AIIMS

Medical Entrance Exam

Solved Paper 2013

Physics

1. To obtain a p-type germanium semiconductor, it must be doped with
(a) arsenic (b) antimony
(c) indium (d) phosphorous

2. Sound waves do not show the phenomenon of
(a) interference (b) diffraction
(c) refraction (d) polarisation

3. The magnifying power of a compound microscope is high if
(a) both the objective and the eyepiece has short focal lengths
(b) both the objective and the eyepiece have long focal lengths
(c) the objective has a short focal length and the eyepiece has a long focal length
(d) the objective has a long focal length and the eyepiece has a short focal length

4. 1 curie is
(a) 1 dps (b) 3×10^{10} dps
(c) 10^6 dps (d) 3.7×10^{10} dps

5. To double the covering range of a TV transmitter tower, its height should be made
(a) 2 times (b) 4 times
(c) $\sqrt{2}$ times (d) 8 times

6. An alternating voltage $V = V_0 \sin \omega t$ is applied across a circuit. As result $I = I_0 \sin(\omega t - \pi/2)$ flows in it. The power consumed per cycle is
(a) zero (b) $0.5\ V_0 I_0$
(c) $0.707\ V_0 I_0$ (d) $1.414\ V_0 I_0$

7. A slab consist of two portions of different materials of same thickness and having the conductivities K_1 and K_2. The equivalent thermal conductivity of the slab is
(a) $K_1 + K_2$
(b) $\dfrac{K_1 K_2}{K_1 + K_2}$
(c) $\dfrac{2K_1 K_2}{K_1 + K_2}$
(d) $\sqrt{K_1 + K_2}$

8. A prism is made up of material of refractive index $\sqrt{3}$. The angle of prism is A. If the angle of minimum deviation is equal to the angle of the prism, then the value of A is
(a) 30°
(b) 45°
(c) 60°
(d) 75°

9. The following table

A	B	X
0	0	1
1	0	1
0	1	1
1	1	0

is a truth table for
(a) NAND gate
(b) NOR gate
(c) XOR gate
(d) AND gate

10. The half-life of a radioactive substance is 10 days. This means that
(a) the substance completely disintegrates in 20 days
(b) the substance completely disintegrates in 40 days
(c) 1/8 part of the mass of the substance will be left intact at the end of 40 days
(d) 7/8 part of the mass of the substance disintegrates in 30 days

11. A source and an observer are moving towards each other with a speed equal to $v/2$, where v is the speed of sound. The source is emitting sound of frequency n. The frequency heard by one observer will be
(a) zero (b) n
(c) $\frac{n}{3}$ (d) $3n$

12. Velocity of sound waves in air is 330 m/s. For a particular sound in air, a path difference of 40 cm is equivalent to phase difference of 1.6π. The frequency of the wave is
(a) 165 Hz (b) 150 Hz
(c) 660 Hz (d) 330 Hz

13. The power factor of the circuit shown in figure is
(a) 0.2 (b) 0.4
(c) 0.8 (d) 0.6

14. A particle is executing linear simple harmonic motion of amplitude A. What fraction of the total energy is kinetic when the displacement is half the amplitude
(a) $\frac{1}{4}$ (b) $\frac{1}{2\sqrt{2}}$
(c) $\frac{1}{2}$ (d) $\frac{3}{4}$

15. Two simple harmonic motions are represented by $y_1 = 4\sin(4\pi t - \frac{\pi}{2})$ and $y_2 = 3\cos(4\pi t)$. The resultant amplitude is
(a) 7 (b) 1
(c) 5 (d) $2 + \sqrt{3}$

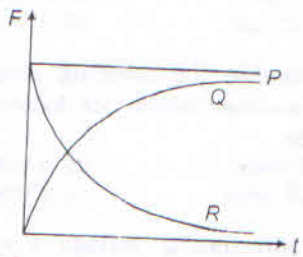
16. Three plates of common surface area A are connected as shown in figure. The effective capacitance will be

(a) $3\varepsilon_0 A/d$ (b) $\varepsilon_0 A/d$
(c) $2\varepsilon_0 A/d$ (d) $\frac{3}{2}\varepsilon_0 A/d$

17. When 20 J of work was done on gas, 40 J of heat energy was released. If the initial internal energy of the gas was 70 J, what is the final internal energy?
(a) 50 J (b) −150 J
(c) 90 J (d) 110 J

18. The value of g at a particular point is 9.8 ms^{-2}. Suppose the earth suddenly shrinks uniformly to half its present size without losing any mass. The value of g at the same point (distance of the point from the centre of earth does not change) will now be
(a) 9.8 ms^{-2} (b) 4.9 ms^{-2}
(c) 19.6 ms^{-2} (d) 39.2 ms^{-2}

19. A spherical ball is dropped in a long column of viscous liquid. Which of the following graphs represent the variation of
(i) gravitational force with time
(ii) viscous force with time
(iii) net force acting on the ball with time?



(a) Q,R,P (b) R,Q,P
(c) P,Q,R (d) R,P,Q

20. The Young's modulus of a wire of length L and radius r is y newton per square metre. If the length is reduced to $\frac{L}{2}$ and radius $\frac{L}{2}$. Its Young's modulus will be

(a) $\frac{y}{2}$ (b) Y

(c) 2Y (d) 4Y

21. A boy of mass m stands on one end of a wooden planck of length L and mass M. The plank is floating on water. If the boy walks from one end of the plank to the other end at a constant speed, the resulting displacement of the plank is given by

(a) $\frac{mL}{M}$ (b) $\frac{ML}{m}$

(c) $\frac{mL}{(M+m)}$ (d) $\frac{mL}{(M-m)}$

22. A sphere of solid material of relative density 9 has a concentric spherical cavity and just sinks in water. If the radius of sphere be R, then the radius of cavity (r) will be related to R as

(a) $r^3 = \frac{8}{9}R^3$

(b) $r^3 = \frac{2}{3}R^3$

(c) $r^3 = \frac{\sqrt{8}}{3}R^3$

(d) $r^3 = \sqrt{\frac{2}{3}}R^3$

23. Average value of kinetic energy and potential energy over entire time period in a SHM is

(a) $0, \frac{1}{2}m\omega^2A^2$

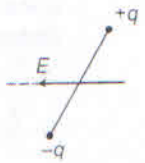
(b) $\frac{1}{2}m\omega^2A^2, 0$

(c) $\frac{1}{2}m\omega^2A^2, \frac{1}{2}m\omega^2A^2$

(d) $\frac{1}{4}m\omega^2A^2, \frac{1}{4}m\omega^2A^2$

24. In which of the states shown in figure, is potential energy of a electric dipole maximum?

(a) 

(b) 

(c) 

(d) 

25. A car is travelling with a linear velocity v on a circular road of radius r. If it is increasing its speed at the rate of a m/s^2, then the resultant acceleration will be

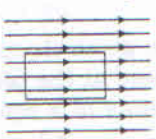
(a) $\sqrt{\frac{v^2}{r^2} - a^2}$

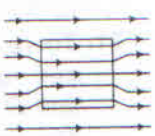
(b) $\sqrt{\frac{v^4}{r^2} + a^2}$

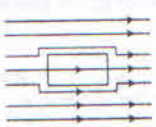
(c) $\sqrt{\frac{v^4}{r^2} - a^2}$

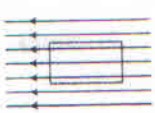
(d) $\sqrt{\frac{v^2}{r^2} + a^2}$

26. A uniform magnetic field parallel to the plane of paper, exsisted in space initially directed from left to right. When a bar of soft iron is placed in the field parallel to it, the lines of force passing through it will be represented by figure.

(a) 

(b) 

(c) 

(d) 

27. A body starts from rest and moves with a uniform acceleration. The ratio of the distance covered in the nth second to the distance covered in n second

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

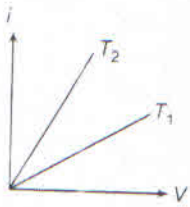
(c) $\frac{2}{n^2}-\frac{1}{n^2}$ (d) $\frac{2}{n}+\frac{1}{n^2}$

28. Wind blowing from South at 10 m/s but to a cyclist it appears to be blowing from the East at 10 m/s. The cyclist has a velocity

(a) $10\hat{i}-10\hat{j}$ (b) $10\hat{i}+10\hat{j}$

(c) $-10\hat{i}+10\hat{j}$ (d) $-10\hat{i}-10\hat{j}$

29. The current i and voltage V graphs for a given metallic wire at two different temperatures T_1 and T_2 are shown in the figure. It is concluded that



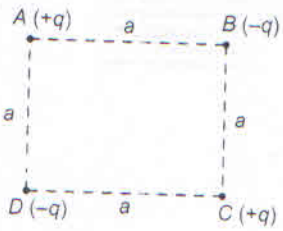
(a) $T_1 > T_2$ (b) $T_1 < T_2$ (c) $T_1 = T_2$ (d) $T_1 = 2T_2$

30. The internal resistance of primary cell is 4 Ω. It generates a current of 0.2 A in an external resistance of 21 Ω. The rate at which chemical energy is consumed is providing the current is

(a) 0.42 J/s (b) 0.24 J/s

(c) 5 J/s (d) 1 J/s

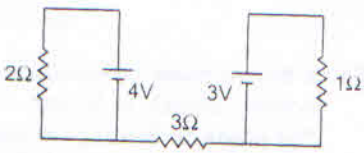
31. There are four point charges $+q$, $-q$, $+q$ and $-q$ are placed at the corners A, B, C, and D respectively of a square of side a. The potential energy of the system is $\frac{1}{4\pi\varepsilon_0}$ times.



(a) $\frac{q^2}{a}(-4+\sqrt{2})$ (b) $\frac{q^2}{2a}(-4+\sqrt{2})$

(c) $\frac{4q^2}{a}$ (d) $\frac{-4\sqrt{2}q^2}{a}$

32. The potential difference across the 3 Ω resistor shown in figure is



(a) zero (b) 1 V

(c) 3.5 V (d) 7 V

33. There are N cells in the circuit of figure. The emf and internal resistance of each cell is E and r respectively. The points A and B in the circuit divide the circuit into n and $(N-n)$ cells. The current in the circuit is

(a) E/r (b) nE/r

(c) NE/nr (d) zero

34. The earth's magnetic field at a certain place has a horizontal component of 0.3 G and total strength 0.5 G. Find angle of dip in $\tan^{-1}$.

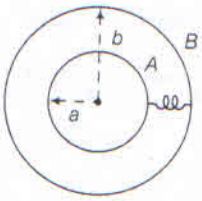
(a) $\delta=\tan^{-1}\frac{4}{3}$ (b) $\delta=\tan^{-1}\frac{3}{4}$

(c) $\delta=\tan^{-1}\frac{5}{3}$ (d) $\delta=\tan^{-1}\frac{3}{5}$

35. Two spherical conductors A and B of radii a and b $(b>a)$ are placed concentrically in air. The two arc connected by a copper wire as shown in figure. The equivalent capacitance of the system is

(a) $\frac{4\pi\varepsilon_0 ab}{b-a}$ (b) $4\pi\varepsilon_0(a+b)$

(c) $4\pi\varepsilon_0 b$ (d) $4\pi\varepsilon_0 a$



36. The magnetic flux linked with the coil varies with time as $\phi = 3t^2 + 4t + 9$. The magnitude of the induced emf of 2s is

(a) 9 V (b) 16 V (c) 3 V (d) 4 V

37. The force F is given by expression $F = A\cos(Bx) + C\sin(Dt)$, where x is the displacement and t is the time. Then dimension of $\frac{D}{B}$ are same as that of

(a) velocity $[LT^{-1}]$
(b) angular velocity $[T^{-1}]$
(c) ngular momentum $[ML^2T^{-1}]$
(d) velocity gradient $[T^{-1}]$

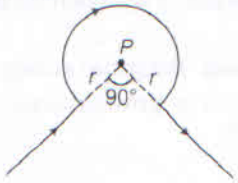
38. The thermo emf of a thermocouple varies with the temperature θ of the hot junction as

$$E = a\theta + b\theta^2 \text{ volt}$$

where the ratio (a/b) is 700°C. If the cold junction is kept at 0°C, then the neutral temperature is

(a) 700°C
(b) 350°C
(c) 1400°C
(d) no neutral temperature is possible

39. The wire shown is figure carries a current of 32 A. If $r = 3.14$ cm, the magnetic field at point P will be



(a) 1.6×10^{-4} T (b) 3.2×10^{-4}T
(c) 4.8×10^{-4}T (d) 6.4×10^{-4}T

40. Carbon, silicon and germanium are semiconductors having four valance e^-. If their respective band gap energies between conduction and valence band are $(Eg)_C, (Eg)_{Si}, (Eg)_{Ge}$. Then

(a) $(E_g)_{Si} < (E_g)_{Ge} < (E_g)_C$
(b) $(E_g)_C < (E_g)_{Ge} > (E_g)_{Si}$
(c) $(E_g)_C > (E_g)_{Si} > (E_g)_{Ge}$
(d) $(E_g)_C = (E_g)_{Ge} = (E_g)_{Si}$

Directions (Q. Nos. 41 to 60) *In each of the following questions, two statement are given. One is assertion and the other is reason. Examine the statement carefully and mark the correct answer according to the instruction given below*

(a) If both the assertion and reason are true and reason explains the assertion.
(b) If both the assertion and reason are true but reason does not explain the assertion.
(c) If assertion is true but reason is false.
(d) If assertion is false but reason is true.

41. **Assertion** In an elastic collision between two bodies, the energy of each body is conserved.

Reason The total energy of an isolated system is conserved.

42. **Assertion** A body can be at rest even when it is under the action of any number of external forces.

Reason Vector sum of all the external forces is zero.

43. **Assertion** In a non-uniform circular motion, the acceleration of the particle is equal to sum of the tangential acceleration and the centripetal acceleration.

Reason The two acceleration are perpendicular to each other.

44. **Assertion** A body can have acceleration even if its velocity is zero at that instant of time.

Reason The body will be momentarily at rest when it reverses its direction of motion.

45. **Assertion** Work done in moving a charge between any two points in a uniform electric field is independent of the path followed by the charge, between these points.

Reason Electrostatic forces are non-conservative.

46. **Assertion** In a transistor amplifier, the output voltage is always out of phase with the input voltage.

Reason The emitter base junction is reverse biased and the base collector junction is forward biased.

47. **Assertion** In case of pure rolling, the force of friction becomes zero.

Reason The speed at the point of contact is zero.

48. **Assertion** Heat from the sun reaches the earth by convection.

Reason Air can be heated only by convection.

49. **Assertion** A wire carrying an electric current has no electric field around it.

Reason Rate of flow of electron's in one direction is equal to the rate of flow of protons in opposite direction.

50. **Assertion** If an electron and proton enter a perpendicular magnetic field with equal momentum, then radius of curve for electron is more than that of proton.

Reason Electron has less mass than proton.

51. **Assertion** The ratio $\frac{C_p}{C_V}$ is more for helium gas than for hydrogen gas.

Reason Atomic mass of helium is more than that of hydrogen.

52. **Assertion** Our ears cannot distinguish two notes, one produced by a violin and other by a guitar, if they have exactly same intensity and same frequency.

Reason When a musical instrument is played, it produces a fundamental note which is accompanied by a number of overtones called harmonics.

53. **Assertion** The de-Broglie wavelength equation has significance for any microscopic and submicroscopic particles.

Reason de-Broglie wavelength is inversely proportional to the mass of the object its velocity is constant.

54. **Assertion** In stationary wave, there is no transfer of energy.

Reason The ratio of kinetic energy to potential energy is independent of the position.

55. **Assertion** Electrons move from a region of higher potential to a region of lower potential.

Reason An electron has less potential energy at a point where potential is higher and *vice-versa*.

56. **Assertion** In a radioactive disintegration, an electron is emitted by the nucleus.

Reason Electron are present inside the nucleus.

57. **Assertion** A normal human eye can clearly see all the objects beyond a certain minimum distance.

Reason The human eye has the capacity to suitably adjust the focal length of its lens to a certain extent.

58. **Assertion** A satellite moving in a circular orbit around the earth has a total energy E_0, then its potential energy is $-E_0$.

Reason Potential energy of the body at a point in a gravitational field of orbit is $\frac{-GMm}{R}$.

59. **Assertion** If a liquid in a vessel is stirred and left to itself, the motion disappear after few minutes.

Reason The moving liquid exerts equal and opposite force.

60. **Assertion** At the centre of earth a body has centre of mass, but no centre of gravity.

Reason This is because $g = 0$ at the centre of earth.

Chemistry

1. Aspirin acts as an analgesic because it
   (a) inhibits the synthesis of prostaglandins which stimulates inflammation of the tissue
   (b) prevents the release of HCl in the stomach
   (c) prevents the interaction of histamine with its receptor
   (d) inhibit activities of enzymes

2. Starch is a mixture of two components, a water soluble component amylose (15-20%) and a water insoluble component amylopectin (80-85%). The aqueous solution of amylose gives a blue colour with iodine solution due to the formation of
   (a) amylose iodide
   (b) amylose iodate
   (c) inclusion complex
   (d) amylose tetraiodide complex

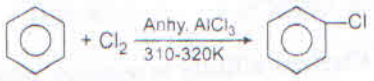
3. What reagent is used in the Hinsberg test of amines?
   (a) $(CH_3CO)_2O$ and pyridine
   (b) $C_6H_5SO_2Cl$ in *aq.* NaOH
   (c) $NaNO_2$ in *aq.* H_2SO_4
   (d) CH_3I (excess) followed by AgOH

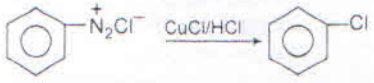
4. Aldol condensation between which of the following two compounds followed by dehydration gives methyl vinyl ketone?
   (a) Formaldehyde and acetone
   (b) Formaldehyde and acetaldehyde
   (c) Two molecules of acetone
   (d) Two molecules of acetaldehyde

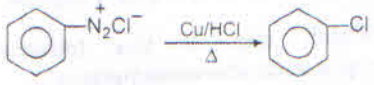
5. Grignard reagents and organolithium compounds on addition to dry ice separately, followed by hydrolysis gives
   (a) ketones and carboxylic acids respectively
   (b) carboxylic acids and ketones respectively
   (c) only carboxylic acids
   (d) only ketones

6. The strongest acid among the following is
   (a) *o*-methoxy phenol (b) *p*-methoxy phenol
   (c) *m*-methoxy phenol (d) phenol

7. On commercial scale phenol is obtained from chlorobenzene. The chlorobenzene needed for the purpose is prepared by Raschig's process. Which one of the following is Raschig's process?

   (a) 

   (b) 

   (c) 

   (d) 

8. How many mL of 0.125 M Cr^{3+} must be reacted with 12.00 mL of 0.200 M MnO_4^- if the redox products are CrO_7^{2-} and Mn^{2+}?
   (a) 8 mL (b) 16 mL
   (c) 24 mL (d) 32 mL

9. At 300 K, 36 g of glucose present per litre in its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of solution is 1.52 bar at the same temperature, what would be its concentration?
   (a) $11 gL^{-1}$ (b) $22 gL^{-1}$
   (c) $36 gL^{-1}$ (d) $42 gL^{-1}$

10. The composition of a sample of wustite is $Fe_{0.93}O$. What percentage of the iron is present in the form of Fe (III)?
    (a) 5% (b) 7.08%
    (c) 15.05% (d) 23.6%

11. When acidified $K_2Cr_2O_7$ solution is added to Sn^{2+} salts, then Sn^{2+} changes to
    (a) Sn (b) Sn^{3+}
    (c) Sn^{4+} (d) Sn^+

12. What would be the expected product of the reaction of propyne with Br_2/H_2O if the mechanism of this reaction is analogous to that of propene?
    (a) 2-brompropenol (b) Bromoacetone
    (c) 2-bromo-2-propanol (d) Bromoprophenol

13. Which of the following carbocation would have the greatest stability?

(a) $CH_3-S-\overset{+}{C}H_2$ (b) $(CH_3)N\overset{+}{C}H_2$

(c) $CH_3O\overset{+}{C}H_2$ (d) $F\overset{+}{C}H_2$

14. Electron affinity is positive, when
(a) O changes into O^-
(b) O^- changes into O^{2-}
(c) O changes into O^+
(d) electron affinity is always negative

15. Which one of the following pairs represents stereoisomerism?
(a) Chain isomerism and rotational isomerism
(b) Structural isomerism and geometrical isomerism
(c) Linkage isomerism and geometrical isomerism
(d) Optical isomerism and geometrical isomerism

16. Using the data given below find out the strongest reducing agent.

$E^\circ_{Cr_2O_4/Cr^{3+}} = 1.33\ V, E^\circ_{Cl_2/Cl^-} = 1.36\ V,$

$E^\circ_{MnO_4^-/Mn^{2+}} = 1.51\ V, E^\circ_{Cr^{3+}/Cr} = -0.74\ V$

(a) Cl^- (b) Mn^{2+}
(c) Cr (d) Cr^{3+}

17. EMF of Daniell cell was found using different concentrations of Zn^{2+} ion and Cu^{2+} ion. A graph was then plotted between E_{cell} and $\log \frac{[Zn^{2+}]}{[Cu^{2+}]}$. The plot was found to be linear with intercept on E_{cell} axis equal to 1.10 V. E_{cell} for Zn / Zn^{2+} $(0.1\ M) || Cu^{2+} (0.01 M) | Cu$ will be
(a) 1.10 V (b) 1.0705 V
(c) 0.93 V (d) 0.078 V

18. Which of the following process is not responsible for the presence of electric charge on the sol particles?
(a) Electron capture by sol particles
(b) Adsorption of ionic species from solution
(c) Formation of Helmholtz electrical double layer
(d) Absorption of ionic species from solution

19. In the metallurgy of aluminium
(a) Al^{3+} is oxidised to Al (s)
(b) graphite anode is oxidised to carbon monoxide and carbon dioxide
(c) oxidation state of oxygen changes in the reaction at anode
(d) oxidation state of oxygen changes in the overall reaction involved in the process

20. In the preparation of HNO_3 we get NO gas by catalytic oxidaton of ammonia. The moles of NO produced by the oxidation of two moles of NH_3 will be
(a) 2 (b) 3
(c) 4 (d) 6

21. The reaction of P_4 with X leads selectively to P_4O_6. The X is
(a) dry O_2
(b) a mixture of O_2 and N_2
(c) moist O_2
(d) O_2 in presence of *aq.* NaOH

22. Which one of the following reactions of xenon compounds are not feasible?
(a) $3XeF_4 + 6H_2O \longrightarrow 2Xe + XeO_3 + 12HF + 1.5O_2$
(b) $2XeF_2 + 2H_2O \longrightarrow 2Xe + 4HF + O_2$
(c) $XeF_6 + RbF \longrightarrow Rb[XeF_7]$
(d) $XeO_3 + 6HF \longrightarrow XeF_6 + 3H_2O$

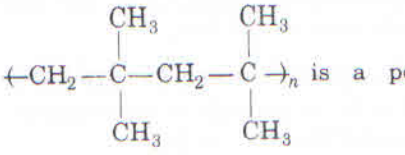
23. The thermal decomposition of HCOOH is a first order reaction with a rate constant of $2.4 \times 10^{-3} s^{-1}$ at certain temperature. Calculate how long will it take for three fourths of initial quantity of HCOOH to decompose?
(a) 578 s (b) 225 s
(c) 436 s (d) 57.8 s

24. Rate constant k of a reaction varies with temperature according to the equation $\log k = \text{constant} - \frac{E_a}{2.303\,R} \times \frac{1}{T}$; where, E_a is the energy of activation for the reaction. When a graph is plotted for $\log k$ *vs* $\frac{1}{T}$ a straight line with a slope -6670 k is obtained. The activation energy for this reaction will be ($R = 8.314\ JK^{-1}mol^{-1}$).
(a) 122.65 kJ mol^{-1}
(b) 127.71 kJ mol^{-1}
(c) 142.34 kJ mol^{-1}
(d) 150.00 kJ mol^{-1}

25. Which of the following statements is not correct about order of a reaction?
(a) The order of a reaction can be a fractional number
(b) Order of a reaction is exeperimentally determined quantity.
(c) The order of a reaction is always equl to the sum of the stoichiometric coefficients of reactants in the balanced chemical equation for a reaction
(d) The order of a reaction is the sum of the powers of molar concentrations of the reactants in the rate law expression

26. Which of the following reagents would not be a good choice for reducing an aryl nitro compound to an amine?
(a) H_2 (excess)/Pt (b) $LiAlH_4$ in ether
(c) Fe and HCl (d) Sn and HCl

27. Which is the correct statement about birth control pills?
(a) Contain estrogen only
(b) Contain progesterone only
(c) Contain a mixture of estrogen and progesterone derivatives
(d) Progesterone enhances ovulation

28.  is a polymer having monomer units

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

29. Glycogen is a branched chain polymer of α-D-glucose units in which chain is formed by $C_1 - C_4$ glycosidic linkage whereas branching occurs by the formation of $C_1 - C_6$ glycosidic linkage. Structure of glycogen is similar to
(a) amylose
(b) amylopectin
(c) cellulose
(d) glucose

30. Each polypeptide in a protein has amino acids linked with each other in a specific sequence. This sequence of amino acids is said to be
(a) primary structure of proteins
(b) secondary structure of proteins
(c) tertiary structure of proteins
(d) quaternary structure of proteins

31. The anticodon transfer RNA for the messenger RNA codon GCA is
(a) TGA (b) GUT
(c) AGT (d) CGU

32. Which one of the following statements is wrong?
(a) Fuel obtained from plastic waste has high octane rating
(b) H_2O_2 with suitable catayst is now used in bleaching of paper
(c) Now-a-days ethanol is produced by one step oxidation of ethene in presence of ionic catalyst in aqueous medium
(d) The growth of fish gets inhibited, if the concentration of dissolved oxygen of water in over 6 ppm

33. The enthalpies of all elements in their standard states are
(a) unity
(b) zero
(c) < 0
(d) different for each element

34. 2 L of an ideal gas at a pressure of 10 atm expands isothermally into a vacuum until its total volume is 10 L. How much work is done in the expansion?
(a) 8 L-atm (b) 16.1 L-atm
(c) 24.0 L-atm (d) No work is done

35. Predict in which of the following entropy decreases.
(a) A liquid crystallizes into a solid
(b) Temperature of a crystalline solid is raised from 0 K to 115 K
(c) $2NaHCO_3(s) \longrightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$
(d) $H_2(g) \longrightarrow 2H(g)$

36. The number of unpaired electrons in a paramagnetic diatomic molecule of an element with atomic number 16 is
(a) 1 (b) 2
(c) 3 (d) 4

37. How many σ and π bonds are in SO_4^{2-} ion?
(a) 4, 2 (b) 3, 2
(c) 4, 3 (d) 3, 3

38. The shape of the orbital with the value of $l = 2, m = 0$ is
(a) spherical (b) double dumb-bell
(c) trigonal planar (d) square planar

39. For the reaction, 1 g mole of $CaCO_3$ is enclosed in 5 L container
$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$
$K_p = 1.16$ at 1073 K then per cent dissociation of $CaCO_3$ is
(a) zero (b) 6.58%
(c) 65% (d) 100%

40. Ionic product of $Ni(OH)_2$ is 2.0×10^{-15}. Molar solubility of $Ni(OH)_2$ in 0.10 M NaOH will be
(a) 1.0×10^{-13} M
(b) 2.0×10^{-13} M
(c) 4.0×10^{-13} M
(d) 8.0×10^{-13} M

Directions (Q. 41 to 60) *In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choice.*
(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 Neoprene can be further hardened by heating in presence of sulphur.

Reason Neoprene contains allylic double bonds which help in introducing sulphur bridges between different polymer chains.

42. Assertion Deoxyribose, $C_5H_{10}O_4$ is not a corbohydrate.

Reason Carbohydrates are hydrates of carbon so compounds which follow $C_x(H_2O)_y$ formula are carbohydrates.

43. Assertion Aniline does not undergo Friedel-Crafts reaction.

Reason Friedel-Crafts is an electrophilic substitution reaction.

44. Assertion In comparison to ethyl chloride it is difficult to carry out nucleophilic substitution on vinyl chloride.

Reason Vinyl group is electron donating.

45. Assertion Phenol forms 2,4, 6-tribromophenol on treatment with Br_2 in carbon disulphide at 273 K.

Reason Bromine polarises in carbon disulphide.

46. Assertion On cooling, the brown colour of nitrogen dioxide disappears.

Reason On cooling, NO_2 undergoes dimerisation resulting in the pairing of odd electrons of NO_2.

47. Assertion Na^+ and Al^{3+} are isoelectronic but the magnitude of ionic radius of Al^{3+} is less than that of Na^+.

Reason The magnitude of effective nuclear charge of the outer shell electrons in Al^{3+} is greater than that in Na^+.

48. Assertion $C_p - C_V = R$, for an ideal gas.

Reason R is the work done when temperature of one mole of an ideal gas is increased by 1°.

49. Assertion On addition of NH_4Cl to NH_4OH solution, pH decreases but remains greater than 7.

Reason Addition of NH_4^+ ion decreases ionisation of NH_4OH thus $[OH^-]$ is decreased, hence pH decreases.

50. **Assertion** The mobility of sodium ion is lower than that of potassium ion.

Reason The ionic mobilities depend on the effective radius of the ion.

51. **Assertion** On adding zinc pieces to aqueous $FeCl_3$ solution, colour changes from deep yellow to light green.

Reason Aqueous $FeCl_3$ is acidic and on adding Zn, nascent hydrogen is produced which reduces deep yellow $FeCl_3$ solution to light green $FeCl_2$ solution.

52. **Assertion** *p*-chlorobenzoic acid is stronger acid than benzoic acid.

Reason Chlorine has electron donating resonance (+ *R*) effect.

53. **Assertion** A free radical is paramagnetic species.

Reason A free radical is formed in homolytic fission of covalent bond.

54. **Assertion** Addition of one equivalent of HCl to 1,3-butadiene at 80°C gives 3-chloro-1-butene as major product.

Reason 3-chloro-1-butene is a kinetically controlled product.

55. **Assertion** Semiconductors are solids with conductivities in the intermediate range from $10^{-6} - 10^{4}$ ohm^{-1} m^{-1}.

Reason Intermediate conductivity in semiconductor is due to partially filled valence band.

56. **Assertion** When methanol is added to water boiling point of water increases.

Reason When a volatile solute is added to a volatile solvent, elevation in boiling point is observed.

57. **Assertion** The Daniell cell becomes dead after some time.

Reason Oxidation potential of zinc anode decreases and that of copper increases.

58. **Assertion** The highest oxidation state of Os is + 8.

Reason Osmium is a 5 *d*-block element.

59. **Assertion** Toxic metal ions are removed by the chelating ligands.

Reason Chelate complexes tend to be more stable.

60. **Assertion** Formic acid reduces Tollen's reagent.

Reason Compounds containing —CHO group reduce Tollen's reagent.

Biology

1. Speciation of sympatric species is due to
   (a) geographic isolation
   (b) reproductive isolation
   (c) isolation/separation
   (d) migration

2. The application of synthetic plant hormone like IAA, IBA and NAA are best described as
   (a) prevent early fruit fall before harvesting and is used to produce parthenocarpic fruit
   (b) prevent early fruit fall only
   (c) to produce both seed less fruits and fruits with seeds
   (d) to produce larger fruit

3. Flame cells and Malpighian tubules are the analogous organ in
   (a) insects and arthropods respectively
   (b) arthropods and echinodermates respectively
   (c) helminths and arthropods with other insect respectively
   (d) arthropods and other insect with helminths respectively

4. Trochlear, trigeminal and glossopharyngeal nerve are respectively.
   (a) IX, V and IV
   (b) IV, V and IX
   (c) V, IV and IX
   (d) IV, V and IX

5. Who had proposed theory of cohesion and adhesion forces?
(a) Dixon and Jolly (1894)
(b) Dixon and Benson (1885)
(c) Dixon and Jolly (1950)
(d) Sir Jagdish Chandra Bose (1850)

6. Which one of the following useful organisms is not a part in production of curd/yoghurt?
(a) *S. thermophilus*
(b) *Lactobacillus bulgaricus*
(c) *Acetobactor aceti*
(d) *Streptococcus lactis*

7. The drugs, which do not develop physiological dependence is
(a) sedative and tranqualisers
(b) stimulational cocaine
(c) opiates
(d) hallucinogens

8. Organogenesis or morphogenesis in tissue culture is controlled/regulated by phytohormones the credit of this important discovery goes to
(a) Skoog and Miller (1957)
(b) Guha and Maheswari (1964)
(c) Calvin and Benson (1894)
(d) Halperin and Wetherall (1964)

9. A man whose father is a colourblind, marry a woman, who is a daughter of colourblind mother. The offspring of this couple will be
(a) all daughter and sons are colourblind
(b) 50% colourblind and 50% normal son
(c) carrier normal daughter and colourblind sons
(d) colourblind sons and normal daughter

10. In a child of 15 years age, plasma calcium level is diagnosed below optimum level. Which organ is malfunctioning?
(a) Thyroid gland
(b) Liver
(c) Parathyroid
(d) Posterior lobe of pituitary

11. Which one of the following best describe polygenic inheritance?
(a) ABO blood group in human and flower colour of *Mirabilis jalapa*
(b) Hair pigment of mouse and tongue rolling in humans
(c) Human eye colour and sickle-cell anaemia
(d) Human height and colour of skin and eyes

12. Go through the following table comparing the effect of sympathetic and parasympathetic nervous system. Which one is matched correctly?

	Features	Sympathetic Nervous System	Parasympathetic Nervous System
(a)	Pupil of eye	Dialates	Constricts
(b)	Heart rate	Decreases	Increases
(c)	Intestinal peristalsis movement	Stimulate	Inhibits
(d)	Salivary gland	Stimulate seceration	Inhibits seceratiin

13. Which one of the following set meaning is not different?
(a) Cistron — Triplet
(b) DNA profile — DNA type
(c) Gene pool — Genome
(d) Gene — Codon

14. How macula lutea and corpus luteum are related?
(a) Contribute in maintain pregnancy
(b) Both are a source of hormones
(c) Both are charaterised by their yellow colour
(d) Both are found in human ovaries

15. Which one as used/regarded as biofertiliser?
(a) A association between pteridophytes and cyanobacteria *Anabaena*
(b) A association between gymnosperms and *Nostoc*
(c) A association between legume and *Rhizobium*
(d) All of the above

16. The common characteristic showing by mushroom smut and rust
(a) is characterised by presence of basidiocarps
(b) is characterised by presence of ascocarps
(c) all are pathogen
(d) all are saprophytic in nature

17. A reptilian looks like house lizard is sitting on plant with its tail coiled around twig in your garden. Can you identify the animal?
(a) Garden lizard (*Calotes*) showing camouflage
(b) *Chamaeleon* showing protective colouration
(c) *Varanus* showing mimicry
(d) *Hemidactylus* showing sexual dimorphism

18. Different varieties of Indian mangoes are most popular in Western and some other European countries. The varieties with different flavour, colour, sugar and fleshy content is due to
(a) genetic diversity
(b) species diversity
(c) induced mutation
(d) hybridisation

19. *hn*RNA undergoes two additional process. Out of them in one process an unusual nucleotide (methyl GPT) is added to the 5′ end of molecule. What would you called this?
(a) Tailing (b) Splicing
(c) Termination (d) Capping

20. Which one exhibits the character of a protozoan during one phase of its life cycle and character of fungi in another phase of its life cycle?
(a) Water moulds (b) Psilophytes
(c) Slime moulds (d) Diatoms

21. Wernickes syndrome is generally common in alcoholic person; which is characterised by less mental activity and dual vision. It is caused by the deficiency of
(a) riboflavin (b) thiamine
(c) pyridoxine (d) retinol

22. Which one of the most common embryo sac in flowering plant?
(a) Monosporic, 8 nucleated and 7 celled
(b) Monosporic, 7 celled and 7 nucleated
(c) Bisporic, 8 nucleated and 7 celled
(d) Bisporic, 8 nucleated and 7 celled

23. Which type of immunoglobulin is/are abundantly found in foetus?
(a) IgE (b) IgG (c) IgM (d) IgD

24. The mandatory combination responsible for assembly of microtubules are
(a) Na^+ and Ca^{2+} (b) Mg^{2+} and Ca^{2+}
(c) Cl^- and Ca^{2-} (d) Na^+ and K^+

25. Which one plant movement is unidirectional?
(a) Phototaxis (b) Chemotaxis
(c) Both (a) and (b) (d) Thigmotrophism

26. The exchange of segments of two non-homologous pair of chromosomes is termed as
(a) crossing over (b) linkage
(c) transformation (d) translocation

27. Spirochaetes is/are
(a) a class of viruses
(b) myxobacteria
(c) spiral-shaped bacteria
(d) richittsias

28. SER and RER can be distinguished with its presence in
(a) protein synthesising cells
(b) protein and lipid synthesising cells
(c) carbohydrates and fat synthesising cells
(d) fat and protein synthesising cells

29. Human Immuno Virus (HIV) contain a protein coat and genetic material and is horse chestnut shaped
(a) double-stranded DNA
(b) single-stranded DNA
(c) single-stranded RNA
(d) double-stranded RNA

30. Root cambium is derived from
(a) primary meristem
(b) secondary meristem
(c) intercalary meristem
(d) apical meristem

31. Which one contain most reduced form of stem?
(a) Bulb (b) Rhizome
(c) Tuber (d) Twinner

32. Which enzyme complex is responsible for the reduction of molecular nitrogen to the level of NH_3 in root module of legume?
(a) Aminase (b) Nitrogenase
(c) Nitrate reductase (d) Nitrite reductase

33. The plants which can withstand with narrow and broad range of temperature tolerance respectively are
(a) monothermal and stenothermal
(b) stenothermal and monothermal
(c) stenothermal and eurythermal
(d) stenothermal and mesothermal

34. Desert can be converted into a lush green land by planting
(a) terrestrial plant (b) xerophytic plant
(c) halophytes (d) psammophytes

35. Which one is a source of commercially important product *Syzygium aromaticum*?
(a) Flower bud (b) Axillary bud
(c) Thalamus (d) Peduncle

36. When a fern plant is develped from its prothallus without fertilisation? This phenomenon is an example of
(a) parthenocarpy (b) apogamy
(c) apospory (d) organogenesis

37. Bruners gland are characteristic feature of
(a) jejunum of small intestine
(b) ileum
(c) duodenum
(d) fundic region of stomach

38. Which one dental formula represent a heterodont placental draught and tough animal?
(a) $I\frac{3}{3}, C\frac{1}{1}, PM\frac{4}{4}, M\frac{2}{3}$ (b) $I\frac{3}{3}, C\frac{1}{1}, PM\frac{3}{2}, M\frac{1}{1}$
(c) $I\frac{2}{1}, C\frac{0}{0}, PM\frac{3}{2}, M\frac{3}{3}$ (d) $I\frac{3}{3}, C\frac{1}{1}, PM\frac{4}{4}, M\frac{3}{3}$

39. Pollorum disease in fowls is caused by
(a) *Salmonella*
(b) *Clostridium*
(c) *Hemophilus*
(d) *Mycobacterium*

40. Green muffler play a important role against
(a) noise pollution
(b) radioactive pollution
(c) soil pollution
(d) air pollution

Directions (Q. Nos. 41-60) *These questions consist two statement each printed as Assertion and Reason. While answering these question, you are required to choose any one of the following four options.*
(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** Plasmids are single stranded extrachromosomal DNA.
Reason Plasmid are usually present in eukaryotic cells.

42. **Assertion** The megaspore mother cell divide by meiotic division to produce four spore.
Reason Megaspore Mother Cell (MMC) are diploid and megaspore are haploid.

43. **Assertion** Living organisms are considered as a close system.
Reason Energy of living organism can not be lost or gained from external environment.

44. **Assertion** Medulla is considered as a respiratory centre in animals.
Reason Rate of breathing is regulated by medulla because of the changes in O_2 content of blood.

45. **Assertion** Tropical rain forest are rich in flora and fauna along with microbes on this biosphere.
Reason The low latitude humid tropics harbour the rainforest ecosystems.

46. **Assertion** Erythroblastosis foetalis is disease related with Rh factor and may cause death of developing foetus inside womb.
Reason It cause massive destruction of erythrocytes in foetus that leads to anaemia and tissue damage of foetus.

47. **Assertion** Radial vascular bundle is the characteristic of majority of the roots including dicots and monocots.

Reason Monocot stem is characterised by colletral open vascular bundle.

48. **Assertion** Due to excessive use of fertiliser and pesticides the available capillary water turns to hypotonic is relation to cell sap.

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

49. **Assertion** Amphibian heart consist of two auricle and one ventricle.

Reason The deoxygenated blood is returned to heart through sinus venosus.

50. **Assertion** Humans are considered advanced from all its primates relatives because of the larger cranial capacity and high intelligence.

Reason A lumber curve is present in man which is also present in apes.

51. **Assertion** Chromosomes are divided into heterochromatin and euchromatin part.

Reason Heterochromatin are those regions of chromosome that remain condensed during interphase and rest of the non-condensed chromosome are called euchromatin.

52. **Assertion** Tongue is a gustatoreceptor.

Reason Receptors for gustatosensation are located in taste bud.

53. **Assertion** Aflatoxin are commercially produced by a species of aspergilli.

Reason These toxin are useful to mankind.

54. **Assertion** Mosses are might have originated from algae.

Reason Protonema of bryophytes is similar to some green algae.

55. **Assertion** Cartilage and bone are flexible and rigid connective tissue.

Reason Blood is a connective tissue.

56. **Assertion** Cell wall is generally absent in animal cell.

Reason Animal cells are covered by a cell membrane.

57. **Assertion** Holoblastic cleavage with almost equal sized blastomeres is a characteristics feature of placental mammals.

Reason Egg of most mammal including human are of centrolecithal type.

58. **Assertion** Most cells in human body release excessive amount of inflammatory chemicals which cause allergic reactions.

Reason Allergen present in environment on reaching human body stimulate mast cells in certain individuals.

59. **Assertion** In angiosperm, the conduction of water is more efficient because xylem contain vessels.

Reason Conduction of water by xylem vessels elements is an active process with energy supplied by xylem parenchyma rich in mitochondria.

60. **Assertion** Gram negative bacteria do not retain the stain when washed with alcohol.

Reason The outer membrane of Gram negative (–ve) bacteria contain lipopolysaccharides, a part of which is integrated into membrane lipid.

General Knowledge & Aptitude

1. The most appropriate measure of a country's economic growth is its
   (a) Gross Domestic Product (GDP)
   (b) Net Domestic Product (NDP)
   (c) Net National Product (NNP)
   (d) Per Capita Product (PCP)

2. Who amongst the following is the regulator of Insurance sector in India?
   (a) IRDA (b) SEBI
   (c) AMFI (d) RBI

3. The Dakshinamurti idol of Shiva depicts him in which form?
   (a) Teacher (b) Dancing
   (c) Reclining (d) Meditating

4. The only Muslim woman to sit on the throne of Delhi was
   (a) Razia Sultan
   (b) Mumtaz Mahal
   (c) Hamida Banu Begum
   (d) Nurzahan

5. Which of the following organisations makes 'Doing Business Report' every year?
   (a) WTO (b) World Bank
   (c) UNCTAD (d) IMF

6. 'Mahatma Gandhi' returned to India, leaving South Africa forever in
   (a) 1915 (b) 1919
   (c) 1914 (d) 1916

7. Which one of the following is not a constitutional body?
   (a) Union Public Service Commission
   (b) State Public Service Commission
   (c) Finance Commission
   (d) Planning Commission

8. Article 340 of the Indian Constitution deals with
   (a) Finance Commission
   (b) Backward Classes Commission
   (c) Election Commission
   (d) Union Public Service Commission

9. The North-South and East-West corridors of the National Highway Development project meet at
   (a) Kanpur (b) Jhansi
   (c) Lucknow (d) Varanasi

10. How many languages are there in the Eight Schedule of the Constitution of India?
   (a) 22 (b) 16
   (c) 18 (d) 20

11. Which of the following longitudes is known as 'Standard Meridian' in India?
   (a) 87° 30' E (b) 85° 30' E
   (c) 84° 30'E (d) 82° 30' E

12. Joint Meeting of both Houses of Parliament is chaired by
   (a) Speakers of Lok Sabha
   (b) President of India
   (c) Chairman of Rajya Sabha
   (d) None of the above

13. A book 'Fault Lines' is written by
   (a) Raghuram Rajan
   (b) D Subba Rao
   (c) Vimal Jalan
   (d) Montek Singh Ahluwalia

14. Vitamin-K is necessary for
   (a) formation of prethrombin
   (b) prevention of pernicious anaemia
   (c) prevention of rickets
   (d) formation of DNA

15. The study related to the plants being used as vegetabel is called
   (a) Flori-culture
   (b) Pomology
   (c) Horticulture
   (d) Olericulture

16. A parallel port is most often used by a
   (a) mouse
   (b) monitor
   (c) printer
   (d) external storage device

17. CDMA stands for
(a) Code Division Multiple Access
(b) Code Divide Multiple Access
(c) Code Division Multiple Area
(d) Code Division Modify Access

18. Sanjukta panigrahi was famous for the dance
(a) Odissi (b) Manipuri
(c) Kathak (d) Bharatnatyam

19. Development of Goitre is mainly due to deficiency of
(a) sodium (b) iodine
(c) calcium (d) iron

20. Union Government has decided to set up a 4000 MW solar power project in Rajasthan at
(a) Jaisalmer (b) Baremer
(c) Dhaulpur (d) Sambher

Answers

Physics

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

Chemistry

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

Biology

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

General Knowledge & Aptitude

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

Hints & Solutions

Physics

1. For p-type germanium semiconductor, the germanium must be doped with trivalent impurity. Since, indium is third group member, therefore germanium must be doped with indium.

2. Sound waves are longitudinal waves. They do not show the phenomenon of polarization because polarization is only possible in transverse waves.

3. The magnifying power is given by $M = \frac{L}{f_o}\frac{D}{f_e}$

for $(D >> f_o)$

where L : distance between objective and eyepiece

D : Least distance of distinct vision

f_o : Focal length of objective

f_e : Focal length of eyepiece

4. 1 curie $= 3.7 \times 10^{10}$ dps

5. as $d = \sqrt{2hR}$

d : Covering range

h : Height of tower

R : Radius of earth

So: $d \propto \sqrt{h}$

To double the covering range its height should be made 4 times.

6. The phase angle between voltage V and current I is $\pi / 2$.

Power factor as $\cos\phi = \cos\frac{\pi}{2} = 0$

Hence the power consumed is zero, which is choice (a).

7. As the two portions of the slab are connect in series

$\therefore \quad K = \frac{\Sigma x_i}{\Sigma x_i / K_i}$ (x is thickness of slab)

$= \frac{x + x}{\frac{\lambda}{K_1} + \frac{n}{K_2}} = \frac{2K_1K_2}{K_1 + K_2}$

8. Given $M = \sqrt{3}$ and $\delta_m = A$

Now

$$\mu = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$$= \frac{\sin\left(\frac{A+A}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \frac{\sin A}{\sin\frac{A}{2}}$$

$$= \frac{2\sin\left(\frac{A}{2}\right)\cos\left(\frac{A}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$$= 2\cos\left(\frac{A}{2}\right)$$

Now, $2\cos\left(\frac{A}{2}\right) = \mu = \sqrt{3}$

or $\cos\left(\frac{A}{2}\right) \Rightarrow \frac{\sqrt{3}}{2} = \frac{A}{2} = 30°$

or $A = 60°$

9. The following truth table is for NAND gate.

10. In 30 days (i.e. 3 half-lives)

So, $\left(\frac{1}{2^3}\right) = \frac{1}{8}$ of the substance is left or $\frac{7}{8}$ part of the mess of the substance disintegrate.

11. When the source and observer are approaching towards each other, then apparent frequency heard by the observer is $n' = \left(\frac{v + v_0}{v - v_0}\right)n$

$$= \frac{\left(v + \frac{v}{2}\right)}{\left(v + \frac{v}{2}\right)}n$$

$$n' = \left(\frac{3}{2} \times \frac{2}{1}\right)n = 3n$$

12. Phase difference $= \frac{2\pi}{\lambda} \times$ path difference

$$1.6\pi = \frac{2\pi}{\lambda} \times 40$$

$$\lambda = \frac{2}{16} \times 40 = 50\,\text{cm} = 0.5\,\text{m}$$

$v = \nu\lambda$ v = Velocity of sound

$\nu = \frac{v}{\lambda}$ ν = Frequency

$$= \frac{330}{0.5} = 660\,\text{Hz}$$

13. Here inductor also have resistance

So, total resistance $= 40 + 40 = 80\,\Omega$

The impedance of $L-C-R$ circuit is given by

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$= \sqrt{(80)^2 + (100-40)^2}$$

$$= \sqrt{(80)^2 + (60)^2} = 100\Omega$$

Power factor, $\cos\phi = \frac{R}{Z} = \frac{80}{100} = 0.8$

14. Kinetic energy $(KE) = \frac{1}{2} m\omega^2 (A^2 - x^2)$

Potential energy $(PE) = \frac{1}{2} m\omega^2 x^2$

Total energy $(E) = \frac{1}{2} m\omega^2 A^2$

When, $x = A/2$

$$KE = \frac{1}{2} m\omega^2 \left(A^2 - \frac{A^2}{4}\right) = \frac{3}{8} m\omega^2 A^2$$

now $E = \frac{1}{2} m\omega^2 A^2$

$\therefore$ $\frac{KE}{E} = \frac{3}{4}$

15. The given two SHM are

$$y_1 = 4\sin(4\pi t + \pi/2)$$

$$= 4\cos 4\pi t$$

$$y_2 = 3\cos(4\pi t)$$

The phase difference between the two vibration is zero

i.e. $\phi = 0$

The resultant amplitude is given by

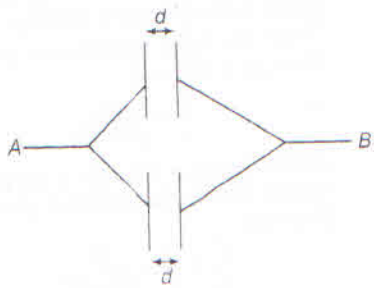
$$A^2 = 4^2 + 3^2 + 2 \times 4 \times 3\cos 0°$$

$$A^2 = 49 \text{ or } A = 7$$

16. (c) The given circuit is equivalent to parallel combination of two identical capacitors.

Each having capacitance $C = \frac{\varepsilon_0 A}{d}$

Thus, $C_{eq} = 2C = \frac{2\varepsilon_0 A}{d}$



17. From the first law of thermodynamics

$$dQ = dU + dW$$

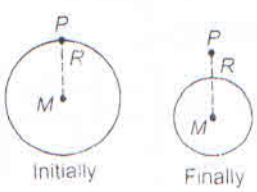
or $$dU = dQ - dW$$

$$= 40 - 20 = 20\,\text{J}$$

Since, heat energy is released by the gas, its internal energy is decrease from 70 J to $70 - 20 = 50$ J.

18. If g be the initial value for acceleration due to gravity and g_f be the final value, then

$$g = \frac{GM}{R^2} = g \text{ and } g_f = \frac{GM}{\left(\frac{R}{2} + \frac{R}{2}\right)^2} = g$$



19. Gravitational force remains constant of the falling spherical ball. It is represented by straight line P. Now, the viscous force $(F = 6\pi\eta rv)$ increases as the velocity increases with time.

Hence, it is represented by curve Q. Net force = gravitational force – viscous force. As viscous force increases, net force decreases and finally become zero. Then the body falls with a constant terminal velocity. It is thus represented by curve R.

20. Young's modulus for a particular material is constant.

21. Before the boy starts walking on the plank, both the boy and the plank are at rest. So total momentum of (boy +plank) system is zero. If the boy walks with a speed v on the plank and as a result if the speed of the plank in the opposite direction is V.

Then the total momentum of system is $mv-(M+m)V=0$

or $$\frac{V}{u}=\frac{m}{(M+m)}$$

Since distance moved is proportional to speed, the displacement L' of the plank is given by

$$\frac{L'}{L}=\frac{V}{v}=\frac{m}{(M+m)}$$

or $$L'=\frac{mL}{(M+m)}$$

22. Weight of the sphere = Weight of water displaced

$$\left(\frac{4}{3}\pi R^3-\frac{4}{3}\pi r^3\right)g\times g=\frac{4}{3}\pi R^3\times 1\times g$$

$$\Rightarrow \quad 9R^3-R^3=9r^3$$

$$\Rightarrow \quad 9r^3=8R^3$$

$$r^3=\left(\frac{8}{9}\right)R^3$$

23. Maximum $KE=\frac{1}{2}m\omega^2A^2$

Minimum $KE=0$

Average $$KE=\left(\frac{0+\frac{1}{2}m\omega^2A^2}{2}\right)$$

$$=\frac{1}{4}m\omega^2A^2$$

Similarly average $$PE=\left(\frac{0+\frac{1}{2}m\omega^2A^2}{2}\right)$$

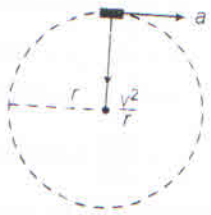
$$=\frac{1}{4}m\omega^2A^2$$

24. Potential energy of electric dipole, $U=-pE$
$=-pE\cos\theta$

In fig. (a) $\theta=\pi$ rad.

Hence, $U=-pE\cos\pi=+pE=$ maximum

25. Centripetal acceleration $=\frac{v^2}{r}$ and it is perpendicular to increase in speed a which is tangential



$\therefore$ Resultant acceleration

$$=\sqrt{\left(\frac{v^2}{r}\right)^2+(a^2)}$$

26. Because of large permeability of soft iron, magnetic lines of force prefer to pass through it. Concentration of lines in soft iron bar increases as shown in Fig. (b).

27. $S_n=u+\frac{a}{2}(2n-1)$ (Distance travelled in nth second)

or $$S_n=0+\frac{a}{2}(2n-1) \quad ...(i)$$

also, $$S=ut+\frac{1}{2}at^2$$

$$=0+\frac{1}{2}an^2 \quad ...(ii)$$

(Distance travelled in nth second)

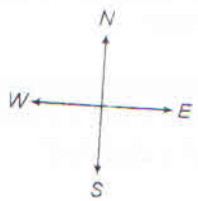
$\therefore$ $$\frac{S_n}{S}=\frac{\frac{a}{2}(2n-1)}{an^2/2}=\frac{2}{n}-\frac{1}{n^2}$$

28. Velocity of wind is 10 m/s from South to North *i.e.*, $\vec{v}_{wind}=10\hat{j}$

But to the cyclist it appears to below from the East at 10 m/s.

So, velocity of wind relative to the cyclist is 10 m/s from East to West.

i.e., $\vec{v}_{wind/cyclist}=-10\hat{i}$



Since,

$$\vec{V}_{wind/cyclist} = \vec{V}_{wind} - \vec{V}_{cyclist}$$

$$\Rightarrow \quad -10\hat{j} = 10\hat{j} - \vec{V}_{cyclist}$$

$$\Rightarrow \quad \vec{V}_{cyclist} = 10\hat{i} + 10\hat{j}$$

29. Slope of graph will give us reciprocal of resistance.

$$\left(\text{as } \frac{I}{V} = \frac{1}{R}\right)$$

Here resistance at temperature T_1 is greater than that at T_2.

Since resistance of metallic wire is max at higher temperature then at lower temperature, hence $T_1 > T_2$.

30. Chemical energy consumed

= Heat energy produced

$= i^2(r + R)(1)$

(As $H = i^2Rt$, t = 1s here)

$= (0.2)^2(4 + 21) = 1$ J/s

31. There will be six pairs.

So, potential energy of the system is

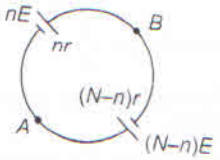
$$U = \frac{(q)(-q)}{4\pi\varepsilon_0 a} + \frac{(-q)(+q)}{4\pi\varepsilon_0 a} + \frac{(+q)(-q)}{4\pi\varepsilon_0 a} + \frac{(-q)(q)}{4\pi\varepsilon_0 a} + \frac{(q)(q)}{4\pi\varepsilon_0 a\sqrt{2}} + \frac{(-q)(-q)}{4\pi\varepsilon_0 a\sqrt{2}}$$

$$U = 4\left(\frac{-q^2}{4\pi\varepsilon_0 a}\right) + 2\frac{q^2}{4\pi\varepsilon_0\sqrt{2}a}$$

$$U = \frac{1}{4\pi\varepsilon_0}\frac{q^2}{a}(-4 + \sqrt{2})$$

32. The two sub circuits are closed loops. They cannot send any current through the 3Ω resistor. Hence the potential difference across the 3Ω resistor is zero.

33. The equivalent circuit is shown in figure below.



$$I = \frac{V}{12}$$

$$= \frac{nE + (N-n)E}{nr + (N-n)r} = \frac{NE}{Nr} = \frac{E}{r}$$

34. Horizontal component of earth's magnetic field is given by $B_H = B\cos\delta$

(δ : Angle of dip)

or $\cos\delta = \frac{B_H}{B} = \frac{0.3}{0.5} = \frac{3}{5}$

$\therefore \quad \frac{1}{\cos\theta} = \sec\delta = \frac{5}{3}$

Now, $\tan\delta = \sqrt{\sec^2\delta - 1} = \sqrt{\left(\frac{5}{3}\right)^2 - 1}$

$= \sqrt{\frac{25}{9} - 1} = \frac{4}{3}$

$\therefore \quad \delta = \tan^{-1}\left(\frac{4}{3}\right)$

35. The charge given to inner sphere will pass to the outer sphere. So, the capacitance of outer sphere will be $4\pi\varepsilon_0 b$.

(As capacitance due to spherical conductor is $4\pi\varepsilon_0 r$, where r is radius of conductor)

36. As emf, $e = \frac{d\phi}{dt}$ $\left(\frac{d\phi}{dt}\right.$: Rate of charge of magnetic flux)

$$= \frac{d}{dt}(3t^2 + 4t + 9)$$

$$= 6t + 4 + 0$$

So, at $t = 2$ s, $e = 6\times2 + 4 = 16$ V

37. In trigonometric function like $\sin\theta, \cos\theta$ etc.

θ is dimensionless

So, $[Bx] = [M^0L^0T^0]$

$[B] = [L^{-1}]$

Also, $[Dt] = [M^0L^0T^0]$

$[D] = [T^{-1}]$

Now $\left[\frac{D}{B}\right] = [LT^{-1}]$

38. Given that, $E = a\theta + b\theta^2$

$\therefore \quad \frac{dE}{d\theta} = a + 2b\theta$

Neutral temperature $\theta_n = \frac{dE}{d\theta} = 0$

$\therefore \quad a + 2b\theta_n = 0$ or $\theta_n = -\left(\frac{a}{2b}\right)$ °C

$\therefore \theta_n = \frac{-700}{2} = -350°$ C (not permissible)

39. Magnetic field due to a complete circular wire loop carrying a current I at the centre is $\frac{\mu_0 I}{2r}$

Here, the straight portions of the wire do not contribute because the point P is along them. The field at P is due to $\frac{3}{4}$th of the loop of radius r. Thus

$$B = \frac{3}{4}\left(\frac{\mu_0 I}{2r}\right)$$

$$= \frac{3}{4} \times \frac{4\pi \times 10^{-7} \times 32}{2 \times 314 \times 10^{-2}} = 4.8 \times 10^{-4} \text{T}$$

40. Here, carbon has the highest resistivity and germanium has the lowest resistivity.

$\therefore$ Carbon has lowest conductivity and germanium has highest conductivity. So, carbon has highest band gas energy and germanium has lowest band gap energy.

41. Due to change in velocity, the energy of each body changes on collision. However the total energy of the system of two bodies is conserved.

42. A body in rest will remain at rest if vector sum of all the external forces is zero.

43. Here assertion is false but reason is true and the acceleration of the particle is given by $|\mathbf{a}| = \sqrt{a_c^2 + a_t^2}$ (*i.e.*, vector sum)

where a_c = centripetal acceleration and a_t = tangential acceleration.

44. When a body while going vertically upward reaches at the highest point then it will be momentarily at rest and then it reverses its direction. At highest point velocity is zero its acceleration is equal to acceleration due to gravity.

45. Electrostatic forces are conservative, so work done in moving a charge in uniform electric field does not depend on path followed. Hence assertion is true but reason is false.

46. Here assertion is true but reason is false infact, the base-emitter junction is forward biased and the base collector junction is reverse biased.

47. As there is no relative motion between two surfaces at point of contact so force of friction will be zero.

48. Heat from sun reaches to earth by radiation so assertion is wrong and air is heated only by convection so reason is correct statement.

49. A wire carrying a current remains neutral because as many electrons enter one end of the wire as leave it from other end, as there is no net charge on the wire so there will be no electric field.

50. When a charged particle enters in perpendicular magnetic field than radius of curved path is given by $r = \frac{mv}{qB} = \frac{p}{qB}$

As momentum p is constant

$$\therefore \quad r \propto \frac{1}{q}$$

As e^- and proton have same charge

$$\frac{r_{e^-}}{r_{p^+}} = \frac{q_{e^-}}{q_{e^+}} = 1$$

Assertion is false, but reason is true.

51. As helium is monoatomic and hydrogen is diatomic, so, helium has less number of degrees of freedom than hydrogen.

$\therefore C_p/C_v$ is more for helium than that of hydrogen.

Assertion and reason as true but reason is not a correct explanation of assertion.

52. When a musical instrument is played, it produces a fundamental note which is accompanied by a number of overtones called harmonic. The number of harmonics is not the same for all instruments. Its the number of harmonics which distinguishes the note produced by a guitar and that produced by violin.

53. As de-Broglie wavelength, $\lambda = \frac{h}{mv}$

So, for constant velocity $\lambda \propto \frac{1}{m}$

So, lesser will be the mass greater will be its de-Broglie wavelength.

54. There is no transfer of energy in a stationary wave but form of energy keeps on charging from one form to another *i.e.*, the ratio of $\frac{KE}{PE}$ changes.

So, assertion is true but reason is false.

55. Since electron has a negative charge, so it has less potential energy at a point where the potential is higher and *vice-versa*.

Hence in an electric field an electron moves from a region of lower potential to a region of higher potential.

(*i.e.*, it tends to move in such a way so that its potential energy become minimum)

56. β-particles are emitted from radioactive nuclei as a neutron is converted into a proton. So, assertion is true but reason is false.

57. Both assertion and reason are true and reason is correct explanation of assertion.

58. Here assertion is false but reason is true.

For satellite,

$$KE = \frac{GMm}{2R}$$

and $$PE = \frac{-GMm}{R}$$

Total energy, $E_0 = KE + PE$

$$= \frac{GMm}{2R} - \frac{GMm}{R}$$

$$= \frac{-GMm}{2R} = \frac{PE}{2}$$

$$PE = 2E_0$$

59. The motion stops due to viscosity of liquid. So, assertion is true but reason is false.

60. At the centre of earth, $g = 0$

$\therefore$ A body has no weight at the centre of earth, and hence no centre of gravity. But centre of mass of a body is not related to gravity.

So, centre of mass exist.

Chemistry

1. Aspirin is a non-additive analgesics. It inhibits the synthesis of compounds known as prostaglandins which stimulate inflammation in the tissues and cause pain.

2. Inclusion complex is a host guest addition compound. The space available within the crystal lattice of the host molecule *i.e.* amylose is in the form of tunnels and the size of the tunnels is such that it can easily accomodate guest molecules *i.e.* iodine molecules to form an addition compound called the inclusion complex.

The blue colour however, disappears on heating and reappers on cooling.

3. Benzene sulphonyl chloride is used in Hinsberg's test of amines to form sulphonamides.

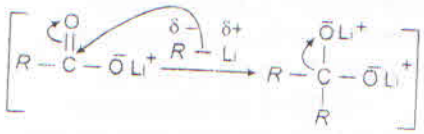
4. $CH_2O + CH_3COCH_3 \xrightarrow[\text{Cross aldol condensation}]{OH^-}$

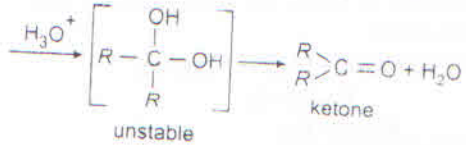
$HOCH_2—CH_2—COCH_3 \xrightarrow[-H_2O]{H^+/H_2O,\ \Delta}$

$CH_2=CH—CO—CH_3$

methyl vinyl ketone

5. Lithium (EN = 1.0) is less electronegative than Mg (EN = 1.2), therefore, organolithium compounds are more nucleophilic than Grignard reagents. As a result, organolithium compounds add more reactive CO_2 as well as less reactive resonance stabilised lithium salt of carboxylic acid thus formed to produce ketones.





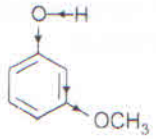
Grignard reagents on the other hand, being less nucleophilic add only to the more reactive CO_2.

$$R\overset{\delta-}{-}\overset{\delta+}{MgX} + O=C=O \xrightarrow{\text{Dry ether}} \left[R-\overset{O}{\overset{\|}{C}}-OMgX\right]$$

$$\xrightarrow{H_3O^+} R-\overset{O}{\overset{\|}{C}}-OH + Mg(OH)X$$

carboxylic acid

6. *m*-methoxy phenol is the strongest acid. Methoxy group at *meta* position exerts only $-I$ effect. Due to this, it withdraws electrons from all the nuclear position of the benzene ring including the one holding the O—H group consequently, electron density in the O—H bond decreases. Hence, *m*-methoxy phenol becomes more acidic than *o*-and *p*-methoxy phenol.



7. In Raschig's process, a mixture of benzene vapours, air and hydrogen chloride is passed over heated $CuCl_2$ at 500 K.

$$2C_6H_6 + 2HCl + O_2 \text{ (air)} \xrightarrow[500\,K]{CuCl_2} 2C_6H_5Cl + 2H_2O$$

8. $Cr^{3+} + \overset{+7}{MnO_4^-} \longrightarrow Mn^{2+} + \frac{1}{2}\overset{+6}{Cr_2O_7^{2-}}$

Reduction

Oxidation

Equivalent of Cr^{3+} = 3 × moles of Cr^{3+}

Equivalents of MnO_4^- = 5 × moles of MnO_4^-

Amound of Cr^{3+} = $0.125 \times V$ millimol

$= 0.125 \times V \times 3$ milliequivalent

Amount of MnO_4^- = $0.200 \times 12.00 \times 5$ milli equivalent

$0.125 \times V \times 3 = 0.200 \times 12.00 \times 5$

$V = 32$ mL

9. $$4.98 = \frac{36 \times S \times 300}{180 \times 1}$$

$S = 0.083$ bar L mol^{-1} K^{-1}

$$\pi_2 = \frac{n_2 S T_2}{V_2}$$

$$1.52 = \frac{n_2 \times 0.083 \times 300}{V_2}$$

$$\frac{n_2}{V_2} = 0.061 \text{ mol } L^{-1} = 11 \text{ g } L^{-1}$$

10. From the valency of Fe (II) and Fe (III), it is clear that three Fe (II) ions will be replaced by two Fe (III) causing a loss of one iron ion. Total loss of iron from one molecule of FeO = 1 – 0.93 = 0.07

Hence, total Fe (III) present in one molecule of FeO = $2 \times 0.07 = 0.14$

Total number of Fe(II) and Fe (III) present in one molecule of FeO = 0.93

Hence, percentage of Fe(III) = $\frac{0.14 \times 100}{0.93}$

= 15.05%

11. $Cr_2O_7^{2-} + 14H^+ + 3Sn^{2+} \longrightarrow 2Cr^{3+} + 3Sn^{4+} + 7H_2O$

12. $CH_3-C \equiv CH + Br_2 \xrightarrow{H_2O}$

$$CH_3-\overset{OH}{\overset{|}{C}}=CHBr \rightleftharpoons CH_3-\overset{O}{\overset{\|}{C}}-CH_2Br$$

Bromoacetone

13. Nitrogen lone pair stabilises the positive charge to the most through resonance

14. When O^-, changes into O^{2-}, change is endothermic because O^- repels the incoming electron due to similar charge, hence it needs energy to accept the electron. So, electron affinity is positive.

15. Pair of optical isomerism and geometrical isomerism are able to exhibit the phenomenon of stereoisomerism because both type of isomers differ only in their orientation in space.

16. Strongest reducing agent is one which is oxidised most easily *i.e.*, which has highest oxidation potential. Cr / Cr^{3+} has highest oxidation potential *i.e.*, (+ 0.74) so, it is oxidised most easily and therefore, it is the strongest reducing agent.

17. For Daniell cell, $Zn + Cu^{2+} \longrightarrow Zn^{2+} + Cu$

$$E_{Cell} = E^\circ_{cell} - \frac{0.0591}{2} \log \frac{[Zn^{2+}]}{[Cu^{2+}]}$$

Intercept $= E^\circ_{cell} = 1.10$ V

$$\therefore \quad E_{cell} = 1.10 - \frac{0.0591}{2}\log\frac{0.1}{0.01}$$

$$E_{cell} = 1.10 - 0.0295 = 1.0705 \text{ V}$$

18. Charge on sol particles is not due to absorption but due to adsoption of ionic species from solution.

19. In metallurgy of aluminium, the oxidation state of O does not change in either the reaction occurring at the anode or overall reaction.

$$C + \overset{-2}{O} \longrightarrow \overset{+2}{C} + \overset{-2}{O} + 2e^-$$

$$C + 2\overset{-2}{O} \longrightarrow \overset{+4}{C} + (\overset{-2}{O})_2$$

$$Al_2O_3 + 3C \longrightarrow 2Al + 3\overset{+2}{C} + 3\overset{-2}{O}$$

20. $4NH_3 + 5O_2 \xrightarrow{\Delta} 4NO + 6H_2O$

or $2NH_3 + \frac{5}{2}O_2 \longrightarrow 2NO + 3H_2O$

21. $P_4 + 3O_2 \xrightarrow{O_2+N_2} P_4O_6$

N_2 prevents further oxidation of P_4O_6 to P_4O_{10}.

22. $XeO_3 + 6HF \longrightarrow XeF_6 + 3H_2O$

This reaction is not feasible because the products again react to give the reactants back.

23. $t_{1/2} = \frac{0.693}{k} \quad \frac{0.693}{2.4\times10^{-3}s^{-1}} = 288.75$ s

$t_{3/4} = 2 \times t_{1/2} = 577.50$ s ≈ 578 s.

24. Slope of the line $= -\frac{E_a}{2.303R} = -6670$ K

$E_a = 2.303 \times 8.314\ (JK^{-1}\ mol^{-1}) \times 6670$ K

$= 127711.4$ J mol^{-1} $= 127.71$ kJ mol^{-1}

25. Order of reaction may or may not be equal to the sum of stoichiometric coefficients.

26. $LiAlH_4$/ether reduces aryl nitro compounds to azo compounds.

$$\underset{\text{nitrobenzene}}{2C_6H_5NO_2} \xrightarrow{LiAlH_4/\text{ether}} \underset{\text{diazobenzene}}{C_6H_5N{=}N{-}C_6H_5}$$

27. Birth control pills contain a mixture of estrogen and progesterone derivatives.

28. The repeating structural unit is $-CH_2C(CH_3)_2$ and hence the monomer is isobutylene $CH_2{=}C(CH_3)_2$

29. Amylopectin is a branched polymer, amylose and cellulose are linear polymers while glucose is the monomer.

30. Primary structure of proteins tells us about the sequence of amino acids in which they are linked.

31. The bases of messenger RNA are complementary to those of DNA strand. Again each adenine (A) of DNA, these appears on RNA, the base uracil (U), opposite guanine (G) is cytosine (C) and *vice-versa* and opposite thymine (T) is adenine (A). Thus, the anticodon of GCA would be CGU.

32. The growth of fish gets inhibited, if the concentration of dissolved O_2 of water is below 6 ppm.

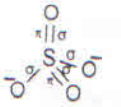
33. By convention standard enthalpy for formation, $\Delta_f H^\circ$ of an element in reference state *i.e.*, its most stable state of aggregation is taken as zero.

34. $q = -W = p_{ex}(10-2) = 0 \times 8 = 0$. No work is done.

35. After freezing, the molecules attain an ordered state and therefore, entropy decreases. In rest of the cases entropy increases.

36. Like O_2 molecule, sulphur (atomic number = 16) exists as S_2 molecule in vapour state and it is paramagnetic due to the presence of two unpaired electrons in antibonding π molecular orbitals.

37.



σ - bonds = 4

π - bonds = 2

38. *s p d f*

$l = 0, 1, 2, 3$ *d*-orbital is double dumb-bell shaped.

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

$K_p = p_{CO_2}$ (only gaseous molecule count)

$K_p = K_c(RT)^{\Delta n}$

$$1.16 = \frac{x}{5}(0.0821 \times 1073)^1$$

$$x = \frac{1.16 \times 5}{0.0821 \times 1073} = 0.0658$$

$$= 0.0658 \times 100 = 6.58\%$$

40. Let the solubility of $Ni(OH)_2 = S$

$$\underset{S}{Ni(OH)_2} + H_2O \rightleftharpoons \underset{S}{Ni^{2+}}(aq) + 2\underset{S}{OH^-}(aq)$$

$K_{sp} = 2.0 \times 10^{-15} = [Ni^{2+}][OH^-]^2$

$= [S][0.10 + 2S]^2$

As K_{sp} is small, $2S << 0.10$

Therefore, $(0.10 + 2s) = 0.10$

Hence,

$$2.0 \times 10^{-15} = S(0.10)^2$$

$$S = 2.0 \times 10^{-13}\ M = Ni^{2+}$$

41. **Reason** is the correct explanation of Assertion.

42. Deoxyribose is a carbohydrate.

Carbohydrates are optically active polyhydroxy aldehydes or polyhydroxy ketones or substances which give these on hydrolysis.

43. $AlCl_3$ forms a salt with aniline ($C_6H_5NH_2^-AlCl_3^-$) which deactivates the benzene ring thereby preventing Friedel-Craft reaction.

44. The carbon-halogen bond in vinyl halide has some double bond character.

45. Phenol forms 2, 4, 6-tribromophenol on treatment with Br_2 in water.

In H_2O, phenoxide ion is formed which highly activates it towards electrophilic substitution reaction.

46. **Reason** is the correct explanation of Assertion.

47. In case of isoelectronic species, effective nuclear charge increases with increase in atomic number, Z (with increase in protons). This results in decrease in size. Hence, ionic radius of $Al^{3+} < Na^+$.

48. $C_p - C_V = R$ = mechanical work due to expansion of one mole of gas when temperature is increased by 1°C.

49. Due to common ion effect ionisation of NH_4OH decreases so, pH decreases.

50. Na^+ ion is smaller in size. It gets more hydrated than K^+ ion. Therefore, mobility of Na^+ ion is lower than that of K^+.

51. **Reason** is the correct explanation of assertion.

52. Chlorine has electron donating resonance effect however its inductive effect ($-I$) wins over resonance effect and makes it overall electron withdrawing due to which it increases the acid strength of benzoic acid.

53. Free radical posses odd number of valence electrons, hence paramagnetic.

54. At very low temperature 1, 3-butadiene undegro 1, 2-addition to give kinetically controlled product as major one.

55. Intermediate conductivity of semiconductor is due to small energy gap between filled valence band and empty conduction band.

56. When methanol is added to water boiling point of water decreases.

When a more volatile solute is added to volatile solvent, vapour pressure of solvent increases.

57. **Reason** is the correct explanation of assertion.

58. Osmium has the electronic configuration $5d^6\ 6s^2$. As $5d$ and $6s$ are close in energy, All the 8 electrons can participate in bonding.

59. **Reason** is the correct explanation of assertion.

60. HCOOH— acts as a reducing agent because it can be easily oxidised to CO_2 and H_2O and hence reduces Tollen's reagent.

Biology

1. Speciation of sympatric species is the formation of species within a single population without geographic isolation. Thus the subpopulation become reproductive isolated in the midest of its parental population.

2. Indole acetic acid, indole butyric acid and napthalene acetic acids, are synthetic auxins. These synthetic auxin are used to prevent pre fall of fruit. 2, 4-D is used in apple and and orange NAA is used in tomatoes. The application of these synthetic auxin on unpollinated pistils develops them into parthenocarpic fruits.

3. Flame cells are the excretory organs in member of phylum–Platyhelminthes. Which are commonly called as helminths and Malpighian tubules are the excretory organs in member of phylum–Arthropoda along with other insect.

4. Trochlear (Pathetic), trigeminal and glossopharyngeal are IV, V and IX cranial nerves respectively. The first one trochlear is smallest cranial nerve while trigeminal is the largest cranial nerve. The third one glossopharyngeal is a mixed nerve.

5. Dixon and Jolly (1894) proposed cohesion and adhesion theory. According to the theory a strong cohesive force between the water molecule is responsible for the tensile strenght of water column in vessels of conducting tissue xylem.

6. Yoghurt/curd consists of pasteurised homogenised milk. In yoghurt production *Streptococcus thermophilus*, *S. lactis* and *Lactobacillus bulgaricus* are inoculated. The *Acetobactor aceti* is used in commercial produciton of acetic acid.

7. Any drug which excites any body function specially those that stimulate the brain and central nervous system is known as stimulants. Cocaine (coca) is a stimulate.

8. Organogenesis or morphogenesis is the regeneration of an organ from the undifferentiated mass of cells. Which is best known as callus. Skoog and Miller (1957) showed that appropriate concentration of phytohormone auxin and cytokinin stimulate the morphogenesis or organogenesis. Higher concentration of auxin with cytokinin promotes cell division in roots while higher concentration of cytokinin with auxin stimulate cell division in roots.

9. Man is normal while women of colourblind mother is also colourblind. The gene for colour blindness is present on *X*-chromosome as a recessive autosomal diseases. One *X*-chromosome from mother goes to daughter and other to son while the *X*-chromosome of father (Normal) goes to daughter and 4 chromosome to son.

	X^C	X^C
X	XX^C	XX^C
Y	X^CY	X^CY

10. The parathyroid gland is malfunctioning or degenerating. Parathyroid gland secret parathormone, which maintain calcium level in plasma. Phosphate balance is also regulated by the secretion of parathyroid gland.

    Therefore, if parathyroid gland degenerates, the calcium and phosphate level (conc) will disturbed.

11. In polygenic inheritance several sets of alleles may produces cumulative effect on the same character, *i.e.*, human height and colour of skin and eye. ABO group in human is an example of codominance whereas flower colour of four O' clock plant is an example of incomplete dominance.

    Hair pigmental mouse is an example of recessive epistasis. Sickle-cell anaemia is an example of codominance.

12.

	Features	Sympathetic Nervous System	Parasympath -etic
(a)	Pupil of eye	Dialates	Constricts
(b)	Heart rate	Increases	Decreases
(c)	Intestinal peristalsis movement	Inhibits	Stimulate
(d)	Salivary gland	Decreased secretion	Increased secretion

13. DNA profiling or DNA fingerprinting or DNA typing or genetic fingerprinting was invented by **Sir Alec Jefferys of UK is 1985.** A person can be identified on the basis of his/her DNA specificity by the techinque. During this technique the dark band on X-ray film present the DNA profile.

The technique is also used to identify crime in rape and murder as well as in dispute in paternity and maternity.

14. Both corpus luteum and macula lutea are characterised by yellow colour. The cytoplasm of the corpus luteum is rich in yellow pigment called lutein. So, it is a yellow body, while macula lutea is yellow spot in human eyes. It occur as a yellow area of retina lying exactly opposite the centre of cornea. Image is formed at yellow spot.

15. Cyanobacteria either free living of symbiotic are considered as biofertiliser because the fix atmospheric nitrogen in form of nitrates and nitrites by biological process. They leaves of *Azolla* pteridophytes has as many as 80,000 BGA and fix atmospheric N_2 in field of rice.

Nostoc with corrolloid roots of *Cycas* also fix atmospheric nitrogen. Soil nitrogen is maintained by association between *Rhizobium* and root nodule of legume.

16. Mushroom, smut and rust are fungi which belong to class– Basidiomycetes of division–Basidiomycotina. Basidiomycetes is characterised with about sixteen thousand described species.

All these fungi of class– Basidiomycetes bear characteristic fruiting bodies called basidiocarps, which are most attractive and are often reffered as fungus flower. This class of fungi includes toadstools (toxic mushroom) puffballs, jelly fungi and shelf fungi and pathogen like smut and rust.

17. It is a arboreal lizard *Chameleons*. These groups of arboreal lizard are mostly found in Africa and Madagaskar. Such lizard show protective colouration and can sit on a tree with its tail coiled around twig.

18. Genetic diversity is the basis of formation of new species of fruit like mango with different flavour colour, fibre content, sugar content. The greator is the genetic diversity of a species, the higher is its efficiency to adapt. The variation in the constitution of genes of a species, constitute genetic diversity of that species. So due to the genetic diversity, natural selection can operate in process of evolution.

The species diversity of any region is determined by various species of habitat. When the process of mutation can be achieved artificially, it is termed as **induced mutation**.

Hybridisation is the procuction of one or more hybrid organism by crossing of genetically different parents.

19. Heterogeneous nuclear RNA undergoes two additional processing known as capping and tailing. In capping process an unusual nucleotide. Methyl guanosine monophosphate (methyl GMP) is added to 5′ end of the RNA.

In tailing process, a adenlate residues (200-300) are added at 3′ end in template independent manner. In splicing, introns are removed and exons are joined in a definite order. Termination is the ending process in gene expression.

20. The slime moulds (or moulds) make up two unique and interesting phyla of kingdom–Protista. The cellular slime moulds are now classified with Protozoa (*Amoeba*) due to their evolutionary closeness and having amoeboid stage.

The other phyla of slime moulds are Plasmodial Slime moulds belongs to **Myxomycota**.

21. Vitamin-B_1 (thiamine) deficiency is most commonly observed in alcoholic person prolonged deficiency of this water soluble vitamin may leads decreased mental function, double vision reduced muscular contraction, lacking in decision capability. These all of the ill effect results into a disorder known as Wernicke's syndrome.

22. The most common embryosac in flowering plant is monosporic, 8 nucleated and 7 celled. It is characterstic of polygonum.

23. IgG immunoglobulin only posses the capability to cross the placenta and is found in foetus.

24. Richard Weisenberg (1972) reported the tubulin polymerisation by addition of Mg^{2+} and Ca^{++}. Microtubule could be disassembled and reassembled over and over by changing on concentration and lowering and raising than raising the temperature.

25. The various type of plant movement can be classified as autonomic and paratonic movement. Autonomic movement can be spontaneous and occur on their own while paratonic movement can be induced by stimulant.

The paratonic movement man be classified into tropic movement which is caused by external stimuli like light, gravity, touch, water, chemical and electricity and tactic which is induced by chemical heat and radiation, like chemotaxis, phototaxis, thermotaxis and Rheotaxis and nestic movement the taxtic movement is considered unidirectional.

26. The exchange of segments of two non-homologous pair of chromosome is termed as translocation. Crossing over is the process of exchange of segment of non-sister chromatids between a homologous pair of chromosomes.

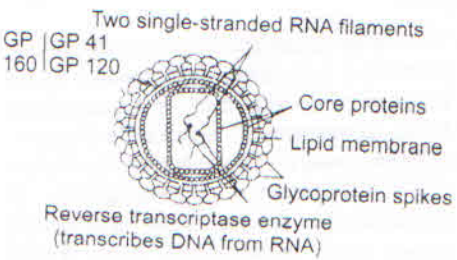
Transformation is the process of transfer of DNA from on bacterial cell to another, when genes are closely present link together in a group and transmitted as a single units this phenomenon is known as linkage.

27. Spirochaetes are spiral-shaped bacteria. These are thick and elastic cell wall structures, use axial filament for motility. Syphilis (STD) is caused by a spirochaete called *Treponema pallidium*.

28. Endoplasmic reticulum was discovered by Porter *et al* (1945). It is a network of membranous sac like structure such as cisternae, vesicles and narrow tubules. On the basis of presence or absence of ribosomes on its surface these structure are of two types

Rough Endoplasimc Reticulm (RER) with ribosomes on its surface is prominently present in protein synthesizing cells. It is also called as **ergastoplasm**. Smooth Endoplasmic Reticulms (SER) lack ribosomes on its surface. It is also known as **sarcoplasm**. These structure predominantly occur in fat synthesising cells.

29. AIDS is a disorder due to HIV (Human Immuno Deficiency Virus). HIV is enveloped within a membrane which is made up of a several GP 120 and GP41 glycoprotein. Both of the proteins resemble spike dots, which gene the horse chesnut appearance to virus. The core (central part) of virus contain two ssRNA, reverse transcriptase enzyme, P -15 protein which is associated with RNA, inner covering of P-24 and outer covering fo P-28.



30. The cambium of root develop from procambial cell that remain undifferentiated between primary xylem and primary phloem. During secondary growth cambium cuts of secondary xylem towards inner side and secondary phloem towards outer side. Thus, cambium is secondary meristem.

31. Bulb, rhizome, tuber are underground modified stem. Twiner is also a modification of stem (aerial). In bulb stem is highly reduced and found in form of disc upon which fleshy scale leaves are borne. Disc and leaves together are reffered as bulbs.

32. The enzyme nitrogenase reduce molecular nitrogen to NH_3 in root nodule of legume. Nitrogenase is a complex system;

consisting of two major protein components a MoFe protein and Fe protein. The MoFe protein joined with one or two Fe protein. The MoFe protein contain two atom of molybdenum and 28-32 atom of iron while the Fe protein has 4 atom of iron.

33. Stenothermic plant have narrow range of temperature tolerance while eurythermal plant can withstand broad range of temperature tolerance.

34. Psammophytes are those plant which can easily grow on sand and gravel. So, plantation of these plant can cover a desert into lush green land. Xerophyte are draught loving plants and can withstand in water scarcely while halophytes grow on saline soil. Terrestrial plants are flowering plants.

35. *Syzygium aromaticum* is clove, belongs to the family–Myrtaceae. It is obtained from flower bud. It consist peduncle, receptacle, four triangular calyx lobes, four unopened petals, numerous stamens and a central style.

36. When a fern plant arise from any cell of fern prothallus, it is called as apogamy. It is a process of development of a saprophyte from gametophyte without fertilisation. Apogamy was first time reported by Farlow (1874). Apospory is development of gametophyte directly from sporophytic tissue, such gametophyte have diploid number of chromosomes.

Parthenocarpy is development of fruit without fertilisation. Organogenesis is the development of organ and tissues.

37. Brunner's gland is characteristic feature of duodenum part of small intestine. It is found in submucosa of duodenum and secret two important vitamin **secretin** and **cholecystokinin**, which in turn stimulate pancreas and gall bladder to release their juice.

38. Dental formula $I\frac{3}{3}, C\frac{1}{1}, PM\frac{4}{4}, M\frac{3}{3} \times 2$

$$= \frac{11}{11} \times 2 = 44$$

belong to draught animal horse. The animal possess highest number of teeth among heterodont placental animal. Rest three dental formula belong to cat, dog and rabbit.

39. Pollarum or **white** diarrhoea is caused by bacterium *Salmonella pollarum*. The disease spreads through contaminated food and water and is characterised by loss of appetite and difficulty in breeding. Some other poultry disease are

Ranikhet – Viral disease
Fowl pox – Viral disease
Fowl cholera – *Pasteurella multicida*
Coryza – *Haemophilus gallinarum*

40. Green plant on roadsides are often considered as green mufler. These green belt minimise noise pollution.

41. Plasmids are double stranded, extrachromosomal circular DNA molecule, occur in cytoplasm of many bacteria. Plasmids usually do not present in eukaryotic cells.

42. Megaspore mother cell is diploid. This divides by meiosis and produce 4 haploid megaspore. Out of them 3 degenerates and one remain functional and develop and into female gametophyte.

43. Living organism are considered as open system as these can gain or lose energy from external surrounding environment. All the living organism restore their energy either directly from sunlight or indirectly from food.

44. The respirartory centre regulate the rate and depth of breathing. The respiratory centre is composed neurons located in medulla oblongata and pons varolli of hind brain.

Present evidence suggests that the chaemosensitive cells of aortic bodies are active and normal pO_2 of artrial blood and a great increase in firing rate occur when pO_2 is reduced.

45. Annual rainfall and humidity determine the diversity of any region. Tropical rain forest receive a annual rainfall form 140-175 cm and allow flora and fauna to flourish.

46. In erythroblastosis foetalis the foetus is always Rh^+ and mother Rh^-. During embryonic development the Rh^+ blood of foetus is mixed with Rh^- blood mother, *i.e.*, Rh factor antibodies formed in mother blood which cause clumping of RBC of foetus during next pregnancy.

47. Radial vascular bundles are characteristic of majority of the roots. In this type of vascular bundle xylem and phloem are arranged on separate radius while in monocot stem the vascular bundle is collateral and closed.

48. Due to excessive use of chemical fertiliser the available water to the plants (capillary water) became hypertonic in relation to cell sap. As a result the water molecule diffuse out of the cell due to exosmosis.

49. The amphibian heart is three chambered, *i.e.*, two auricle and one ventricle. The deoxygenated blood returned to the right atrium through sinus venosus, *i.e.* right atrium receive deoxygenated blood from different body parts.

50. The man is more intelligent and advance then the primates because of lagre brain smaller lumber region due to reduced number of lumber vertebrae is present in both apes and man.

51. The euchromatin is rich in DNA active near centre which replicate quite early in s-phase (synthetic phase) while the heterochromatin is tightly of coiled and genetically next due to less amount of DNA.

52. Tongue is also called as gustato receptor and is considered receptor for taste. The receptor for gustatory sensation are located in taste bud on the tongue.

53. Aflatoxin is a mycotoxin produced by *Aspergillus flavus*, a common mold. Contaminated food is main source of infection.

This toxin cause aflatoxicosis which may lead to haemorrhizae cirrosis of liver and cancer of liver in human being.

54. According to fossil records, mosses are evolved from algae. Protonema of mosses is similar to certain green algae.

55. Cartilage is a flexible connective tissue while bone is a rigid connective tissue. Blood is also a connective tissue having plasma as liquid part.

56. Cell wall is outermost covering all plant cell. It is present above the plasma membrane. It is composed of cellulose (green plant) hemicellulose pectin, etc. Fungal cell wall is made up of chitin. It provide rigidity to plant cell.

Cell walls absent in animal cells, have outermost covering is cell membrane (plasma membrane) which is selectively permeable and lipoproteinacious in nature.

57. Eggs contain a small amount of yolk or without any yolk are known as microlecithal/alecithal/oligolecithal/meiolecithal eggs. Such eggs are found in starfish, *Amphioxus eutherian* mammals including rabit and human being.

In such eggs equal holoblastic cleavage takes place in which equal or approximately equal sized blastomeres are formed.

58. The symptom of an allergic reaction develop in response to histamine. Most cells release a large amount of histamine into the blood stream and it also acts as a intitator of the inflammatory response which aid the arrival of leucocytes at the side of infection. Histamine stimulate capillary dilation, increased capillary permeability, closure of bronchial tube, mucus secretion, pain and swelling.

59. Reason Xylem is the principal water conductive tissue forming a continuous system that run through out the plant body. Within the system water passes from the roots tip through the shoot in an unbroken stream.

When water reaches the leveas, much of it transpirate through stomata.

The two principal type conducting element in xylem are **trachieds** and **vessels** both of which have thick secondary wall, elongated in shaped and have no living protoplast at maturity.

It conductive trachieds element water flow from trachied to trachied through opening called **pits** in the secondary walls in contrast, vessels element do nto have pits but contain definite opening or **perforations** in their endo walls by which they are linked together and through which water flow.

Conduction of water through vessels in not an active process, and is a passive process. Primitive angiosperm have only trachieds but the majority of the living angiosperm posses vessels. Transport of water through vessels is efficient.

60. Gram staining **bacteria** technique was developed by Hans Christian Gram (a Danish Bacteriologist) in 1884. On the basis of technique, *bacteria can be classified into*

(a) Gram positive; show positive test with Gram stain.

(b) Gram negative; show negative test with Gram stain.

The step involve in gram staining are summarised as

The composition of bacterial cell wall is basis for Gram staining technique. The cell wall of Gram (-ve) bacteria contain alcohol soluble lipid (lipopolysaccharides) while the cell wall of (+ve) Gram positive bacteria lack these lipid there retain crystal violet iodine complex used.