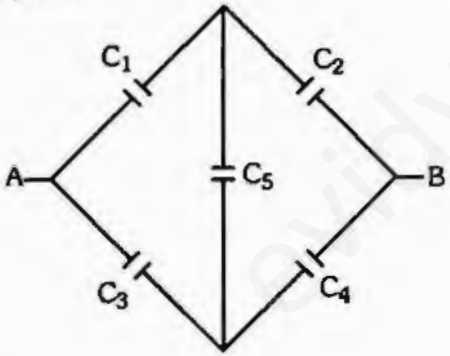
So, area of loop = πr^2

Therefore, its magnetic moment will be

$$\pi r^2 \times i$$

5.(c)

6.(c) Here C_1 and C_2 are in series. Similarly C_3 and C_4 are also in series. This whole setup is in parallel.



So, $C = C_2 + C_2$

$$\frac{C + C}{2} = \frac{2C}{2} + C$$

Here, no current will follow the C_5 path because it is null point circuit.

7. (a) On account of super position the amplitudes get added. Since the two waves travelling in opposite directions are sinuites they produced maximum displacement equal to twice the amplitude of either.

8. (a)This is so because here voltage leads the current by $\pi/2$ in phase

9. (a) $e = -\frac{d\phi}{dt}$ or volt $= -\frac{\text{weber}}{\text{second}}$

10. (d) Obtain the value of magnetic field B at distance x from the centre of the coil on the axis. Find the rate of change of B with respect to $x = \frac{dB}{dx}$. Putting the value to zero gives x = R/2.

11. (a) First three statements are correct. The fourth statement *alone is wrong*, the fringes are due to reflection and interference.

12. (b) $\frac{e}{m} = \frac{1.6 \times 10^{-19}}{9.1 \times 10^{-31}}$. Coulomb/kg.

13. (b) 14. (b) Check dimensions 15. (b)

16. (c) The fall of temperature from H to A is the same as the fall of temperature from H to B. Hence on joining A and B by the conductor, no heat transfer will take place through the conductor.

17.(c) 18.(c) 19.(a) 20.(a) 21.(a) 22.(a)

23. (b) Remember momentum for photon α E and momentum for particle $\alpha \sqrt{E}$

24. (b) Use the relation $\rho = \frac{1}{e(n_e \mu_e + n_h \mu_h)}$

25. (a) The resultant of force of gravity and force of inertia must be $\perp$ to the surface.

26. (c) 27. (b) If the car accelerates for time t_1, then $at_1 = b(t - t_1)$

28. (a) Use the relation

$$p_1 + \frac{1}{2} d v_1^2 = p_2 + \frac{1}{2} d v_2^2$$

for a horizontal tube.

29. (a) Reaction N has component in vertical direction equal to the weight of the object. The horizontal component of N provides the centripetal force. Now ω can be calculated

30. (c) Force due to surface tension = 2 *l* T

Force of weight of needle $= \pi \frac{d^2}{4} \times l \times \rho \times g$

Equate the two.

31. (a) At the required displacement, the kinetic energy $= \frac{1}{2} \times$ maximum kinetic energy. This gives $\sin\theta = 1/\sqrt{2}$.

32. (b) Integrate with respect to time, once.

33. (a) Here the two mutually ⊥ vibrations have phase diff. $\pi/2$ and amplitudes are equal.

34. (b) Note that $n = \frac{1}{2l}\sqrt{\frac{T}{\pi r^2 d}}$

and $\gamma = \frac{T}{\pi r^2}$ / strain.

$$\therefore \frac{T}{\pi r^2} = \gamma \times \text{strain} \quad = \frac{1}{2l}\sqrt{\frac{\gamma \times \text{strain}}{d}}.$$

35. (b) To show that (d) is wrong, use the relation PV^{γ} = constant.

36. (d) 37.(a) 38.(b)

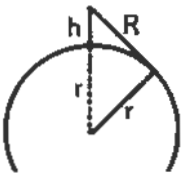
39. (a) Apply Law of Malus and remember that the first plate reduces the intensity to half.

40. (a) 41.(c) 42. (d) We know that $C = \frac{1}{\sqrt{\Sigma_o \mu_o}}$

43. (d) 44. (b) Deflection θ is proportional to heat produced which is proportional to $(i)^2$.

45. (b) $(r + h)^2 - r^2 = R^2$

$\therefore R^2 = 2rh + h^2$



Second term on the rt. hand side is negligible as compared to the first term.

$\therefore R \alpha \sqrt{h}$

46. (d) $v_n \alpha n^2/Z$. 47. (b) 48. (d) Note that $E = -\frac{V}{l}$

49. (a) 50.(a) 51.(a) 52.(c) 53.(c) 54.(a) 55.(a) 56.(a) 57.(c) 58.(a) 59.(a) 60.(a)

CHEMISTRY (ANSWERS WITH HINTS)

1. (a) In Bohr's model, an electron in the atom is located at a definite distance from the nucleus and revolving around it with a definite velocity. According to Heisenberg's uncertainty principle, it is impossible to determine simultaneously the exact position and momentum (*i.e.* velocity) of an electron in the atom.

2. (a) According to Bohr's theory, the energy of the electron, E, is related to the nuclear charge Z, and the number of election orbit n, by the equation

$$E \alpha Z^2/n^2.$$

For hydrogen atom, n = 1 ; so, first I. E. of hydrogen

$$\alpha Z^2 = 2.179 \times 10^{-18} \text{ J}$$

second I E. of He is the energy involved in removing electron from He^+ from its first orbit. Here, Z = 2 an n = 1.

Hence, $\Delta E(He^+) = 4 \times \Delta E_{(H)}$

$$= 4 \times 2.179 \times 10^{-18} \text{J}$$

$$= 8.716 \times 10^{-18} \text{J}.$$

3. (b) The electron configuration of He is $1s^2$ which is also the electron configuration of Li^+. Since the atomic spectra depend on electron transitions, similar electron configuration species give rise to similar spectra.

4. (b) The elements C, Si, Ge, and Sn all belong to group IV A. The coordination of C is limited to 4 as it has no vacant *d* orbitals available in the valence shell and, so, it cannot form ($[CCl_6]^{2-}$). Other elements have the maximum coordination number of 6.

5. (c) The conjugate acid and base differ by H^+, the acid has H^+ added to the base : $NH_2^- + H^+ \longrightarrow NH_3$.

6. (b) A single spinning electron behaves like a small magnet. Two electrons that are paired in an orbital have opposite spins, and their magnetic moments oppose each other and cancel. The magnetic properties of unpaired electrons cause paramagnetism in atoms containing such electrons. An atom is diamagnetic if all of its electrons are paired.

7. (c) The given conditions will favour an endothermic reaction (i.e., a reaction that proceeds with absorption of heat) in which the volume

of the product (s) is less than the volume of the reactant (s).

8. (d) The stability of the oxy-acids of chlorine increases with the oxygen content owing to the increasing number of electrons involved in the formation of σ and π bonds. So, the oxidising strength, which depends on the ease of losing oxygen, decreases from HClO to $HClO_4$

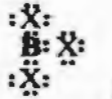
9. (a) Ag_2CO_3 and Ag_2O are thermally unstable and decompose to give free silver on heating. Ag_2C_2, silver carbide, is formed when acetylene is passed through $AgNO_3$ soln. and not in this reaction.

10. (d) The coordination number of C is limited to 4, hence, it cannot coordinate with water molecules which is essential to undergo hydrolysis. The coordination number of Si, Ge, and Sn can increase to 6.

11. (b) 12. (a) In H_2SO_4, HNO_3 and $HClO_4$, the central atoms, S, N, and Cl, are in their highest oxidation states, i.e., + 6, + 5, and + 7 respectively. So, they can only act as oxidizing agents. The central N atom in HNO_2 is in the oxidation state of + 3 which may increase up to 5 or decrease. Hence, HNO_2 can act as both an oxidizing agent and a reducing agent.

13. (b) The general osmotic pressure equation is $\pi v = nkT$, where π is osmotic pressure, v the volume of the solution, n the number of moles of solute, k is equal to R, the gas constant and T is absolute temperature. From the equation, $\pi = \frac{nkT}{v}$, it follows that decreases in T or increase in v (by adding more solvent) will cause osmotic pressure to decrease. Addition of solute will increase *n* causing osmotic pressure to increase.

14. (a)



In boron trihalides the boron atom is two electron short of the inert gas configuration, Hence, they can accept a pair of electrons and are, therefore, Lewis acids. They hydrolyse in water forming H_3BO_3 and $HX(BX_3 + 3H_2O \longrightarrow H_3BO_3 + 3HX]$.

They form addition compounds with ethers; one of the lone pairs of electrons on the O atom in the ether is donated to the electron-deficient B atom is B × 3. In boron trihalides, the central B atom is sp^2 hybridized and, therefore, the molecules are planar (and not tetrahedral).

15. (b) As_2S_3 colloidal particles carry negative charge and are coagulated by positively charged. ions; higher the positive charge, more readily the coagulation takes place. Among the given compounds, the cation with the highest positive charge is given by $AlCl_3$ [$AlCl_3 \longleftrightarrow Al^{3} + 3Cl^{-}$].

16. (b) $pOH = -\log [OH^-] = -\log 1 \times 10^{-8} = 8$

$$pH + pOH = 14$$

$$\therefore \quad pH = 14 - 8 = 6$$

17. (c) The pressure exerted by a gas is proportional to the number of its molecules in the container. Suppose, the weight of methane and hydrogen is 16g each. Mol. wt. of CH_4 is 16; so, 16 g methane = N molecules of methane. Mol. wt. of H_2 is 2; so, 16g of hydrogen = 16/2 = 8N molecules. The total no. of molecules = N + 8N = 9N. Hence, the fraction of the total pressure exerted by hydrogen = 8N / 9N = 8 / 9.

18. (d) Here,

$$H^+ + NH_4OH \longrightarrow NH_4^+ + H_2O, \quad \Delta H = -12.27 \text{ kcal.}$$

The neutralization may be regarded to proceed in two steps :

i. $NH_4OH \longrightarrow NH_4^+ + OH^-$, $\Delta H_1 = ?$

ii. $H^+ + OH^- \longrightarrow H_2O$, $\Delta H_2 = -13.7$ kcal

So, $\Delta H = \Delta H_1 + \Delta H_2$

or, $\Delta H_1 = \Delta H - \Delta H_2$

$= -12.27 - (-13.7) = 1.43$ kcal.

19. (c) Paramagnetism of O_2 molecule suggests the presence of unpaired electron (s). The conventional formula shows all electrons paired.

20. (b) The alkane with the given carbon chain is

$$CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} - CH_3.$$

Since it has all the four H in CH_4 substituted by CH_3 groups, (a) is correct. Neopentane is the common name for this alkane and, so, (b) is correct. The longest carbon chain consists of 3 carbon atoms and, so, in the IUPAC system it is (c). (d) is the incorrect name.

21. (a) The enthalpy of formation of $CaCO_3$ (s) = Enthalpy of formation of CaO (s) + Enthalpy of formation of CO_2(g) - Enthalpy of the reaction

$$CaCO_3(s) \longrightarrow CaO\ (s) + CO_2\ (g)$$

$= -152\ kJ - 14.0\ kJ - (42kJ) = -288\ kJ.$

22. (b) It is only in ethyne, CH ≡ CH, that the hydrogen atoms can be replaced by metals, such as Na, Cu, and Ag. These replacement reactions show the acidic character of hydrogen in ethyne.

23. (b) A is $CH_3 \cdot COONH_4$,
B is $CH_3 \cdot CO \cdot NH_2$,
C is $CH_3 \cdot CN$ called methyl cyanide or acetonitrile.

24. (a) Distillation of mixture of Ca-acetate and Ca - formate yields acetaldehyde. Acetone is produced by the distillation of Ca-acetate alone. Acetic acid is not formed when Ca-acetate is heated alone or mixed with Ca-formate.

25. (c) Ethylene dissolves in conc. H_2SO_4 forming $C_2H_5 \cdot HSO_4$ by addition across the double bond. Benzene dissolves forming its sulphonic acid. Aniline is a base and readily dissolves in acids. Hexane, an alkane does not dissolve in conc. H_2SO_4.

26. (d) A nucleophilic reagent acts by donating or sharing its electrons. Among the given molecules only : NH_3 can act thus. $AlCl_3$ and BF_3 are electron-deficient molecules and $O = C = O^3$ is a saturated molecule.

27.(a) 28.(b) 29. (d) Cannizaro's reaction is given by aldehydes which have no hydrogen atom on the alpha carbon, and all the given aldehydes are only of this kind.

30. (c) With $NaHCO_3$ both Ca^{2+} and Mg^{2+} form $Ca(HCO_3)_2$ or $Mg(HCO_3)_2$. These are soluble in water and, so, no change is observed. On boiling, these decompose to $CaCO_3$ or $MgCO_3$ respectively which being white insoluble substance, cause milkiness.

31. (b) Anhydrous $AlCl_3$ produces an electrophile which facilitates substitution.

32. (d) Starch molecule is built up of a large number of α- glucose rings joined through oxygen atoms. The ultimate product of its hydrolysis is glucose.

33. (b) This test is based on the formation of NaCN for which C and N are both provided by the organic compound. Among the given compounds, only hydrazine, N_2H_4, does not contain carbon (it is not an organic compound). So, it does not give the test under reference although it contains nitrogen.

34. (c) The group reagent for group III is NH_4Cl followed by NH_4OH. The purpose of adding NH_4Cl is to suppress the ionization of NH_4OH ($NH_4OH \rightleftharpoons NH^{4+} + OH^-$) by common-ion effect so as to decrease the OH^- ion concentration. At the reduced OH^- concentration, the ion products of the group IV metal hydroxides do not exceed their solubility products and, so their precipitation is prevented.

35. (c) DDT is dichloro-diphenyl-trichloroethane, $(C_6H_4Cl)_2 \cdot CH.CCl_3$, made by the condensation of chlorobenzene, C_6H_5Cl, and chloral, $CCl_3 \cdot CH(OH)_2$.

36.(a) 37. (b) Graphite burns to give CO_2. So, standard enthalpy of formation of CO_2 and the heat of combustion when one mole of graphite burns are identical

38. (c) Aldehydes, being reducing agents, reduce Tollen's reagent (am.$AgNO_3$) to produce a mirror of free silver. Ketones are not reducing agents and do not react with Tollen's reagent. With the reagents (a) and (b) both aldehydes and ketones react to give insolubie crystalline

derivatives. With (d) neither the aldehydes nor the ketones react.

39. (a) n - Heptane contains 7 carbon atoms. Its cyclisation will yield a 7-carbon aromatic hydrocarbon which toluene is.

40. (c) On exposure to sunlight and air, $CHCl_3$ is slowly oxidized to highly poisonous carbonyl chloride, $COCl_2$, and HCl rendering it unfit for use as anaesthetic. The presence of HCl is tested with $AgNO_3$ solution

41. (b) The protons and neutrons undergo interconversions inside the nucleus through the exchange of positively and negatively charged mesons, π^+ and π^-. The exchange of a π^+ between the proton (p) and neutron (n) in a ${}^{2}_{1}H$ nucleus may be represented as

$$p_1 + n_2 \xleftarrow{} n_1 + \pi^+ + n_2 \xleftarrow{} n_1 + p_2$$

Similarly, the exchange of a π^- may be represented as

$$p_1 + n_2 \xleftarrow{} p_1 + \pi^- + P_2 \xleftarrow{} n_1 + p_2.$$

42. (b) The purity of gold is 100 per cent is 24-carat gold.
Hence, 18-carat gold is $(^{18}/_{24}) \times 100 = 75\%$ pure.

43. (c) on burning liq H_2 will produce only $H_2O(g)$

(a) is incorrect as liq. H_2 is very costly since liquefaction of H_2 (g) involves high operational costs. (b) is irrelevant. (d) is not correct as higher fuels with higher calorific value are available.

44. (d) 45.(a) 46. (c) The rotation about carbon-carbon bond is least hindered when it is a single bond. Ethene has a double bond and ethyne a triple bond. Only, ethane and hexachloroethane have a carbon-carbon single bond. However, the large chlorine atom in hexachloroethane present steric hindrance in contrast to the much smaller hydrogen atoms in ethane.

47. (d) For nth order reaction, units of $k = \text{concn.}^{(n-1)}\ \text{Time}^{-1}$
For zero order rate equation $n = o$;
$\therefore$ units are
$\text{concn.}^{-1}\ \text{Time}^{-1} = \text{mol}\ L^{-1}\ \text{sec}^{-1}$.

48. (d) This linkage is called the peptide linkage.

49. (d) 50. (c) Isoelectronic ions have the same electron configurations and, therefore, the same number of electrons. The atomic number of B, C, N, O, and S are 5, 6, 7, 8 and 16 respectively. The number of electrons in SO_3^{2-} is 42; in other ions, 32.

51.(a) 12g. of C contains 6.023×10^{23} atoms and 27g of Al also contains 6.023×10^{23} atoms. These two are gram atomic masses of carbon and aluminium respectively, hence, reason is a correct explanation for assertion.

52.(d) Sucrose ($C_{12}H_{12}O_{11}$), is not the sweetest in taste, hence, assertion is not correct.

53.(c) it is true that potassium cannot be obtained by the electrolysis of fused KCl in molten $CaCl_2$. But the reason is incorrect because it has nothing to doe with solvation of K in $CaCl_2$, it is due to the fact that the standard electrode potential of these elements.

54.(a) Violet or blue light have maximum energy in visible ray. If from element first, ejection of electrons are possible even with other colour of light then it can eject electrons in lower energy of light also. But for second element it can eject its photoelectron in violet light means it requires high energy (high threshold energy)

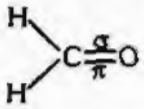
55.(a) It is true that cyclo butane is less stable than cyclopentane because in cyclobutane the bond angle is less i.e., 90^o whereas in cyclopentane bond angle is 108^o. Due to this fact cyclobutane face more internal strain as compared to cyclopentane. Generally speaking, if bond angle is less internal strain is more, hence, stability is less.

56.(d) (C_6H_5—CH_2Cl), Benzoyl chloride cannot be used in the preparation of tertiary amine. For the preparation of tertiary amine aniline is required

$$C_6H_5NH_2 \xrightarrow[-HCl]{CH_3Cl} C_6H_5NHCH_3$$

$$\xrightarrow[-HCl]{CH_3Cl} C_6H_5N(CH_3)_2$$

57.(c) Since HCHO contains double bond



Meaning one sigma bond and one π-bond.

Therefore, the hybridization of carbon here is sp^2. Hence, reason is incorrect.

58.(d) There is no difference in energy level between $2p_x$ and $2p_y$, therefore, no spectral lines will form. Hence, assertion is incorrect.

59.(c) Vinyl group i.e. $-CH=CH_2$ is electron deficient in nature that is why it cannot donate electrons, on contrast it can withdraw electron. Hence, reason is incorrect.

60.(b) Both assertion and reason are correct, but the correct explanation for assertion is;

the Pauli's exclusion principle which states that "No two electrons in an atom can have all the four sets of quantum numbers identical" If $2s^3$ electronic configuration is existing then two electron will show all the four set of quantum number identical, which is impossible and violates Pauli's exclusion principle.

BIOLOGY (ANSWERS WITH EXPLANATIONS)

1. (d) The gray matter of the spinal cord is divided into two (2) components : motor and receptor. The motor part is comprised of the ventral and intermediolateral columns and gives rise to the ventral roots. Ventral horn cells supply voluntary muscles; intermediolateral cells give rise to preganglionic sympathetic fibers of the thoraco-lumbar system. The receptor portion is located in the dorsal horn. The white matter of the spinal cord is composed of nerve fibers in a network of connective tissue.
2. (d) Development in animals results from the cleavage divisions of the zygote. The zygote divides first into two cells, then these divide into four, and so on, until it becomes a cell mass called the morula. Through more divisions the morula becomes a hollow ball of cells which is called the blastula
3. (a) A backcross consists of crossing a dominant phenotype with a pure homozygous recessive. In this manner the breeder determines if the phenotype is heterozygous or homozygous.
4. (a) This is the general body plan, a slight modification as found in the annelids
5. (b) Mesoderm is the middle layer of the three primary germ layers. The following are considered to be of mesodermal origin :
   1. connective tissue, cartilage, and bone
   2. striated and smooth muscle
   3. blood and lymph cells
   4. walls of the circulatory system
   5. genito-urinary system
   6. spleen.
6. (d) Epithelium is a group of cells forming a tissue. Epithelium lines the gut, the respiratory system, the genito-urinary system and forms the epidermis. It, therefore, can protect, secrete, and absorb.
7. (a) A contractile vacuole is found in freshwater protozoa; it periodically expels water to the outside. In this manner excess water leaves the cell. Due to its osmotic relationship with its environment, water is entering and the cell must maintain the water level of its protoplasm.
8. (d) Use your basic genetic knowledge
   1. 100 % aa 2. 25 % AA, 50 % Aa, 25 % aa
   3. 100 Aa 4. 50 % Aa, 50 % aa.
9. (b) The class Cyclostomata of the phylum Chordata and sub-phylum Craniata are jawless, finless, without scales or bony plates, have a sucking mouth and possess 6-14 gill slits in the adult. The cyclostomes are the lampreys and hag-fishes.
10. (b) The medulla is a part of the brain stem and connects to the spinal cord at the foramen magnum. The following cranial nerves are associated with the medulla: a, XII- hypoglossal nerve; b, XI-- spinal accessory nerve; c, X-- vagus nerve; d, IX --- glossopharyngeal

nerve; e. VIII – stato-acoustic nerve; and f. portions of the facial nerve (VII). The vagus nerve (X) is the most important parasympathetic nerve. Stimulation of vagal fibers slows the heart rate; constricts the smooth muscles of the bronchial tree; stimulates secretion by the bronchial mucosa; and promotes peristalsis, gastric, and pancreatic secretions. Blood pressure control also involves aortic body, carotid sinus, and carotid body receptor modulation by the glossopharyngeal (IX) and vagus (X) nerves.

11. (d) Alternating periods of light and darkness and the proportion thereof is extremely important to the functioning (cycles) of plant and animal life observed

12. (b) At the time of puberty usually an increase in sex drive, beard growth, and development of a deeper voice are experienced. The external genitalia is part of the organism and will develop and grow as the organism does. It is genetically determined and is a primary characteristic of the male

13. (b) Reception via afferent (sensory) receptors, conduction via sensory fibers to the central nervous system (spinal cord), and propagation of the impulses to the efferent (motor) system will then result in appropriate action. Usually most reflex arcs include one association neuron in the spinal cord between their afferent and efferent fibers. The medulla is not a part of the spinal cord; it is a part of the brain, and usually reflex arcs do not utilize higher centers.

14. (a) The peculiar features of renal circulation -- such as the renal arteries originating directly from the aorta, the glomerulo-capillary arrangement, and differences in calibres of the afferent and efferent vessels--indicate that blood pressure is of great functional significance for the production of urine. The vascular component probably plays an important role in the filtration process

15. (c) Directly underlying epithelium is found a homogenous, noncellular material, composed of reticular fibers and protein polysaccharides which serves to bind down the tissue; this structure is the basement membrane

16. (d) This is a definition and should be memorized

17. (d) The percentage of white blood cells varies as listed

Agranular cells :	
1. lymphocytes	20-25 %
2. monocytes	3-8 %
Granular cells:	
1. neutrophils	65-75 %
2. eosinophils	2-5 %
3. basophils	0.5 % or less.

18. (d) An anticoagulant is a substance that prevents or retards coagulation of blood. Heparin is an acid mucopolysaccharide; it occurs most abundantly in the liver. Aspirin (acetylsalicylic acid) is an analgesic, antipyretic, antirheumatic compound that possesses anticoagulant properties. Dicumarol is a trademark for bishydroxycoumarin an excellent anticoagulant.

19. (d) dull teeth - *D* sharp teeth - *d*
dark-brown - *T* albino - *t*
chocolate - Tt

The male is TtDd; the female Ttdd; we want ttdd offspring; what is the proportion ? The male provides us with the following *TD*, *Td*, *tD*, *td*. The female provides us with the following Td, Td, td, td. Therefore, 2/16 of the offspring will be ttdd.

20. (c) Salivary secretions come readily into contact with the host when bitten by an insect and parasites can be transmitted via this mode

21. (a) Multiple alleles determine the human blood types. The common blood types are : A, B, AB, and O. Red blood cells of a person classified as "Type A" contain " Agglutinogen A" and their serum contains "Agglutinin b." Type AB contains agglutinogens A and B but no agglutinins. Type O possesses no agglutinogens but the serum carries a + b agglutinins. Rhesus (Rh) agglutinogen is present in humans and is represented by a dominant gene R. The agglutinogen of an Rh positive fetus passes across the placenta, enters the maternal blood stream and elicits the production of an agglutinin (antibody) by the mother. The agglutinin passes into the circula-

tion of the fetus and if present in sufficient concentration can produce agglutination, at times fatal to the developing fetus.

22. (c) The reproductive cycle is under hormonal regulation; gonadotropic hormones of the pituitary (anterior lobe) stimulate the ovaries to produce a mature egg. The pituitary and ovaries have a reciprocal effect upon each other. FSH (follicle stimulating hormone) from the pituitary elicits estrogen production from the developing follicle. When estrogen concentration reaches a certain blood level, it inhibits FSH production. At that time the egg is discharged and the cells lining the follicle come under the influence of another gonadotropin LH (luteinizing hormone) which influences the development of the corpus luteum. The corpus luteum produces the hormone progesterone which influences the wall of the uterus in preparation for implantation. As the concentration of progesterone rises, LH production is checked. If fertilization has occurred, the production of FSH is curtailed throughout the period of gestation through the production of estrogen by the placenta and ovary. If fertilization does not occur, the cycle begins anew.

23. (d) Many activities are attributed to the hypothalamus. Lesions of this area may produce diabetes insipidus, obesity, sexual dystrophy, and loss of temperature control

24. (a) The mystery of the origin of life still eludes us. Two basic concepts are proposed: 1. Vitalistic - a vital force created life; 2. Mechanistic - - forces of nature were instrumental. Oparin suggested that the primitive atmosphere was made up of gases like methane, ammonia, hydrogen, and water vapor. Miller discharged electricity through the above environment and found after a week, a variety of organic compounds, including amino acids were produced. Combinations of these then could theoretically have led to the build-up of complex molecules and eventually protoplasm.

25. (c) Langerhans described the beta cells (within the islets of Langerhans) of the pancreas which produce insulin that affects the metabolism of glucose directly. Fat and protein are indirectly affected. After a meal the level of blood sugar rises eliciting the production of insulin which stimulates the absorption of glucose by the cells and helps in its conversion to glycogen. Insulin deficiency leads to high blood sugar levels and the disease called diabetes mellitus.

26. (c) The cause of muscle fatigue is said to be the accumulated anaerobically produced lactic acid. Lactic acid may later be broken down into carbon dioxide and water for elimination, or it may be converted into glycogen and stored for future use.

27. (b) This is a disease which results from eating poorly cooked pork which contains *Trichinella spiralis*. Eosinophilia, nausea, fever, diarrhea stiffness, and painful swelling of muscles are characteristic.

28. (a) Tonus refers to muscular activity in which a shortened condition is maintained for a prolonged period. Visceral muscle is the outstanding example. The word tonus can be applied to any sustained process which is the result of probable regularly repeated excitation.

29. (a) Anterior-posterior diameters of eyeballs vary. A long eye is considered near-sighted or myopic; light rays come to focus before they reach the retina; therefore, a concave lens if needed for correction. A short eye results in far-sightness or hypermetropia; light rays would come to focus in back of the retina and, therefore, a convex lens is needed for correction.

30. (c) Blood pressure is usually measured by placing the sphygmomanometer cuff around the arm compressing the brachial artery and vein. Maximum blood pressure is obtained during ventricular contraction (systole); in our case 160. Minimum blood pressure indicates ventricular rest (diastole); in our case 90

31. (a) If more than two stimuli are given to a muscle in rapid succession, a partial fusion of all contractions results. The contractions occur before relaxation can take place or is completed. If a contraction is steadily maintained and no relaxation occurs between separate stimuli, the contraction is known as tetanus.

32. (a) A niche is defined as the position or status that an organism occupies with respect to the other organisms with which it associates.

33. (a) Bile is secreted by the liver, stored and concentrated in the gall bladder and poured into the duodenum. It contains bile salts, cholesterol, lecithin, fat, pigments, and mucin. It aids in the emulsification, digestion, and absorption of fat. It contributes to the alkalinization of the intestines.

34. (d) The autonomic nervous system innervates all smooth muscle, and glands. The autonomic nervous system is divided into a sympathetic (flight and fight) component and parasympathetic (maintains homeostasis) component. It exerts important influences on the intrinsic eye musculature; skin glands; and the cardiovascular, respiratory, endocrine, and reproductive systems. Fear, rage, pain, etc., evoke sympathetic activity which mobilizes the resources of the body. Gastrointestinal activity is curtailed; heart rate and blood pressure increase; and coronary arteries and bronchioles dilate.

35. (a) In a parfocal optical microscope the objective lenses are so constructed or mounted that one may change from one to another and the image remains focused; the lenses have focal points in the same plane

36. (d) The cell bodies of the motor (efferent) system are located in the ventral horns (gray matter) of the spinal cord and their fibers leave the cord via ventral (anterior) roots which join with the dorsal (sensory) roots to form a spinal nerve. If a spinal nerve were sectioned, loss of both sensation and motor activity would be experienced. In this case only motor functions were interrupted

37. (b) The cell membrane is semipermeable, can be resolved by the electron microscope, is about 75 Å wide and appears on electron micrographs as two (2) dark lines with a light space between them. Evidence indicates that the two bordering dark lines are composed of proteins while the middle (light) layer contains lipids.

38. (c) See also question 22. FSH stimulates the production of estrogen by the developing follicle. LH stimulates the production of progesterone by the corpus luteum.

39. (d) Nitrogen comprises 78 % of the atmosphere. Denitrification by bacteria results in NO_3 being broken down into nitrogen and oxygen. Combustion and volcanic activity also play a part in the release of nitrogen to the atmosphere. Nitrogen as N_2 in the air is, however, of no use to plants. Plants require ions of ammonia (NH_3), nitrites (NO_2) or the nitrates (NO_3) discussed above.

The answers to questions (40 - 42) are self - explanatory.

40.(d) 41.(a) 42.(a)

43. (a) In order for the breeder to determine if a line is genotypically pure a backcross is used. A backcross consists of crossing a dominant phenotype with a pure homozygous recessive (in our case bb)

44. (d) To produce all black cows (BB or Bb, 3 out of 4) we must multiply

$$\frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} = \frac{81}{256},$$

45. (c) To produce all gray cows (bb, 1 out of 4) we must multiply

$$\frac{1}{4} \times \frac{1}{4} \times \frac{1}{4} \times \frac{1}{4} \times = \frac{1}{256}.$$

46.(b) 47.(a) 48.(c). The staircase phenomenon or treppe is due to a gradual increase in the extent of muscle contraction; a limit will be reached after rapid repeated stimuli. Fatigue is the decreased response of the nerve to stimulation.

49. (c) Mesoderm is the germ layer of origin of the skeletal system

50. (c) Ribosomes can be free floating or they may be attached to the endoplasmic reticulum which is then called rough endoplasmic reticulum (RER)

51.(b) 52.(c) 53.(c) 54.(c) 55.(d) 56.(d) 57.(b) 58.(a) 59.(b) 60.(a)

General Knowledge

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