



JAWAHARLAL INSTITUTE OF
POSTGRADUATE MEDICAL
EDUCATION & RESEARCH



JIPMER MBBS

SAMPLE PAPER 2012



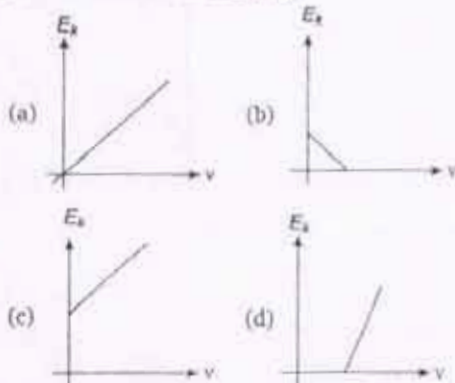
JIPMER

Medical Entrance Exam

Solved Paper 2012

Physics

1. The cylindrical tube of a spray pump has a cross-section of 8 cm^2 , one end of which has 40 fine holes each of area 10^{-8} m^2 . If the liquid flows inside the tube with a speed of 0.15 m min^{-1} , the speed with which the liquid is ejected through the holes is
- (a) 50 m/s (b) 5 m/s
(c) 0.05 m/s (d) 0.5 m/s
2. Which one of the following graph represents the variation of maximum kinetic energy (E_k) of the emitted electrons with frequency ν in photoelectric effect correctly?



3. A vessel of height $2d$ is half filled with a liquid of refractive index $\sqrt{2}$ and the other half with a liquid of refractive index n (the given liquids are immiscible). Then, the apparent depth of the inner surface of the bottom of the vessel (neglecting the thickness of the bottom of the vessel) will be

- (a) $\frac{n}{d(n + \sqrt{2})}$ (b) $\frac{d(n + \sqrt{2})}{n\sqrt{2}}$
(c) $\frac{\sqrt{2}n}{d(n + \sqrt{2})}$ (d) $\frac{nd}{d + \sqrt{2}n}$

4. A shell of mass 20 kg at rest explodes into two fragments whose masses are in the ratio $2 : 3$. The smaller fragment moves with a velocity of 6 m/s . The kinetic energy of the larger fragment is
- (a) 96 J (b) 216 J
(c) 144 J (d) 360 J
5. An electric bulb has a rated power of 50 W at 100 V . If it is used on an AC source 200 V , 50 Hz , a choke has to be used in series with it. This choke should have an inductance of
- (a) 0.1 mH (b) 1 mH
(c) 0.1 H (d) 1.1 H
6. In Young's double slit experiment with sodium vapour lamp of wavelength 589 nm and the slits 0.589 mm apart, the half angular width of the central maximum is
- (a) $\sin^{-1}(0.01)$ (b) $\sin^{-1}(0.0001)$
(c) $\sin^{-1}(0.001)$ (d) $\sin^{-1}(0.1)$

7. A parallel plate capacitor with air as the dielectric has capacitance C . A slab of dielectric constant K and having the same thickness as the separation between the plates is introduced so as to fill one-fourth of the capacitor as shown in the figure. The new capacitance will be

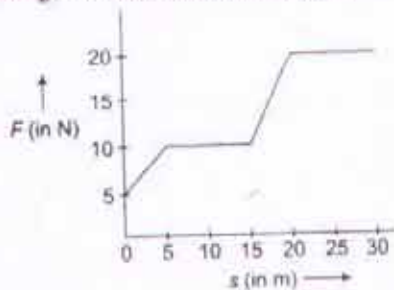




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- (a) $(K + 3) \frac{C}{4}$ (b) $(K + 2) \frac{C}{4}$
(c) $(K + 1) \frac{C}{4}$ (d) $\frac{KC}{4}$

8. Three concurrent co-planar forces 1 N, 2 N and 3 N acting along different directions on a body
- (a) can keep the body in equilibrium if 2 N and 3 N act at right angle
(b) can keep the body in equilibrium if 1 N and 2 N act at right angle
(c) cannot keep the body in equilibrium
(d) can keep the body in equilibrium in 1 N and 3 N act at an acute angle
9. The work done by a force acting on a body is as shown in the graph. The total work done in covering an initial distance of 20 m is



- (a) 225 J (b) 200 J
(c) 400 J (d) 175 J
10. Horizontal tube of non-uniform cross-section has radii of 0.1 m and 0.05 m respectively at M and N. For a streamline flow of liquid, the rate of liquid flow is



- (a) changing continuously with time
(b) greater at M than at N
(c) greater at N than at M
(d) same at M and N
11. A coil of n number of turns is wound tightly in the form of a spiral with inner and outer radii a and b respectively. When a current of strength I is passed through the coil, the magnetic field at its centre is
- (a) $\frac{\mu_0 n I}{(b-a)} \log_e \frac{a}{b}$ (b) $\frac{\mu_0 n I}{2(b-a)}$
(c) $\frac{2\mu_0 n I}{b}$ (d) $\frac{\mu_0 n I}{2(b-a)} \log_e \frac{b}{a}$

12. A certain vector in the xy -plane has an x -component of 4 m and a y -component of 10 m. It is then rotated in the xy -plane so that its x -component is doubled. Then, its new y -component is (approximately)

- (a) 20 m (b) 7.2 m
(c) 5.0 m (d) 4.5 m

13. A police party is moving in a jeep at a constant speed v . They saw a thief at a distance x on a motorcycle which is at rest. The moment the police saw the thief, the thief started at constant acceleration a . Which of the following relations is true if the police is able to catch the thief?

- (a) $v^2 < ax$
(b) $v^2 < 2ax$
(c) $v^2 \geq 2ax$
(d) $v^2 = ax$

14. If two soap bubbles of different radii are connected by a tube, then

- (a) air flows from bigger bubble to the smaller bubble till sizes become equal
(b) air flows from bigger bubble to the smaller bubble till sizes are interchanged
(c) air flows from smaller bubble to bigger
(d) there is no flow of air

15. The thermo emf of a hypothetical thermocouple varies with the temperature θ of hot junction as $E = a\theta + b\theta^2$ in volts, where the ratio $\frac{a}{b}$ is 700°C .

If the cold junction is kept at 0°C , then the neutral temperature is

- (a) 700°C
(b) 1400°C
(c) 390°C
(d) no neutral temperature is possible for this thermocouple

16. A launching vehicle carrying an artificial satellite of mass m is set for launch on the surface of the earth of mass M and radius R . If the satellite is intended to move in a circular orbit of radius $7R$, the minimum energy required to be spent by the launching vehicle on the satellite is

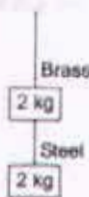
(Gravitational constant = G)

- (a) $\frac{GMm}{R}$ (b) $-\frac{13GMm}{14R}$
(c) $\frac{GMm}{7R}$ (d) $-\frac{GMm}{14R}$



17. The two lenses of an achromatic doublet should have
- equal powers
 - equal dispersive powers
 - equal ratio of their power and dispersive power
 - sum of the product of their powers and dispersive power equal to zero

18. If the ratio of lengths, radii and Young's modulus of steel and brass wires shown in the figure are a, b and c respectively, the ratio between the increase in lengths of brass and steel wires would be



- $\frac{b^2 a}{2c}$
 - $\frac{bc}{2a^2}$
 - $\frac{ba^2}{2c}$
 - $\frac{a}{2b^2 c}$
19. A soap bubble of radius r is blown up to form a bubble of radius $2r$ under isothermal conditions. If T is the surface tension of soap solution, the energy spent in the blowing
- $3\pi T r^2$
 - $6\pi T r^2$
 - $12\pi T r^2$
 - $24\pi T r^2$
20. A current of 1.6 A is passed through a solution of CuSO_4 . How many Cu^{++} ions are liberated in one minute? (Electronic charge = $1.6 \times 10^{-19} \text{ C}$)
- 3×10^{20}
 - 3×10^{10}
 - 6×10^{20}
 - 6×10^{10}
21. A magnetic field exerts no force on
- a magnet
 - an unmagnetised iron bar
 - a moving charge
 - stationary charge
22. In an L - C - R circuit inductance is changed from L to $L/2$. To keep the same resonance frequency, C should be changed to
- $2C$
 - $\frac{C}{2}$
 - $4C$
 - $\frac{C}{4}$
23. The sound waves after being converted into electrical waves are not transmitted as such because
- they travel with the speed of sound
 - the frequency is not constant
 - they are heavily absorbed by the atmosphere
 - the height of antenna has to be increased several times

24. The tip of a needle does not give a sharp image on a screen. This is due to
- polarisation
 - interference
 - diffraction
 - None of these

25. An engine moving towards a wall with a velocity 50 m/s emits a note of 1.2 kHz . Speed of sound in air is 350 m/s . The frequency of the note after reflection from the wall as heard by the driver of the engine is
- 2.4 kHz
 - 0.24 kHz
 - 1.6 kHz
 - 1.2 kHz

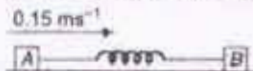
26. The surface temperature of the sun which has maximum energy emission at 500 nm is 6000 K . The temperature of a star which has maximum energy emission at 400 nm will be
- 8500 K
 - 4500 K
 - 7500 K
 - 6500 K

27. The truth table given below is for (A and B are the inputs, Y is the output)

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

- NOR
- AND
- XOR
- NAND

28. Two rectangular blocks A and B of masses 2 kg and 3 kg respectively are connected by a spring of spring constant 10.8 Nm^{-1} and are placed on a frictionless horizontal surface. The block A was given an initial velocity of 0.15 ms^{-1} in the direction shown in the figure. The maximum compression of the spring during the motion is



- 0.01 m
 - 0.02 m
 - 0.05 m
 - 0.03 m
29. 0.1 m^3 of water at 80°C is mixed with 0.3 m^3 of water at 60°C . The final temperature of the mixture is
- 65°C
 - 70°C
 - 60°C
 - 75°C

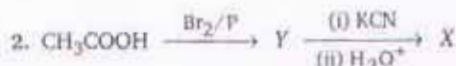


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30. $y = 3 \sin \pi \left(\frac{t}{2} - \frac{x}{4} \right)$ represents an equation of a progressive wave, where t is in second and x is in metre. The distance travelled by the wave in 5 s is
(a) 8 m (b) 10 m (c) 5 m (d) 32 m
31. A body of mass $m_1 = 4$ kg moves at 51 m/s and another body of mass $m_2 = 2$ kg moves at 101 m/s. The kinetic energy of centre of mass is
(a) $\frac{200}{3}$ J (b) $\frac{500}{3}$ J (c) $\frac{400}{3}$ J (d) $\frac{800}{3}$ J
32. A wheel of radius 0.4 m can rotate freely about its axis as shown in the figure. A string is wrapped over its rim and a mass of 4 kg is hung. An angular acceleration of $8 \text{ rad}\cdot\text{s}^{-2}$ is produced in it due to the torque. Then, moment of inertia of the wheel is ($g = 10 \text{ ms}^{-2}$)
(a) $2 \text{ kg}\cdot\text{m}^2$ (b) $1 \text{ kg}\cdot\text{m}^2$
(c) $4 \text{ kg}\cdot\text{m}^2$ (d) $8 \text{ kg}\cdot\text{m}^2$
33. An object start sliding on a frictionless inclined plane and from same height another object start falling freely.
(a) both will reach with same speed
(b) both will reach with same acceleration
(c) both will reach in same time
(d) None of the above
34. A boy on a cycle pedals around a circle of 20 metres radius at a speed of 20 m/s. The combined mass of the body and the cycle makes with the vertical so that it may not fall is ($g = 9.8 \text{ m/s}^2$)
(a) 60.25° (b) 63.90° (c) 26.12° (d) 30.00°
35. A coin is dropped in a lift. It takes time t_1 to reach the floor when lift is stationary. It takes time t_2 when lift is moving up with constant acceleration. Then,
(a) $t_1 \geq t_2$ (b) $t_2 > t_1$
(c) $t_1 = t_2$ (d) $t_1 >> t_2$
36. The engine of a jet aircraft applies a thrown force of 10^5 N during take off and causes the plane to attain a velocity of 1 km/s in 10 s. The mass of the plane is
(a) 10^2 kg (b) 10^3 kg
(c) 10^4 kg (d) 10^5 kg
37. A stone weighing 1 kg and sliding on ice with a velocity of 2 m/s is stopped by friction in 10 s. The force of friction (assuming it to be constant) will be
(a) -20 N (b) -0.2 N
(c) 0.2 N (d) 20 N
38. The potential energy of a body is given by $U = A - Bx^2$ (where x is the displacement) The magnitude of force acting on the particle is
(a) constant
(b) proportional to x
(c) proportional to x^2
(d) inversely proportional to x
39. When a ceiling fan is switched on, it makes 10 revolution in the first 3 s. Assuming a uniform angular acceleration, how many rotation it will make in the next 3 s
(a) 10 (b) 20 (c) 30 (d) 40
40. A hollow sphere of volume V is floating on water surface with half immersed in it. What should be the minimum volume of water poured inside the sphere so that the sphere now sinks into the water
(a) $\frac{V}{2}$ (b) $\frac{V}{3}$ (c) $\frac{V}{4}$ (d) V

Chemistry

1. Which one of the following sets of quantum numbers represents the highest energy level in an atom?
(a) $n = 4, l = 0, m = 0, s = +\frac{1}{2}$
(b) $n = 3, l = 1, m = 1, s = +\frac{1}{2}$
(c) $n = 3, l = 2, m = -2, s = +\frac{1}{2}$
(d) $n = 3, l = 0, m = 0, s = +\frac{1}{2}$



Here, X is

- (a) glycollic acid
(b) α -hydroxy propionic acid
(c) succinic acid
(d) malonic acid



3. Acetic anhydride is prepared in the laboratory by heating sodium acetate with
(a) ethyl chloride (b) acetyl chloride
(c) conc. H_2SO_4 (d) zinc dust

4. For the homogeneous reaction,



the equilibrium constant K_c has the units

- (a) conc. $^{+10}$ (b) conc. $^{+1}$
(c) conc. $^{-1}$ (d) it is dimensionless
5. For the reaction,
 $NH_3 + OCl^- \longrightarrow N_2H_4 + Cl^-$
occurring in basic medium, the coefficient of N_2H_4 in the balanced equation will be
(a) 1 (b) 2
(c) 3 (d) 4
6. Which one of the following has a coordinate bond?
(a) NH_4Cl (b) $AlCl_3$
(c) $NaCl$ (d) Cl_2
7. Which of the following would exert maximum osmotic pressure?
(a) Decinormal aluminium sulphate
(b) Decinormal barium chloride
(c) Decinormal sodium chloride
(d) A solution obtained by mixing equal volumes of (b) and (c) and filtering
8. Cow milk, an example of natural emulsion, is stabilised by
(a) fat (b) water
(c) casein (d) Mg^{2+} ions
9. For a zero order reaction
(a) $t_{1/2} = R_0$ (b) $t_{1/2} \propto 1/R_0$
(c) $t_{1/2} \propto R_0^2$ (d) $t_{1/2} \propto 1/R_0^2$
10. The extraction of which of the following metals involves bessemerisation?
(a) Fe (b) Ag
(c) Al (d) Cu
11. The correct order of decreasing first ionisation energy is
(a) $C > B > Be > Li$ (b) $C > Be > B > Li$
(c) $B > C > Be > Li$ (d) $Be > Li > B > C$
12. Consider the following reaction,
 $C_6H_5NO_2 \xrightarrow{Sn/HCl} X \xrightarrow{C_6H_5COCl} Y + HCl$
What is Y?

- (a) Acetanilide (b) Benzinilide
(c) Azobenzene (d) Hydrazobenzene

13. Which of the following is most basic in nature?
(a) NH_3 (b) CH_3NH_2
(c) $(CH_3)_2NH$ (d) $C_6H_5N(CH_3)_2$

14. An example of natural biopolymer is
(a) teflon (b) nylon-66
(c) rubber (d) DNA

15. Which of the following is known as invert soap?
(a) Pentaerythritol monostearate
(b) Sodium stearyl sulphate
(c) Trimethyl stearyl ammonium bromide
(d) Ethoxylated nonylphenol

16. Le-blanc process is employed in the manufacture of
(a) baking soda (b) washing soda
(c) potash (d) plaster of Paris

17. Which one of these is not true for benzene?
(a) It forms only one type of monosubstituted product
(b) There are three carbon-carbon single bonds and three carbon-carbon double bonds
(c) Heat of hydrogenation of benzene is less than its theoretical value
(d) The bond angle between carbon-carbon bonds is 120°

18. The IUPAC name of acrylaldehyde is
(a) prop-2-en-1-al (b) propenylaldehyde
(c) but-2-en-1-al (d) propenal

19. The structures of $(CH_3)_3CBr$ and $CH_3[CH_2]_3Br$ represent
(a) chain isomerism
(b) position isomerism
(c) chain as well as position isomerism
(d) functional isomerism

20. Petrol for aviation purpose must contain
(a) straight chain hydrocarbons
(b) aromatic hydrocarbons
(c) olefinic hydrocarbons
(d) highly branched chain paraffins

21. The solubility product of Hg_2I_2 is equal to
(a) $[Hg_2^{2+}][I^-]$ (b) $[Hg^{2+}][I^-]$
(c) $[Hg_2^{2+}][I^-]^2$ (d) $[Hg^{2+}][I^-]^2$

22. The number of atoms contained in a fcc unit cell of a monoatomic substance is
(a) 1 (b) 2 (c) 4 (d) 6



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23. In the first order reaction, 75% of the reactant gets disappeared in 1.386 h. The rate constant of the reaction is

- (a) $3.0 \times 10^{-3} \text{ s}^{-1}$ (b) $2.8 \times 10^{-4} \text{ s}^{-1}$
(c) $17.2 \times 10^{-3} \text{ s}^{-1}$ (d) $1.8 \times 10^{-3} \text{ s}^{-1}$

24. Moist hydrogen peroxide can not be dried over conc. H_2SO_4 because

- (a) it can catch fire
(b) it is reduced by H_2SO_4
(c) it is oxidised by H_2SO_4
(d) it is decomposed by H_2SO_4

25. Glauber's salt is

- (a) $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ (b) $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$
(c) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (d) $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$

26. The most basic element is

- (a) fluorine (b) iodine
(c) chlorine (d) bromine

27. Propyne on passing through red hot copper tube forms

- (a) benzene (b) toluene
(c) mesitylene (d) None of these

28. Which one of the following is mainly responsible for depletion of ozone layer?

- (a) Methane
(b) Carbon dioxide
(c) Water
(d) Chlorofluorocarbons

29. On warming with silver powder, chloroform is converted into

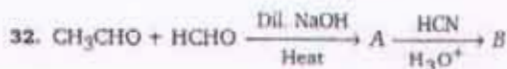
- (a) acetylene
(b) hexachloroethane
(c) 1, 1, 2, 2-tetrachloroethane
(d) ethylene

30. Ammonia is a Lewis base and it forms complexes with many cations. Which one of the following cations does not form a complex with ammonia?

- (a) Ag^+ (b) Cu^{2+}
(c) Cd^{2+} (d) Pb^{2+}

31. Argol, a brown crust, formed during the fermentation of grape juice contains

- (a) CO_2
(b) fused oil
(c) potassium hydrogen tartarate
(d) lye



The structure of compound B is

- (a) $\text{CH}_2=\text{CH}-\underset{\text{OH}}{\text{C}}\text{H}-\text{COOH}$
(b) $\text{CH}_2=\text{CH}-\underset{\text{CN}}{\text{C}}\text{H}-\text{OH}$
(c) $\text{CH}_3\text{CH}_2-\underset{\text{OH}}{\text{C}}\text{H}-\text{COOH}$
(d) $\text{CH}_3-\underset{\text{OH}}{\text{C}}\text{H}-\text{COOH}$

33. The pH value of 0.001 M aqueous solution of NaCl is

- (a) 7 (b) 4
(c) 11 (d) unpredictable

34. Which buffer solution comprising of the following has its pH value greater than 7?

- (a) $\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$
(b) $\text{HCOOH} + \text{HCOOK}$
(c) $\text{CH}_3\text{COONH}_4$
(d) $\text{NH}_4\text{OH} + \text{NH}_4\text{Cl}$

35. Which of the following has sp^2 -hybridisation?

- (a) C_2H_6 (b) C_2H_4 (c) BeCl_2 (d) C_2H_2

36. Hydrogen molecule differs from chlorine molecule in the following respect.

- (a) Hydrogen molecule is non-polar but chlorine molecule is polar
(b) Hydrogen molecule is polar while chlorine molecule is non-polar
(c) Hydrogen molecule can form intermolecular hydrogen bonds but chlorine molecule does not
(d) Hydrogen molecule cannot participate in coordinate bond formation but chlorine molecule can

37. The ratio of the difference in energy between the first and the second Bohr orbit to that between the second and the third Bohr orbit is

- (a) 1/2 (b) 1/3 (c) 4/9 (d) 27/5

38. Graphite is a

- (a) molecular solid (b) covalent solid
(c) ionic solid (d) metallic solid



39. Which one of the following transition metal ions is diamagnetic?
- (a) Co^{2+} (b) Ni^{2+}
(c) Cu^{2+} (d) Zn^{2+}

40. Which of the following metal carbonates decomposes on heating?
- (a) MgCO_3 (b) Na_2CO_3
(c) K_2CO_3 (d) Rb_2CO_3

Zoology

- Gel electrophoresis is used for
 - cutting of DNA into fragments
 - separation of DNA fragments according to their size
 - construction of recombinant DNA by joining with cloning vectors
 - isolation of DNA molecule
- Polysome is formed by
 - several ribosomes attached to a single mRNA
 - many ribosomes attached to a strand of endoplasmic reticulum
 - a ribosome with several sub-units
 - ribosomes attached to each other in a linear arrangement
- Which type of white blood cells are concerned with the release of histamine and the natural anticoagulant heparin?
 - Neutrophils
 - Basophils
 - Eosinophils
 - Monocytes
- Which one of the following in birds, indicates their reptilian ancestry?
 - Scales on their hindlimbs
 - Four-chambered heart
 - Two special chambers crop and gizzard in their digestive tract
 - Eggs with a calcareous shell
- Select incorrect pair
 - Porifera — Choanocytes
 - Coelenterata — Nematocysts
 - Annelida — Segmentation
 - Monera — Eukaryote
- Bilateral symmetry, metameric segmentation, coelom and open circulatory system are the features of
 - Annelida
 - Arthropoda
 - Mollusca
 - Echinodermata
- Ancestor of man who first stood erect was
 - Australopithecus*
 - Cro-magnon
 - Java-ape man
 - Peaking man
- Core zone, buffer zone and manipulation zone are found in
 - national park
 - sanctuary
 - tiger reserve
 - biosphere reserve
- Which insecticide is more hazardous to human health?
 - Rotenone
 - Pyrethrum
 - DDT
 - Humulin
- Universal donor is
 - O Rh⁺
 - O Rh⁻
 - AB Rh⁺
 - AB Rh⁻
- One of these is not concerned with wildlife conservation
 - IVF
 - IUCN
 - WWF
 - IBWL
- Largest tiger population is found in
 - Sunderban national park
 - Corbett national park
 - Ranthambhor national park
 - Kanha national park
- Genetic material found in Human Immunodeficiency Virus (HIV) is
 - double stranded RNA
 - single stranded RNA
 - double stranded DNA
 - single stranded DNA
- Gigantism and acromegaly are due to
 - hypothyroidism
 - hyperthyroidism
 - hypopituitarism
 - hyperpituitarism
- If a child is of O blood group and his father is of B blood group, the genotype of father is
 - $i^O i^O$
 - $i^A i^B$
 - $i^O i^B$
 - $i^O i^A$
- Spermatogenesis is under the regulatory influence of
 - ADH
 - FSH
 - LH
 - STH
- Which of the following can be controlled by using biopesticides?
 - Insects
 - Diseases
 - Weeds
 - All of these



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18. Which hormone is secreted in a woman if pregnancy has occurred?
(a) Estrogen
(b) Progesterone
(c) Luteinizing hormone
(d) Human chorionic gonadotropin
19. Product of biotechnology is
(a) transgenic crops (GM crops)
(b) humulin
(c) biofertilizer
(d) All of the above
20. Phase common in aerobic and anaerobic respiration is
(a) Krebs' cycle (b) glycolysis
(c) glycogenolysis (d) ETS
21. Oxyntic cells secrete
(a) HCl (b) trypsin
(c) NaOH (d) pepsinogen
22. Menstruation is due to sudden
(a) reduction of FSH
(b) increase of LH
(c) reduction in estrogen and progesterone
(d) None of the above
23. Correctly matched set of phylum, class and example is
(a) Protozoa—Mastigophora—*Entamoeba*
(b) Mollusca—Bivalvia—*Pinctada*
(c) Arthropoda—Diplopoda—*Scolopendra*
(d) Chordata—Cyclostomata—*Phrynosoma*
24. Urea synthesis occurs in
(a) kidney (b) liver
(c) brain (d) muscles
25. Which is common to kidney and skeleton in mammals?
(a) Cortex (b) Medulla
(c) Pelvis (d) Radius
26. Which is regarded as urinary bladder of embryo?
(a) Amnion (b) Allantois
(c) Chorion (d) Yolk sac
27. Deficiency of vitamin-B₁₂ causes
(a) cheilosis (b) thalassemia
(c) beri-beri (d) pernicious anaemia
28. Blood is a kind of
(a) areolar tissue
(b) connective tissue
(c) fluid connective tissue
(d) reticular connective tissue
29. Which of these is used to control human population?
(a) Estrogen + progesterone
(b) IUCD and MTP
(c) Tubectomy and vasectomy
(d) All of the above
30. Addiction to alcohol causes
(a) cirrhosis (b) epilepsy
(c) neurosis (d) psychosis
31. The most primitive vertebrates are
(a) ostracoderms
(b) cephalochordates
(c) placoderms
(d) cyclostomes
32. Change in the number of body parts is called
(a) continuous variation
(b) discontinuous variation
(c) meristic variation
(d) substantive variation
33. Which has an additional X-chromosome?
(a) Turner's syndrome
(b) Klinefelter's syndrome
(c) Super female
(d) Down's syndrome
34. Origin of life occurred in
(a) Precambrian (b) Coenozoic
(c) Palaeozoic (d) Mesozoic
35. Branch of zoology dealing with the study of fishes is called
(a) Arthrology (b) Ichthyology
(c) Saurology (d) herpetology
36. Theory of continuity of germplasm was propounded by
(a) Mendel (b) Lamarck
(c) Weismann (d) Haeckel
37. Which extraembryonic membrane in humans prevents desiccation of the embryo inside the uterus?
(a) Chorion
(b) Allantois
(c) Yolk sac
(d) Amnion
38. The most active phagocytic white blood cells are
(a) neutrophils and eosinophils
(b) lymphocytes and macrophages
(c) eosinophils and lymphocytes
(d) neutrophils and monocytes



39. During the propagation of a nerve impulse, the action potential results from the movement of
- K^+ ions from extracellular fluid to intracellular fluid
 - Na^+ ions from intracellular fluid to extracellular fluid
 - K^+ ions from intracellular fluid to extracellular fluid

(d) Na^+ ions from extracellular fluid to intracellular fluid

40. Darwin's finches are an excellent example of
- adaptive radiation
 - seasonal migration
 - brood parasitism
 - connecting links

Botany

- In which one of the following, the male and female gametophytes don't have free-living independent existence?
 - Pteris*
 - Funaria*
 - Polytrichum*
 - Codrus*
- A transgenic food crop, which may help in solving the problem of nightblindness in developing countries is
 - Flavr savr tomatoes
 - Starlink maize
 - Bt soyabean
 - Golden rice
- Vascular tissues in flowering plants develop from
 - phellogen
 - plerome
 - periblem
 - dermatogen
- Nitrogen-fixation in root nodules of *Alnus* is brought about by
 - Bradyrhizobium*
 - Clostridium*
 - Frankia*
 - Asorhizobium*
- A mature pollen grain of *Pinus* has
 - 2 cells
 - 3 cells
 - 4 cells
 - 5 cells
- Polyploidy can be induced by the application of
 - auxin
 - kinetin
 - colchicine
 - ethylene
- Quantasome are present in
 - chloroplast
 - mitochondria
 - Golgi body
 - lysosome
- In mitochondria, enzyme cytochrome oxidase is present in
 - outer membrane
 - perimitochondrial space
 - inner membrane
 - matrix
- Which of the following bio-engineered bacteria is utilized for cleaning of marine oil slicks?
 - Escherichia coli*
 - Pseudomonas syringae*
 - Pseudomonas putida*
 - Rhizoctonia solani*
- Green potatoes are toxic due to
 - phytoalexins
 - solanin
 - triazine
 - hormones
- Cells obtained from cancerous tumours are known as
 - hybridomas
 - myelomas
 - lymphocytes
 - monoclonal cells
- The plant of *Triticum aestivum* is
 - haploid
 - diploid
 - tetraploid
 - hexaploid
- Which of the following is a total root parasite?
 - Cuscuta*
 - Rafflesia*
 - Santalum*
 - Monotropa*
- Which of the following tissues consist of living cells?
 - Vessels
 - Tracheids
 - Companion cell
 - Sclerenchyma
- Which is a useful product of epidermal origin?
 - Saffron
 - Cotton fibres
 - Clove
 - Jute
- Fern spores are usually
 - haploid
 - diploid
 - triploid
 - tetraploid
- When pollen tube enters through micropyle, the process is called
 - porogamy
 - chalazogamy
 - mesogamy
 - apogamy



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18. Outer wall of pollen grain is made up of
(a) cellulose (b) sporopollenin
(c) pectocellulose (d) lignin
19. Nucleotides are formed by
(a) purine, sugar and phosphate
(b) purine, pyrimidine and phosphate
(c) purine, pyrimidine, sugar and phosphate
(d) pyrimidine, sugar and phosphate
20. DNA replication occurs in
(a) G₁-phase (b) S-phase
(c) G₂-phase (d) M-phase
21. Which of the following plant cells is not surrounded by a cell wall?
(a) Root hair cell
(b) Stem hair cell
(c) Gamete cell
(d) Bacterial cell
22. Which of the following cell organelles stores hydrolytic enzymes?
(a) Centriole (b) Lysosome
(c) Chromoplast (d) Chloroplast
23. A monocarpic plant is one, which
(a) has only one carpel
(b) flowers once in a life-time
(c) produces only one seed
(d) produces only one fruit
24. AIDS virus contains
(a) RNA with protein
(b) DNA with protein
(c) DNA without protein
(d) DNA only
25. Calyptra develops from
(a) venter wall of archegonium
(b) outgrowth of gametophyte
(c) neck wall of archegonium
(d) paraphysis of the archegonial branch
26. Protonema is the stage in the life cycle of
(a) *Cycas* (b) *Funaria*
(c) *Selaginella* (d) *Mucor*
27. A fern differs from a moss in having
(a) swimming archegonia
(b) swimming antherozoids
(c) independent gametophytes
(d) independent sporophytes
28. Female cone of *Pinus* is a
(a) modified needles
(b) modified long shoot
(c) modified dwarf shoot
(d) modified scale
29. Development of an embryo without fertilization is called as
(a) apomixis (b) polyembryony
(c) parthenocarpy (d) parthenogenesis
30. Which of the following floral parts forms pericarp after fertilization?
(a) Nucellus
(b) Outer integument
(c) Ovary wall
(d) Inner integument
31. Prothallus of the fern produces
(a) spores (b) gametes
(c) Both (a) and (b) (d) cones
32. Which of the following cell organelles is associated with photorespiration?
(a) Mitochondria (b) Peroxisome
(c) Chloroplast (d) All of these
33. The thickness of unit membrane is
(a) 20 Å (b) 35 Å
(c) 55 Å (d) 75 Å
34. Chromosomes are arranged along the equator during
(a) prophase (b) metaphase
(c) anaphase (d) telophase
35. Width of the DNA molecule is
(a) 15 Å (b) 20 Å
(c) 25 Å (d) 34 Å
36. In gymnosperms, the ovule is naked because
(a) ovary wall is absent
(b) integuments are absent
(c) perianth is absent
(d) nucellus is absent
37. The rupture and fractionation do not usually occur in the water column in vessel/tracheids during the ascent of sap because of
(a) lignified thick walls
(b) cohesion and adhesion
(c) weak gravitational pull
(d) transpiration pull
38. The fleshy receptacle of syconus of fig encloses a number of
(a) achenes
(b) samaras
(c) berries
(d) mericarps



39. Which one of the following is linked to the discovery of bordeaux mixture as a popular fungicide?
- Bacterial leaf blight of rice
 - Downy mildew of grapes
 - Loose smut of wheat
 - Black rust of wheat

40. Unisexuality of flowers prevents
- autogamy, but not geitonogamy
 - Both geitonogamy and xenogamy
 - geitonogamy, but not xenogamy
 - autogamy and geitonogamy

English

Directions (Q. 1-5) *Out of the four alternatives, choose the one which expresses the correct meaning of the given word and blacken the appropriate rectangle [] in the Answer Sheet.*

- Irreproachable
(a) remarkable
(b) extraordinary
(c) faultless
(d) immense
- Felicity
(a) prosperity
(c) bliss
(b) honesty
(d) sorrow
- Knave
(a) emperor
(c) soldier
(b) enchanter
(d) scoundrel
- Frontier
(a) edge
(c) boundary
(b) landmark
(d) corner
- Rout
(a) death
(c) loss
(b) defeat
(d) crash

Directions (Q. 6-8) *Choose the word opposite in meaning to the given word and blacken the appropriate rectangle [] in the Answer Sheet.*

- Niggardly
(a) hastily
(c) likely
(b) lavishly
(d) gorgeously
- Melodious
(a) harmonious
(c) odious
(b) tuneless
(d) mellifluous
- Advanced
(a) progressed
(b) outpaced
(c) receded
(d) retarded

Directions (Q. 9-12) *In these questions, four words are given in each question, out of which only one word is wrongly spelt. Find the word and indicate it in the Answer Sheet by blackening the appropriate rectangle.*

- (a) quadruple
(c) quadrangle
(b) quagmaire
(d) quadrant
- (a) postar
(c) posture
(b) pastor
(d) pasture
- (a) referrence
(c) difference
(b) preference
(d) preformance
- (a) agreeably
(c) doubtfully
(b) cruely
(d) fatally

Directions (Q. 13-16) *Four alternatives are given for the underlined or given idiom/phrase. Choose the alternative which best expresses the meaning of the underlined or given idiom/phrase and blacken the appropriate rectangle [] in the Answer Sheet.*

- His parents cut him off, without a shilling
(a) disinherited him
(b) snubbed him
(c) gave him only a shilling
(d) sent him away with a shilling
- The carefully worked-out plan fell through because of an unexpected event
(a) came out successfully
(b) had a steep fall
(c) was shattered
(d) failed
- He has too many irons in the fire
(a) is engaged in too many enterprises at the same time
(b) has several problems
(c) has many ideas in his head
(d) has a fire burning constantly in his house



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16. We wanted to give Rita a surprise party but John let the cat out of the bag
- (a) spoiled the party with a cat
 - (b) gave her a party himself
 - (c) told her about it unintentionally
 - (d) prevented her from attending it

Directions (Q. 17-21) Out of the four alternatives, choose the one which can be substituted for given words/sentence and blacken the appropriate rectangle in the Answer Sheet.

17. Study of insects is
- (a) Etymology
 - (b) Entomology
 - (c) Ecology
 - (d) Embryology
18. Careful in the spending of money, time, etc.
- (a) Punctual
 - (b) Economical
 - (c) Miserly
 - (d) Calculative
19. Reproducing or memorizing word for word
- (a) Verbatim
 - (b) Verbose
 - (c) Verbiage
 - (d) Verbalism
20. That which cannot be captured
- (a) Untakable
 - (b) Ungrippable
 - (c) Impregnable
 - (d) Slippery
21. One who breaks the law
- (a) Aggressor
 - (b) Politician
 - (c) Transgressor
 - (d) Pedestrian

Directions (Q. 22-25) A part of the sentence is underlined. Below are given alternatives to the underlined part at (a), (b) and (c). Which may improve the sentence. Choose the correct alternative. In case no improvement is needed your answer is (d). Blacken the appropriate rectangle in the Answer Sheet.

22. The only way to solve the racial problem is by education.
- (a) because of
 - (b) thanks to
 - (c) on account of
 - (d) no improvement
23. He may be poor now but he appears to be rich.
- (a) to seem rich
 - (b) rich to be
 - (c) to have been rich
 - (d) no improvement
24. The suspected couple was taken away from the airport through a side entrance to the police station for interrogation.
- (a) whisked
 - (b) rushed
 - (c) guided
 - (d) No improvement
25. She left the room feeling contrite.
- (a) sorry for what she had done
 - (b) rather ill
 - (c) extremely irritated
 - (d) No improvement

Directions (Q. 26-30) In these questions the first and the last parts of the sentence are numbered 1 and 6. The rest of the sentence is split into four parts and named P, Q, R and S. These four parts are not given in their proper order. Read the parts and find out which of the four combinations is correct. Then find the correct answer and blacken the appropriate rectangle in the Answer Sheet.

26. 1. I think the essence of wisdom is emancipation as far as possible, from the tyranny of the here and now.
- P. If any one could, he would hardly be able to remain alive.
- Q. But it is possible to make a continual approach towards impartiality.
- R. No one can view the world with complete impartiality.
- S. This is of course a matter of degree.
6. It is this approach towards impartiality that constitutes growth in wisdom.
- (a) QRSP
 - (b) RQPS
 - (c) SRPQ
 - (d) PRSQ
27. 1. But at the moment I glanced round at the crowd that had followed me.
- P. It was immense crowd, two thousand at the least and growing every minute.
- Q. They were watching me as they would watch a conjurer about to perform a trick.
- R. I looked at the sea of yellow faces above the garish clothes-faces all happy and excited over this bit of fun, all certain that the elephant was going to be shot.
- S. It blocked the road for a long distance on either side.
6. They did not like me, but with the magical rifle in my hands, I was momentarily worth watching.
- (a) RPQS
 - (b) QSRP
 - (c) SRPQ
 - (d) PSRQ
28. 1. There are many roads into the world of books, but the way of fiction is probably the most common.
- P. Then too the appeal of the story, whether told as poem, play, history, biography or novel is primitive and strong.



- Q. The reason is plain.
R. They are to us what epic poetry was to the Greeks and Romans, what the stage was to the Elizabethans.
S. The novel and the short story come closer to the experience. If the modern reader then any other form of contemporary writing.
6. Mankind's delight in stories is as timeless and universal as the art of the story teller.
(a) QSRP (b) SRPQ (c) RSQP (d) PRSQ
29. 1. Nehru spent most part of his childhood in studies.
P. He rushed back to India and led an active political life joining hands with Gandhi.
Q. His studies went on uninterrupted abroad until he received a call from India.
R. He went to Cambridge to study.
S. But now and then, he could not help listening to political discussions in his house.
6. Till the end of his career, he made Gandhi his political master.
(a) RSQP (b) SRQP (c) PQRS (d) SRPQ
30. 1. Venice is a strange and beautiful city in the North of Italy.
P. There are about four hundred old stone bridges joining the Islands of Venice.
Q. In this city, there are no motor-cars, no horses and no buses.
R. These small Islands are near one another.
S. It is not one Island but a hundred and seventeen Islands.
6. This is because Venice has no streets.
(a) PQRS (b) RSPQ
(c) SRPQ (d) PSQR

Directions (Q. 31-35) Sentences are given which blanks to be filled in with an appropriate and suitable word. Four alternatives are suggested for each question. Choose the correct alternative out of the four and blacken the appropriate rectangle in the Answer Sheet.

31. We warned her the danger
(a) from (b) about
(c) against (d) of
32. We all laughed the affair.
(a) over (b) about
(c) for (d) on
33. The chairman, as well as the members, to blame for this misfortune.
(a) are (b) were
(c) is (d) has
34. The streets are lighted electricity.
(a) with (b) by
(c) on (d) in
35. Homeopathic treatment, they say, cuts the need for operation and risk from surgery.
(a) off
(b) out
(c) down
(d) away

Directions (Q. 36-40) You have two brief passages with five questions following each passage. Read the passages carefully and choose the best answer to each question out of the four alternatives and blacken the appropriate rectangle in the Answer Sheet.

"The beauty of the Japanese landscape is that it conveys philosophical messages through each feature. The use of curving pathways rather than straight lines, for instance. This feature springs from the belief that only evil travels in straight lines, good forces tend to wander. Then odd numbers of plants on trees are used in these gardens because these numbers are considered auspicious. Even the plants used are symbolic. For example, the cyprus represents longevity and the bamboo symbolisms abundance," says Sadhana Roy Choudhary.

In Japan, nature is said to be so closely intertwined with human life that parents actually plant a sapling in their garden when a child is born in the family, letting the growth of the child coincide with the growth of the plant.

36. They prefer curving pathways because
(a) they are inauspicious
(b) they can walk easily
(c) they stumble over straight ones
(d) good spirits walk in them
37. 'Abundance' means
(a) long life
(b) happiness
(c) plenty
(d) permanent



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38. The Japanese parents plant a sapling at the time of birth of a child because
(a) it is auspicious to plant a sapling
(b) it is closely associated with the growth of the child
(c) it gives longevity to the child
(d) it gives happiness to the child
39. According to the passage the Japanese are
(a) superstitious
(b) philosophical
(c) lovers of nature
(d) lovers of numerology
40. The Japanese pathways tend to be
(a) symbolic (b) beautiful
(c) curved (d) straight

Answers

Physics

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (b) | 2. (d) | 3. (b) | 4. (a) | 5. (d) | 6. (c) | 7. (a) | 8. (c) | 9. (b) | 10. (c) |
| 11. (d) | 12. (b) | 13. (c) | 14. (c) | 15. (*) | 16. (b) | 17. (d) | 18. (d) | 19. (d) | 20. (a) |
| 21. (d) | 22. (a) | 23. (c) | 24. (c) | 25. (c) | 26. (c) | 27. (d) | 28. (c) | 29. (a) | 30. (b) |
| 31. (c) | 32. (a) | 33. (a) | 34. (b) | 35. (a) | 36. (b) | 37. (b) | 38. (b) | 39. (c) | 40. (a) |

Chemistry

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (c) | 2. (d) | 3. (b) | 4. (b) | 5. (a) | 6. (a) | 7. (a) | 8. (c) | 9. (a) | 10. (d) |
| 11. (b) | 12. (b) | 13. (c) | 14. (d) | 15. (c) | 16. (c) | 17. (b) | 18. (a) | 19. (c) | 20. (d) |
| 21. (c) | 22. (c) | 23. (b) | 24. (d) | 25. (a) | 26. (b) | 27. (c) | 28. (d) | 29. (a) | 30. (d) |
| 31. (c) | 32. (a) | 33. (a) | 34. (d) | 35. (b) | 36. (d) | 37. (d) | 38. (b) | 39. (d) | 40. (a) |

Zoology

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (b) | 2. (a) | 3. (b) | 4. (d) | 5. (d) | 6. (b) | 7. (a) | 8. (d) | 9. (c) | 10. (b) |
| 11. (a) | 12. (a) | 13. (b) | 14. (d) | 15. (c) | 16. (b) | 17. (d) | 18. (d) | 19. (d) | 20. (b) |
| 21. (a) | 22. (c) | 23. (b) | 24. (b) | 25. (c) | 26. (b) | 27. (d) | 28. (b) | 29. (a) | 30. (a) |
| 31. (a) | 32. (c) | 33. (b) | 34. (a) | 35. (b) | 36. (c) | 37. (d) | 38. (d) | 39. (d) | 40. (a) |

Botany

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (a) | 2. (d) | 3. (b) | 4. (c) | 5. (c) | 6. (c) | 7. (a) | 8. (c) | 9. (c) | 10. (b) |
| 11. (b) | 12. (d) | 13. (b) | 14. (c) | 15. (b) | 16. (a) | 17. (a) | 18. (b) | 19. (c) | 20. (b) |
| 21. (c) | 22. (b) | 23. (b) | 24. (d) | 25. (a) | 26. (b) | 27. (d) | 28. (d) | 29. (d) | 30. (c) |
| 31. (c) | 32. (d) | 33. (d) | 34. (d) | 35. (b) | 36. (a) | 37. (b) | 38. (a) | 39. (b) | 40. (a) |

English

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (b) | 2. (b) | 3. (a) | 4. (e) | 5. (d) | 6. (c) | 7. (a) | 8. (c) | 9. (e) | 10. (d) |
| 11. (d) | 12. (b) | 13. (a) | 14. (d) | 15. (b) | 16. (e) | 17. (a) | 18. (d) | 19. (b) | 20. (c) |
| 21. (e) | 22. (a) | 23. (c) | 24. (e) | 25. (e) | 26. (c) | 27. (b) | 28. (a) | 29. (a) | 30. (c) |
| 31. (b) | 32. (d) | 33. (e) | 34. (a) | 35. (e) | 36. (c) | 37. (e) | 38. (d) | 39. (c) | 40. (d) |



Hints and Solutions

Physics

1. According to equation of continuity,

$$av = \text{constant}$$

$$\therefore \text{For tube, } (8 \times 10^{-4}) \times \left(\frac{0.15}{60}\right) = a_1 v_1$$

$$\text{For holes, } (40 \times 10^{-8}) \times v = a_2 v_2$$

$$\therefore a_2 v_2 = a_1 v_1$$

$$\therefore 40 \times 10^{-8} \times v = \frac{8 \times 10^{-4} \times 0.15}{60}$$

$$\Rightarrow v = \frac{8 \times 10^{-4} \times 0.15}{40 \times 10^{-8} \times 60} \\ = 5 \text{ m/s}$$

2. According to photoelectric equation

$$E_k = hv - hv_0 \quad \dots (i)$$

If the energy of photon (hv) is less than the work function (hv_0) of metallic surface, then electrons will never be ejected from surface regardless of intensity of incident light.

Also, from Eq. (i), when

$$v = v_0, E_k = 0$$

\therefore Graph (d) represents variation of E_k with v .

3. Refractive index $\mu = \frac{\text{Real depth } (d)}{\text{Apparent depth } (x)}$

$$\text{For 1st liquid, } \sqrt{2} = \frac{d}{x_1}$$

$$\Rightarrow x_1 = \frac{d}{\sqrt{2}}$$

Similarly, for 2nd liquid,

$$n = \frac{d}{x_2}$$

$$\Rightarrow x_2 = \frac{d}{n}$$

$$\text{Total apparent depth} = x_1 + x_2$$

$$= \frac{d}{\sqrt{2}} + \frac{d}{n} = \frac{d(n + \sqrt{2})}{n\sqrt{2}}$$

4. Total mass of the shell = 20 kg

Ratio of the masses of the fragments = 2 : 3

\therefore Masses of the fragments are 8 kg and 12 kg

Now, according to the conservation of momentum

$$m_1 v_1 = m_2 v_2$$

$$\therefore 8 \times 6 = 12 \times v$$

v (velocity of the larger fragment) = 4 m/s

$$\text{Kinetic energy} = \frac{1}{2} m v^2$$

$$= \frac{1}{2} \times 12 \times (4)^2 = 96 \text{ J}$$

5. Resistance of bulb

$$R = \frac{V^2}{P} = \frac{(100)^2}{50}$$

$$= 200 \Omega$$

$$\text{Current through bulb } (I) = \frac{V}{R}$$

$$= \frac{100}{200} = 0.5 \text{ A}$$

In a circuit containing inductive reactance (X_L) and resistance (R), impedance (Z) of the circuit is

$$Z = \sqrt{R^2 + \omega^2 L^2} \quad \dots (i)$$

$$\text{Here, } Z = \frac{200}{0.5} = 400 \Omega$$

$$\text{Now, } X_L^2 = Z^2 - R^2 \\ = (400)^2 - (200)^2$$

$$(2\pi fL)^2 = 12 \times 10^4$$

$$L = \frac{2\sqrt{3} \times 100}{2\pi \times 50}$$

$$= \frac{2\sqrt{3}}{\pi} = 1.1 \text{ H}$$

6. In Young's double slit experiment half angular width is given by

$$\sin \theta = \frac{\lambda}{d}$$

$$= \frac{589 \times 10^{-9}}{0.589 \times 10^{-3}} = 10^{-3}$$

$$\Rightarrow \theta = \sin^{-1}(0.001)$$

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7. The condenser with air as the dielectric has capacitance

$$C_1 = \frac{\epsilon_0}{d} \left(\frac{3A}{4} \right) = \frac{3\epsilon_0 A}{4d}$$

Similarly, the condenser with K as the dielectric constant has capacitance

$$C_2 = \frac{\epsilon_0 K}{d} \left(\frac{A}{4} \right) = \frac{\epsilon_0 AK}{4d}$$

Since, C_1 and C_2 are in parallel

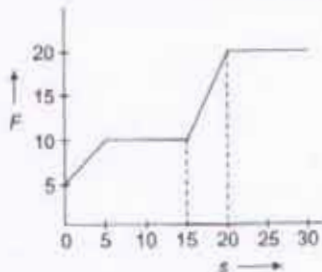
$$\begin{aligned} C_{\text{net}} &= C_1 + C_2 \\ &= \frac{3\epsilon_0 A}{4d} + \frac{\epsilon_0 AK}{4d} = \frac{\epsilon_0 A}{d} \left[\frac{3}{4} + \frac{K}{4} \right] \\ &= \frac{C}{4} (K + 3) \end{aligned}$$

8. If we keep 1 N and 2 N forces act in same direction then these are balanced by 3 N force, but this is against statement of question.

Hence, options (c) is correct.

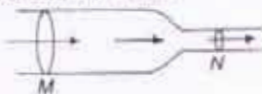
9. Work done $W = \text{Area } ABCEFDA$

$$= \text{Area } ABCD + \text{Area } CEFD$$



$$\begin{aligned} &= \frac{1}{2} \times (15 + 10) \times 10 + \frac{1}{2} \times (10 + 20) \times 5 \\ &= 125 + 75 = 200 \text{ J} \end{aligned}$$

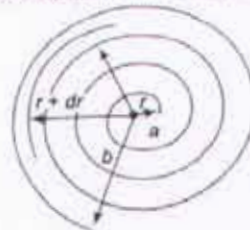
10. The velocity of flow will increase if cross-section decreases and vice-versa.



i.e., $A_1 v_1 = A_2 v_2$
or $Av = \text{constant}$

Therefore, the rate of liquid flow will be greater at N than at M .

11. Consider an element of thickness dr at a distance r from the centre of spiral coil.



Number of turns in coil = n

Number of turns per unit length
 $= \frac{n}{b-a}$

Number of turns in element $dr = dn$

Number of turns per unit length in element dr
 $= \frac{ndr}{b-a}$

i.e., $dn = \frac{ndr}{b-a}$

Magnetic field at its centre due to element dr is

$$\begin{aligned} dB &= \frac{\mu_0 I dn}{2r} = \frac{\mu_0 I}{2} \frac{n}{(b-a)} \frac{dr}{r} \\ \therefore B &= \int_a^b \frac{\mu_0 I n dr}{2(b-a)r} = \frac{\mu_0 I n}{2(b-a)} \int_a^b \frac{dr}{r} \\ &= \frac{\mu_0 I n}{2(b-a)} \log_e \left(\frac{b}{a} \right) \end{aligned}$$

12. Here, $A = 4\mathbf{i} + 10\mathbf{j}$

$$\begin{aligned} \therefore |A| &= \sqrt{(4)^2 + (10)^2} = \sqrt{16 + 100} \\ &= \sqrt{116} \text{ m} \end{aligned}$$

Now, according to question,

$$A = 8\mathbf{i} + n\mathbf{j}$$

So, $|A| = \sqrt{(8)^2 + n^2}$

$$\therefore \sqrt{116} = \sqrt{(8)^2 + n^2}$$

Squaring on both sides

$$116 = 64 + n^2$$

or $n^2 = 116 - 64 = 52$

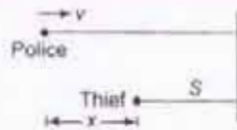
or $n = 7.2 \text{ m}$

13. Let the police party catch the thief after t s

$$\therefore \text{Distance travelled by police party in } t \text{ s} = vt$$



and distance travelled by thief = $x + \frac{1}{2} \alpha t^2$



So, $x + \frac{1}{2} \alpha t^2 \leq vt$
 or $\frac{\alpha t^2}{2} - vt + x = 0$
 or $t = \frac{v \pm \sqrt{v^2 - 2\alpha x}}{\alpha}$

For t to be real, $v^2 \geq 2\alpha x$

14. Air flows from smaller bubble to bigger & the pressure in smaller bubble is higher.
 15. Given, $E = a\theta + b\theta^2$

$\therefore p = \frac{dE}{d\theta} = \frac{d}{d\theta} (a\theta + b\theta^2)$
 $= a + 2b\theta$
 At $\theta = T_n, p = 0$
 $\Rightarrow T_n = -\frac{a}{2b} = -350^\circ\text{C}$

No correct option is given.

16. The energy of artificial satellite at the surface of the earth

$$E_1 = -\frac{GMm}{R}$$

When the satellite is intended to move in a circular orbit of radius $7R$, then energy of artificial satellite

$$E_2 = -\frac{1}{2} \frac{GMm}{7R}$$

The minimum energy required

$$E = E_1 - E_2$$

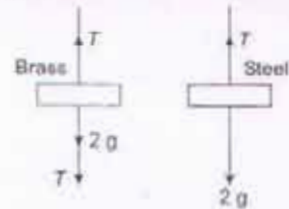
$$= -\frac{GMm}{R} + \frac{1}{2} \left(\frac{GMm}{7R} \right)$$

$$= \frac{-14GMm + GMm}{14R}$$

$$= -\frac{13GMm}{14R}$$

17. The two lenses of an achromatic doublet should have, sum of the product of their powers and dispersive power equal to zero.

18. Free body diagram of the two blocks are



Given, $\frac{l_1}{l_2} = a, \frac{r_1}{r_2} = b, \frac{Y_1}{Y_2} = c$

Let Young's modulus of steel is Y_1 and of brass is Y_2

$\therefore Y_1 = \frac{F_1 \cdot l_1}{A_1 \cdot \Delta l_1}$... (i)

and $Y_2 = \frac{F_2 \cdot l_2}{A_2 \cdot \Delta l_2}$... (ii)

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

$$\frac{Y_1}{Y_2} = \frac{F_1 \cdot l_1}{F_2 \cdot l_2} \cdot \frac{A_2 \cdot \Delta l_2}{A_1 \cdot \Delta l_1}$$

or $\frac{Y_1}{Y_2} = \frac{F_1 \cdot A_2 \cdot l_1 \cdot \Delta l_2}{F_2 \cdot A_1 \cdot l_2 \cdot \Delta l_1}$... (iii)

Force on steel wire from free body diagram

$$T = F_1 = 2g \text{ N}$$

Force on brass wire from free body diagram

$$F_2 = T' = T + 2g = 4g \text{ N}$$

Now, putting the values of F_1, F_2 in Eq. (iii), we get

$$\frac{Y_1}{Y_2} = \left(\frac{2g}{4g} \right) \cdot \left(\frac{\pi r_2^2}{\pi r_1^2} \right) \cdot \left[\frac{l_1}{l_2} \right] \cdot \left(\frac{\Delta l_2}{\Delta l_1} \right)$$

or $c = \frac{1}{2} \left(\frac{1}{b^2} \right) \cdot a \left(\frac{\Delta l_2}{\Delta l_1} \right)$

or $\frac{\Delta l_1}{\Delta l_2} = \left(\frac{a}{2b^2c} \right)$

19. Initially area of soap bubble

$$A_1 = 4\pi r^2$$

Under isothermal condition radius becomes $2r$,

Then, area $A_2 = 4\pi (2r)^2$

$$= 4\pi \cdot 4r^2$$

$$= 16\pi r^2$$



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Increase in surface area

$$\begin{aligned}\Delta A &= 2(A_2 - A_1) \\ &= 2(16\pi r^2 - 4\pi r^2) \\ &= 24\pi r^2\end{aligned}$$

Energy spent

$$\begin{aligned}W &= T \times \Delta A \\ &= T \cdot 24\pi r^2 \\ W &= 24\pi r^2 T\end{aligned}$$

20. Charge flowing in one minute

$$q = I \times t = 1.6 \times 60 \text{ C}$$

Charge required to liberate one copper ion $2C$

$$\begin{aligned}\text{Number of Cu}^{2+} \text{ liberated} &= \frac{1.6 \times 60}{2 \times 1.6 \times 10^{-19}} \\ &= 3 \times 10^{20}\end{aligned}$$

21. From $F = qBv$, $F = 0$, when $v = 0$

i.e., a stationary charge experiences no force in a magnetic field.

$$22. v = \frac{1}{\sqrt{LC}}$$

When L is changed to $L/2$, C must be changed to $2C$ to keep v same.

24. Image is not sharp because of deviation of light from straight line path account of diffraction of light.

25. The reflected sound appears to propagate in a direction opposite to that of moving engine. Thus, the source and the observer can be presumed to approach each other with same velocity.

$$\begin{aligned}v' &= \frac{v(v + v_o)}{(v - v_s)} \\ &= v \left(\frac{v + v_o}{v - v_s} \right) \quad (\because v_o = v_s)\end{aligned}$$

$$\begin{aligned}\Rightarrow v' &= 1.2 \left(\frac{350 + 50}{350 - 50} \right) \\ &= \frac{1.2 \times 400}{300} \\ &= 1.6 \text{ kHz}\end{aligned}$$

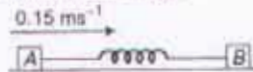
26. By using Wien's displacement law,

$$\begin{aligned}(\lambda_m)_1 T_1 &= (\lambda_m)_2 T_2 \\ \Rightarrow 500 \times 6000 &= 400 \times T_2\end{aligned}$$

$$\begin{aligned}\Rightarrow T_2 &= \frac{500 \times 6000}{400} \\ T_2 &= 7500 \text{ K}\end{aligned}$$

27. The output Y is a combination of AND + NOT gate. Hence, the truth table is for NAND gate.

28. As the block A moves with velocity 0.15 ms^{-1} , it compresses the spring which pushes B towards right. A goes on compressing the spring till the velocity acquired by B becomes equal to the velocity of A , i.e., 0.15 ms^{-1} . Let this velocity be v . Now, spring is in a state of maximum compression. Let x be the maximum compression at this stage.



According to the law of conservation of linear momentum, we get

$$\begin{aligned}m_A u &= (m_A + m_B) v \\ \text{or } v &= \frac{m_A u}{m_A + m_B} \\ &= \frac{2 \times 0.15}{2 + 3} = 0.06 \text{ ms}^{-1}\end{aligned}$$

According to the law of conservation of energy,

$$\begin{aligned}\frac{1}{2} m_A u^2 &= \frac{1}{2} (m_A + m_B) v^2 + \frac{1}{2} k x^2 \\ \frac{1}{2} m_A u^2 - \frac{1}{2} (m_A + m_B) v^2 &= \frac{1}{2} k x^2 \\ \frac{1}{2} \times 2 \times (0.15)^2 - \frac{1}{2} (2 + 3) (0.06)^2 &= \frac{1}{2} k x^2 \\ 0.0225 - 0.009 &= \frac{1}{2} k x^2 \\ \text{or } 0.0135 &= \frac{1}{2} k x^2 \\ \text{or } x &= \sqrt{\frac{0.027}{k}} = \sqrt{\frac{0.027}{10.8}} = 0.05 \text{ m}\end{aligned}$$

29. Let the final temperature of mixture be t .

Heat lost by water at 80°C

$$\begin{aligned}&= ms\Delta t \\ &= 0.1 \times 10^3 \times s_{\text{water}} \times (80^\circ - t) \\ &\quad (\because m = V \times d = 0.1 \times 10^3 \text{ kg})\end{aligned}$$

Heat gained by water at 60°C

$$= 0.3 \times 10^3 \times s_{\text{water}} \times (t - 60^\circ)$$



According to principle of calorimetry

Heat lost = Heat gained

$$\begin{aligned} \therefore 0.1 \times 10^3 \times s_{\text{water}} \times (80^\circ - t) \\ = 0.3 \times 10^3 \times s_{\text{water}} \times (t - 60^\circ) \end{aligned}$$

$$\text{or } (80^\circ - t) = 3 \times (t - 60^\circ)$$

$$\text{or } 4t = 260^\circ$$

$$\text{or } t = 65^\circ \text{C}$$

30. The given equation of a progressive wave is

$$y = 3 \sin \pi \left(\frac{t}{2} - \frac{x}{4} \right) = 3 \sin 2\pi \left(\frac{t}{4} - \frac{x}{8} \right)$$

The standard equation of a progressive wave is

$$y = y_0 \sin 2\pi \left(\frac{t}{T} - \frac{x}{\lambda} \right)$$

Comparing these two equations, we get

$$T = 4 \text{ s}, \quad \lambda = 8 \text{ m}$$

\(\therefore\) Velocity of wave,

$$v = \frac{\lambda}{T} = \frac{8}{4} = 2 \text{ ms}^{-1}$$

Distance travelled by wave in time t is

$$s = vt$$

$$\text{or } s = 2 \times 5 = 10 \text{ m}$$

$$31. v_{\text{CM}} = \frac{m_1 \frac{dr_1}{dt} + m_2 \frac{dr_2}{dt}}{m_1 + m_2} = \frac{4 \times 5\mathbf{i} + 2 \times 10\mathbf{i}}{4 + 2}$$

$$v_{\text{CM}} = \frac{40\mathbf{i}}{6} = \frac{20}{3} \mathbf{i}$$

The kinetic energy

$$\begin{aligned} K &= \frac{1}{2} mv^2 \\ &= \frac{1}{2} \times (4 + 2) \times \frac{20 \times 20}{3 \times 3} \\ &= \frac{1}{2} \times 6 \times \frac{20 \times 20}{3 \times 3} \end{aligned}$$

$$K = \frac{400}{3} \text{ J}$$

32. Given, $r = 0.4 \text{ m}$

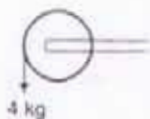
$$\alpha = 8 \text{ rad s}^{-1}$$

$$m = 4 \text{ kg}, \quad l = ?$$

Torque, $\tau = I\alpha$

$$mgr = I \cdot \alpha$$

$$\text{or } 4 \times 10 \times 0.4 = I \times 8$$



$$\Rightarrow I = \frac{16}{8} = 2 \text{ kg} \cdot \text{m}^2$$

$$\text{or } I = 2 \text{ kg} \cdot \text{m}^2$$

$$34. \tan \theta = \frac{v^2}{rg} = \frac{400}{20 \times 900}$$

$$\theta = 63.7^\circ$$

$$35. \text{ For stationary lift } t_1 = \sqrt{\frac{2h}{g}}$$

and when the lift is moving up with constant acceleration

$$t_2 = \sqrt{\frac{2h}{g}}$$

$$\therefore t_1 > t_2$$

36. Acceleration produced in jet

$$= \frac{\text{Change in velocity}}{\text{Time}}$$

$$a = \frac{(10^3 - 0)}{10}$$

$$= 100 \text{ m/s}^2$$

$$\therefore \text{ Mass} = \frac{\text{Force}}{\text{Acceleration}} = \frac{10^5}{10^2} = 10^3 \text{ kg}$$

37. $u = 2 \text{ m/s}, \quad v = 0, \quad f = 0 \text{ s}$

$$\begin{aligned} a &= \frac{v - u}{t} \\ &= \frac{0 - 2}{10} = -\frac{2}{10} \\ &= -\frac{1}{5} \end{aligned}$$

$$= -0.2 \text{ m/s}^2$$

\(\therefore\) Friction force = ma

$$= 1 \times (-0.2) = -0.2 \text{ N}$$

38. $U = A - Bx^2$

$$F = -\frac{dU}{dx} = 2Bx$$

$$F = x$$

39. Angle turned in three second and $\theta_3 \text{ s} = 2\pi \times 10$

$$= 20\pi \text{ rad}$$

$$\theta_1 = \omega_0 t + \frac{1}{2} \alpha t^2$$

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$$\alpha = \frac{49\pi}{9} \text{ rad/s}^2$$

Now, angle turned in 6 s from the starting

$$\begin{aligned}\theta_2 &= \omega_0 t + \frac{1}{2} \alpha t^2 \\ &= 0 + \frac{1}{2} \times \left(\frac{40\pi}{9}\right) \times (6)^2 \\ &= 80\pi \text{ rad}\end{aligned}$$

Angle turned between $t = 3 \text{ s}$ to $t = 6 \text{ s}$

$$\begin{aligned}\theta_{\text{lost}} &= \theta_2 - \theta_3 = 80\pi - 20\pi \\ &= 60\pi\end{aligned}$$

$$\text{Number of revolution} = \frac{60\pi}{2\pi} = 30$$

40. When a body (sphere) is half immersed, then
Upthrust = weight of sphere

$$\frac{V}{2} \times \rho_{\text{liq}} \times g = v \times \rho \times g$$

$$\therefore \rho = \frac{\rho_{\text{liq}}}{2}$$

When body (sphere) is fully immersed then,

Upthrust = weight of sphere + weight of water poured in sphere

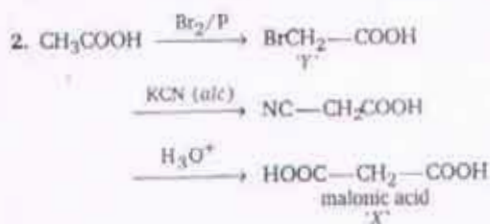
$$V \times \rho_{\text{liq}} \times g = V \times \rho \times g + V' \times \rho_{\text{liq}} \times g$$

$$V \times \rho_{\text{liq}} = \frac{V \times \rho_{\text{liq}}}{2} + V' \times \rho_{\text{liq}}$$

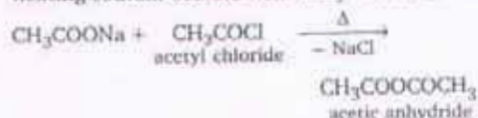
$$V' = \frac{V}{2}$$

Chemistry

1. For highest energy level in an atom, $(n+l)$ should be maximum.



3. In laboratory, acetic anhydride is prepared by heating sodium acetate with acetyl chloride.

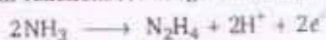


4. For the given reaction, $\Delta n_g = n_p - n_r$
(where, n_p = number of moles of gaseous products and n_r = number of moles of gaseous reactants).

$$\Delta n_g = (6 + 4) - (4 + 5) = +1$$

$$\begin{aligned}\text{Units of } K_c &= (\text{concentration})^{\Delta n_g} \\ &= (\text{concentration})^{+1}\end{aligned}$$

5. The two half-reactions for the given reaction are

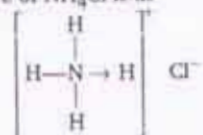


On adding both the reactions, we get



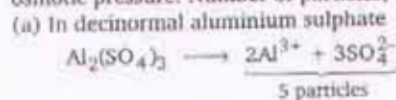
The obtained equation is a balanced equation and in it, the coefficient of N_2H_4 is 1.

6. The structure of NH_4Cl is as

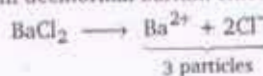


Thus, NH_4Cl has a coordinate bond along with covalent and ionic bonds.

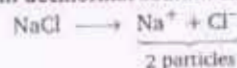
7. Osmotic pressure is a colligative property, i.e., depends upon the number of particles of solute. Thus, the solution in which solute gives maximum number of ions, exerts maximum osmotic pressure. Number of particles,



- (b) In decinormal barium chloride,



- (c) In decinormal sodium chloride,



- (d) When equal volumes of (b) and (c) are mixed, the concentration becomes half of present concentration.

Thus, decinormal aluminium sulphate exerts maximum osmotic pressure.



8. Cow milk, a natural emulsion, is stabilised by casein (milk protein).

9. For a zero order reaction

$$\text{rate, } -\frac{d[R]}{dt} = k$$

On integrating, we get

$$[R] = -kt + [C]$$

When $t = 0$, $[R] = [R_0]$

$$\therefore [C] = [R_0]$$

$$\therefore [R] = -kt + [R_0]$$

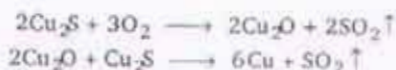
$$\text{When, } t = t_{1/2}, [R] = \frac{[R_0]}{2}$$

$$\therefore \frac{[R_0]}{2} - [R_0] = -kt_{1/2}$$

$$\therefore t_{1/2} = \frac{[R_0]}{2k}$$

$$t_{1/2} \propto [R_0]$$

10. In a Bessemer converter, copper pyrites are oxidised to FeO and Cu_2O . FeO is slagged off. Cu_2O reacts with Cu_2S left unoxidised to give Cu .

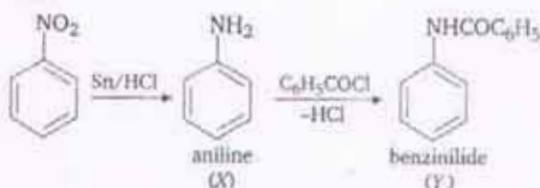


Thus, extraction of Cu involves bessemerisation.

11. On moving from left to right in a period, as the size decreases, ionisation energy increases. But first IE of elements of II A group is higher than that of the elements of III A group because of the stable ns^2 configuration (of II A group). Hence, the order of first ionisation energy is



12.



13. Basicity of amines depends upon the availability of lone pair of nitrogen for donation. Electron releasing group like $-\text{CH}_3$ increases the basicity of amines by increasing electron density

over nitrogen, which facilitate the donation of lone pair of electrons.

Electron withdrawing groups like $-\text{Ph}$ group withdraws electrons and thus, make amines less basic by decreasing electron density over nitrogen. Hence, the order of basic nature of the given amines is



Thus, $(\text{CH}_3)_2\text{NH}$ is most basic.

14. The natural polymer which controls the various life processes in the body of organism is called biopolymer, e.g., DNA, RNA.

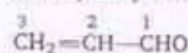
Rubber is also a natural polymer but not a biopolymer. Teflon and nylon-66 are synthetic polymers.

15. Trimethyl stearyl ammonium bromide has a chiral nitrogen atom, thus is known as invert soap.

16. Le-blanc process is used in the manufacture of potash, i.e., K_2CO_3 .

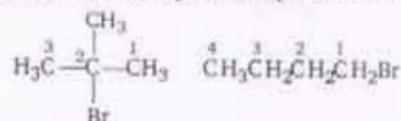
17. Benzene does not contain 3 single bonds and 3 double bonds. These are all partially double due to resonance.

18. The structure of acryldehyde is



Thus, its IUPAC name is prop-2-en-1-al.

19. The structures of the given compounds are as



Since, in these, the chain of carbon atoms and the position of functional group i.e., Br both are different, they exhibit chain as well as position isomerism.

20. Petrol for aviation purpose must contain highly branched chain paraffins (alkanes) which are obtained through catalytic cracking.



$$\therefore K_{sp} = [\text{Hg}_2^{2+}][\text{I}^-]^2$$



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22. In a fcc unit cell, the number of corner atoms
 $= 8 \times \frac{1}{8} = 1$

(∵ Each corner is shared with 8 other unit cells)

The number of face atoms $= 6 \times \frac{1}{2} = 3$

Thus, the total number of atoms per unit cell
 $= 1 + 3 = 4$

23. For a first order reaction,

$$k = \frac{2.303}{1.386 \times 60 \times 60} \log \frac{a}{a - 0.75a}$$

$$= \frac{2.303}{1.386 \times 60 \times 60} \log 4$$

$$= 2.8 \times 10^{-4} \text{ s}^{-1}$$

24. Conc. H_2SO_4 decomposes H_2O_2 , thus H_2O_2 can not be dried over it.



25. Formula of compound Name of compound

$\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ Glauber's salt

$\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ Hypo

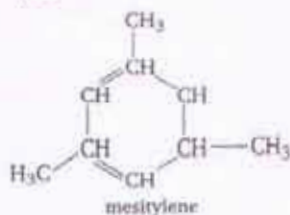
$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ Blue vitriol

$\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ Borax

26. The basic nature of elements increases from top to bottom in a group. Therefore, iodine is the most basic element.



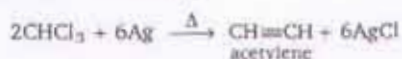
27. $3\text{CH}_3\text{CH}=\text{CH}$ (propyne) $\xrightarrow[\text{tube}]{\text{Red hot Cu}}$



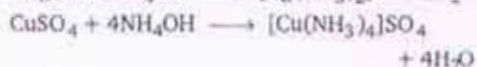
28. Chlorofluorocarbons are responsible for the depletion of ozone layer as they provide Cl free radical which infact reacts with ozone and converts it into O_2 as



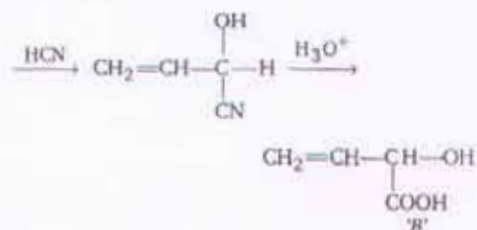
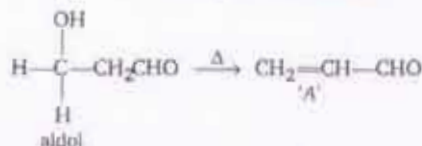
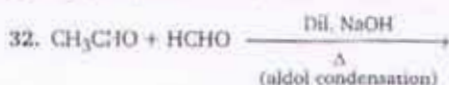
29. Chloroform, CHCl_3 , when warmed with silver powder, gives acetylene.



30. Ammonia is a Lewis base. It forms complexes with transition elements like Ag^+ , Cu^{2+} and Cd^{2+} while it does not form complex with Pb^{2+} because Pb is not a transition element.



31. Argol is potassium hydrogen tartarate.

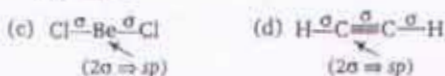
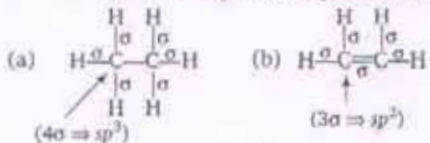


33. NaCl is a neutral salt, thus the pH value of its aqueous solution is 7.

34. The pH value of basic buffer solutions is always greater than 7. Among the given, only $\text{NH}_4\text{OH} + \text{NH}_4\text{Cl}$ constitutes the basic buffer (a mixture of weak base and its conjugated salt), thus, has pH greater than 7.

35. When there is 3σ bonds, the hybridisation is sp^2 .

The structures of the given compounds are



Thus, $\text{CH}_2=\text{CH}_2$ has sp^2 hybridisation.



36. Hydrogen molecule contains no lone pair, hence not able to take part in coordinate bond formation but Cl_2 can.
37. $\Delta E = E_2 - E_1 = \frac{1312}{1^2} - \frac{1312}{2^2} = 1312 \left(\frac{3}{4} \right)$,
 $E_3 - E_2 = \frac{1312}{2^2} - \frac{1312}{3^2} = 1312 \left(\frac{5}{36} \right)$
 $\therefore E_2 - E_1 : E_3 - E_2 = \frac{3}{4} : \frac{5}{36} = 27 : 5$
38. In graphite, the constituent particles are atoms and intermolecular force is covalent bonding. Thus, it is an example of covalent solid.

Zoology

1. When genomic DNA extracted from any tissue of a plant or animal species is digested with a restriction enzyme, it is cleaved into segments. The segments of different sizes can be separated through gel electrophoresis. Gel electrophoresis involves movement of fragments or molecules on the basis of molecule size and shape under the influence of electric field.

Endonucleases are enzymes that produce internal cuts called cleavage in DNA molecules. It cleaves DNA only within or near recognition sites, which have specific base sequences, such endonucleases are known as restriction endonucleases.

The selected vector is cut open with a restriction enzyme that has a unique target site located in the sequence, where the DNA insert should be integrated to facilitate the selection of recombinant DNA.

2. In prokaryotes, ribosomes attach to the 5' end of mRNA as soon as transcription begins. A bunch of ribosome moves along a single mRNA molecule adding 15 amino acids/second to the polypeptide chain, almost the same speed at which RNA polymerase transcribes the mRNA. The group of ribosomes together with the single mRNA molecules, they are translating is called polysome. The use of polysomes is advantageous to a cell since, the overall rate of protein synthesis is increased compared to the rate that would occur if there were no polysomes.

39. Transition metal ion having absence of unpaired electron is diamagnetic.

(a) $\text{Co}^{2+} = [\text{Ar}] 3d^7$ (three unpaired electrons)

(b) $\text{Ni}^{2+} = [\text{Ar}] 3d^8$ (two unpaired electrons)

(c) $\text{Cu}^{2+} = [\text{Ar}] 3d^9$ (one unpaired electron)

(d) $\text{Zn}^{2+} = [\text{Ar}] 3d^{10}$ (no unpaired electron)

Thus, Zn^{2+} is diamagnetic.

40. MgCO_3 decomposes on heating to give MgO and CO_2 while alkali metal carbonates (except Li_2CO_3) do not.

In eukaryotic cells, the ribosomes are attached to rough endoplasmic reticulum by ribophorin protein. Electron microscopy reveals that membranes of homogenised endoplasmic reticulum disrupt to form closed vesicles called microsomes. Microsomes derived from rough endoplasmic reticulum are studied with ribosomes and are called rough ribosomes.

3. The basophils are probably like mast cells of connective tissue. They release heparin, histamine and serotonin. Their nucleus is usually three lobed and their granules take basic stain strongly.

Monocytes are largest of all types of leucocytes. Their nucleus is bean-shaped. They are motile and phagocytic in nature. They engulf bacteria and cellular debris. Generally, they will change into macrophages after entering tissue spaces. Eosinophils have two-lobed nucleus. They are non-phagocytic and help in dissolving blood clot. Their number increases in people with allergic conditions such as asthma or hay fever. Neutrophils are most numerous of all leucocytes. They eat harmful germs and are therefore, phagocytic in nature. Their nucleus is many lobed and stain weakly with both acid and basic stains.

4. Nearly a century ago TH Huxley called birds 'glorified reptiles' thereby meaning that birds have evolved from some reptilian ancestor. Both birds and reptiles lay the same type of eggs, which are deposited outside water. Eggs are



large and telolecithal. The ovum is surrounded by albumen, an egg membrane and a thick hard calcareous shell, which are all secreted by special glands located in the walls of oviduct.

Birds like mammals have completely four chambered heart with double circulation, in which there is no mixing of pure and impure bloods. Whereas the ventricle is imperfectly divided in reptiles, resulting in partial mixing of bloods.

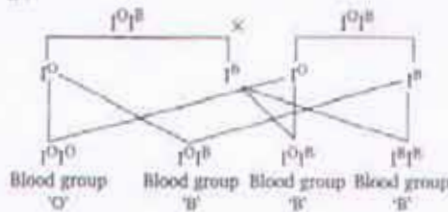
All birds have horny epidermal scales confined to the lower parts of their legs and feet, which are exactly like the epidermal scales of the reptiles. Besides birds are covered by feathers, which are homologous to the reptilian horny scales as they have a similar origin and develop from similar germ buds.

5. Kingdom—Monera includes all prokaryotes (autotrophic or heterotrophic) viz., mycoplasmas, bacteria, Actinomycetes (mycelial bacteria) and photosynthetic cyanobacteria, while all unicellular eukaryotic organisms like flagellates, diatoms, dinoflagellates, slime moulds, sarcodina, etc. are included in kingdom—Protista.
6. The members of phylum—Arthropoda show bilateral symmetry, three germ layers in body wall, external metamerism, jointed and paired appendages, haemocoel and open type of circulatory system with dorsal heart.
7. *Australopithecus* are considered as connecting link between ape and man. They were the ancestors of man who first stood erect. Their cranial capacity was 300-500 cc.
8. Biosphere reserves are a special category of protected areas of land and/or coastal environments, wherein people are an integral component of the ecosystem. It represents a specified area zoned for particular activity and consists of core zone without any human activity, buffer zone with limited human activities and manipulation zone with several manipulating human activities.
9. DDT is the most hazardous, non-biodegradable insecticide, which is fat soluble but insoluble in water. It persists in the environment for a very long period. Being fat soluble, it accumulates in

the animal tissues and gets concentrated at different trophic levels of food chain. In each step, DDT is more concentrated. This is also called biomagnification.

10. With regard to transfusions of whole blood or packed red blood cells, individuals with O type negative blood are often called universal donors and those with type AB positive blood are called universal recipients. Person with blood group O⁺ do not have any type of antigen present on surface of the RBC so recipient will not form any antibody against it.
11. *In Vitro* Fertilization (IVF) is also known as test tube baby technique. It involves fertilizing of one or more eggs outside the female's body and then transferring the zygotes (known as pre embryos) back into the uterus (i.e., embryo transfer).
12. As compared to other reserves in the world, Sunderban National Park has the largest tiger population. It also reserves the salt water crocodiles, Gangetic dolphins, chitals, wild boars, rhesus macaques, etc.
13. Human Immunodeficiency Virus (HIV) is the causal organism of AIDS (Acquired Immuno Deficiency Syndrome). It is a retrovirus belonging to the family—Retroviridae. The core of HIV contains two molecules of single stranded RNA (as genetic material) and reverse transcriptase.
14. Hypersecretion of Growth Hormone (GH) or Somatotropin Hormone (STH) from adenohypophysis of pituitary gland causes gigantism in children and acromegaly in adulthood. Gigantism involves excessive growth (lengthening) of bones with enlargement of internal organs as well. Acromegaly causes abnormal thickening of bones (due to ossification of periosteum) especially at face and margins of hand and feet.
15. Genotype of a person with blood group 'B' may be $I^B I^B$ or $I^O I^B$, person with genotype $I^B I^B$ can not produce offsprings with blood group 'O' in any case but if the person's genotype is $I^O I^B$, then its offsprings may have blood group 'O'.

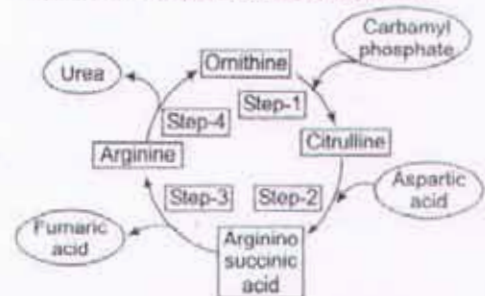
e.g.,



16. Follicle Stimulating Hormone (FSH) is produced by basophilic cells of adenohypophysis of pituitary gland. In females, this hormone is responsible for the growth of ovarian follicles up to ovulation, while in males, its functions are development of seminiferous tubules and maintenance of spermatogenesis.
17. Biopesticides are pesticides of biological origin, which may be of various types depending upon the types of pests killed or controlled by them, e.g., algicides, fungicides, bacteriocides, herbicides or weedicides, insecticides, nematocides and rodenticides, etc. These were initially employed to protect crop plants against pests but they are non-equally important for destroying or controlling vectors for various animals and human pathogens, thus, can be used for controlling various diseases also.
18. If fertilization occurs and the foetus is implanted in the endometrium, the trophoblast cells of the developing placenta secrete a hormone called Human Chorionic Gonadotrophic hormone (HCG). This hormone like LH maintains the corpus luteum and secretion of progesterone and estradiol by it. These two hormone check the breakdown of the endometrium of the uterus. The absence of menstrual bleeding is the earliest sign of pregnancy.
19. Biotechnology may be, simply defined as the use of microorganisms animals or plant's cells or their components to generate products and services useful to human beings. Now-a-days, biotechnology is very helpful in producing transgenic crops or Genetically Modified (GM) crops, transgenic animals, biofertilizers, antibodies, hormones like humulin (genetically engineered human insulin), antibodies and various other useful products.
20. Glycolysis is an essential and first path of respiration. It is common in both aerobic and

anaerobic respiration and occurs in the cytosol of all living cells of prokaryotes as well as eukaryotes.

21. Oxyntic cells or parietal cells are large and rounded cells located upon the surface of gastric gland and secrete HCl and CIF (Castle's Intrinsic Factor). This HCl gives the gastric fluids, a pH of about 2.0.
22. The corpus luteum plays an important role in the preparation of endometrium for the implantation of fertilized egg by secreting estrogen and progesterone hormones. But if the egg is not fertilized then the corpus luteum begins to degenerate and it stops the production of progesterone and estrogen hormones, which causes shedding of the endometrium lining with menstrual bleeding.
23. *Pinctada* sp. are the bivalve molluscs, commonly known as pearl oysters. These belong to sub-class-Lamellibranchia, class-Bivalvia or Pelycipoda, phylum-Mollusca and kingdom-Animalia.
24. The formation of urea from NH_3 and CO_2 occurs in liver. Through Ornithine cycle or Krebs' Hansleit cycle. All the steps of this cycle are enzymatic and can be visualized as follows.



25. The term 'pelvis' is common to both kidney and skeleton in mammals. In relation to kidney, it can be described as a chamber in the kidney into which the urine drains from renal tubules before passing to the ureter. For skeleton, it is related with pelvic girdle or hip girdle.
26. Allantois is an extraembryonic membrane developed as an outgrowth from hindgut. In the eggs of reptiles and birds, it functions as a urinary bladder and stores the waste excretory products. It also provides oxygen (in reptiles,



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birds and mammals) and food (in mammals) to the embryo.

27. The deficiency (hypovitaminosis) of vitamin-B₁₂ or cyanocobalamin causes pernicious anaemia, demyelination of nerve fibres and glossitis (inflammation of tongue).
28. Blood is a living, vascular, fluid connective tissue, which is made of 60% plasma, 40% blood cells and platelets.
29. To control the human population many birth control methods can be used, such as **hormonal method**, i.e., use of contraceptive pills (estrogen and progesterone are main constituents), **mechanical prevention method**, i.e., use of IUCDs (Intrauterine Contraceptive Device), **surgical sterilization methods**, like tubectomy (surgical removal of fallopian tubules) or vasectomy (surgical removal of vas deferens).
30. In alcoholic person, some part of alcohol is changed into acetaldehyde, which stimulates the formation of fat. This fat is deposited over the wall of arteries and also accumulates in liver cells. Due to which liver gets failed and there is very little regulation of carbohydrate, protein and fat metabolism. This disorder is known as **fatty liver syndrome**. Later on, the liver gets turned into solid, hard, fibrous organ causing **liver cirrhosis**.
31. Class—Ostracodermi of vertebrata includes most primitive vertebrates, e.g., *Cephalaspis* and *Drepanaspis*.
32. Meristic variations involve any change in the number of body parts. In other words, it may be defined as the numerical variation in the taxonomic characters, e.g., number of spots, vertebrae, etc.
33. Klinefelter's syndrome is caused by one or more extra X-chromosome (i.e., XXY, XXXY). The man with such a syndrome is sterile, has small testes, long legs and feminine characters like breasts.
34. The first living form is named as protocell or eobiont or protobiont, which evolved into prokaryotic cell. These were originated about 3900-3500 million years ago, during Precambrian era.

35. Branch of Zoology	Area
Arthrology	Study of joints
Ichthyology	Study of fishes
Saurology	Study of lizards
Herpetology	Study of reptiles

36. Theory of continuity of germplasm was proposed by August Weismann (1892), a German Biologist, he suggested that the changes occurring in germplasm are inherited by offsprings, whereas in somatoplasm are not transmitted to next generation.
37. Amnion is an extraembryonic membrane that surrounds embryo in reptiles, birds and mammals. It provides a kind of private aquarium to the embryo and protects it from mechanical shock and desiccation.

Chorion (serosa) is the outermost extra embryonic membrane in reptiles, birds and mammals. It surrounds the whole embryonic system of embryo.

Yolk sac contains yolk in reptiles and birds. In mammals, yolk sac is also known as umbilical vesicle. It is connected to enteron of embryo by a slender yolk stalk.

Allantois functions as an embryonic urinary bladder or as a respiratory extension of hind gut in reptiles and birds. In mammals, it is modified to carry blood vessels to and from the placenta.
38. Neutrophils are most abundant granulocytes which engulf microbes by phagocytosis. These have 2-7 lobulated nucleus and do not stain any basic or acidic dye monocytes are large sized leucocytes, which are highly motile and phagocytic in nature.
39. During the propagation of nerve impulse when a stimulus of adequate strength is applied to a polarized membrane, the permeability of the membrane to Na⁺ is greatly increased at the point of stimulation. As a result, the sodium ion channels permit the influx of Na⁺ by diffusion. Since, there are more Na⁺ ions entering than leaving, the electrical potential of the membrane changes from -70 mV towards zero.

At 0 mV the membrane is said to be depolarized. While the resting potential is determined largely by K⁺ ions, the action potential is determined



largely by Na^+ ions. Action potential is another name of nerve impulse. The stimulated negatively charged point on the outside of the membrane sends out an electrical current to the positive point adjacent to it. This local current causes the adjacent inner part of the membrane to reverse its potential from -70 mV to $+30$ mV.

40. Adaptive radiation represents evolution of new forms in several directions from the common ancestral type. In 1831, Darwin got an opportunity to travel by HMS Beagle for a voyage of world exploration. Beagle sailed to

the Galapagos Islands, here Darwin found a living laboratory of evolution. The common birds of Galapagos Islands, the finches were markedly different from the finches of main land. The closely related species of finches had beaks of different shapes and sizes and adapted for feeding on completely different diet showing adaptive radiation.

The transitional fossil forms, which show characteristic of two different groups of living animals are called connecting links, e.g., *Archaeopteryx*, *Seymouria*, etc.

Botany

1. In *Pteris* (also *Dryopteris*), the spore germinates to produce the prothallus. The prothallus is a small, green, flat, surface loving, thallus-like object. It is monoecious and bears sex organs on the ventral side. The antheridia (male sex organs) arise among the rhizoids towards the posterior side of the prothallus and are emergent. The archegonia develop in central cushion behind the apical notch. In these plants, male and female gametophytes do not have free living independent existence.

All species of *Polytrichum* are dioecious. The antheridia and archegonia are borne on different gametophore. The plant body is an erect leafy shoot but is not the entire gametophyte. The leafy shoot arise from protonema (the juvenile stage).

The leafy gametophore of *Funaria* reproduces sexually by formation of antheridia and archegonia. The antheridia are formed at the summit of a relatively small, thin, leafy shoot, which develops first. The female branch arises later as a lateral outgrowth from the base of parent male shoot.

2. Vitamin-A deficiency causes nightblindness among children. Vitamin-A deficiency often occurs, where rice is the staple food since, rice grain does not contain β -carotene. Three transgenes providing phytoene synthase, phytoene desaturase, β carotene desaturase and lycopene cyclase activities were transferred into rice by *Agrobacterium* mediated transformation. The resulting transgenic rice popularly called

Golden rice contains good quantities of β -carotene.

Flavr savr is genetically modified tomato, which remains fresh and retains their flavour much longer than normal tomato due to blocking of synthesis of fruit softening enzyme polygalacturonase.

3. Histogen theory for shoot apical meristem has been proposed by Hanstein (1870). It advocates that there are three distinct meristematic zones (layers) called dermatogen periblem and pierome. The dermatogen is the outermost histogen giving rise to epidermis, periblem is the middle on producing the cortex and pierome is the innermost resulting in central cylinder (i.e., vascular tissue).

Cork cambium (phellogen) is the secondary lateral meristem found in outer cortical region. Its cells divide periclinally cutting off cells towards the outside (forming cork or phellem) and inside (forming secondary cortex or phelloderm).

4. Nitrogen is the most critical element. Atmosphere is the greatest reservoir of nitrogen. Molecular nitrogen cannot be utilized directly by plants. It has to be fixed or converted into compounds prior to utilization. Symbiotic nitrogen fixation is accomplished by *Rhizobium* species, which occurs on the roots of leguminous plants. Certain non-leguminous plants also form nodules to fix nitrogen. The best known example in temperate region is



alder (*Alnus* sp.) The bacteria involved in nodule formation is an Actinomycetes, the *Frankia*.

Clostridium is anaerobic, saprotrophic, free-living nitrogen fixing bacteria.

Bradyrhizobium is symbiont in plants of *Parasponia* and soyabean.

The *Azorhizobium* forms both stem and root nodules in *Sesbania* (aquatic plant).

5. In *Pinus*, the microspore nucleus divides by a periclinal wall and forms a very small prothallial cell and large central cell. The central cell cuts off a second prothallial cell and antheridial cell. The nucleus of the antheridial cell divides to form generative cell and tube cell. Thus, the pollen grain of *Pinus* is shed at four cell stage when it consists of two vegetative prothallial cells, a generative cell and a tube cell.
6. Colchicine is a poisonous chemical, isolated from seeds and bulbs of autumn crocus (*Colchicum autumnale*). It blocks spindle formation and thus, inhibits the movement of sister chromatids to the opposite poles. The resulting restitution nucleus includes all the chromatids. As a result, the chromosome number of the cell is doubled, which leads to polyploidy.
7. Quantasomes are the photosynthetic units present in the thylakoids of chloroplast. Each of the quantasomes contain about 250-300 chlorophyll molecules.
8. Mitochondria contains various enzymes as follows :
 - (i) **Outer membrane** Acetyltransferase, glycerophosphatase, phospholipase-A, monoamine oxidase, etc.
 - (ii) **Inner membrane** Cytochrome oxidase, dehydrogenase, succinate NADH, dehydrogenase, ATPase, etc.
 - (iii) **Perimitochondrial space** Adenylate kinase, nucleoside diphosphokinase, etc.
 - (iv) **Matrix** Pyruvate dehydrogenase, citrate synthase, aconitase, isocitrate dehydrogenase, fumarase, α -ketoglutarate dehydrogenase, malate dehydrogenase, etc.
9. *Pseudomonas putida* is a genetically engineered bacterium with many different plasmids to degrade the pollutants. It is developed by Dr. Anand Mohan Chakraborty and is known as superbug or oil eating bug or Chakraborty's superbug. Now-a-days, this genetically engineered bacterium is utilized for cleaning of marine oil slicks.
10. Solanin is a glycoalkaloid poison or natural nerve toxin produced in the green part of the potato. It is a bitter poisonous crystalline alkaloid, which helps the plant to defend against predators, insects, diseases, etc. Ingestion of it may cause vomiting, diarrhoea, headache and even paralysis of central nervous system.
11. Myeloma is a type of cancer that develops from plasma cells occurring in the bone marrow. It may develop, wherever the plasma cells occur.
12. The common bread wheat (*Triticum aestivum*) is an allohexaploid, which has two copies of each of the genomes A, B and D. Its somatic complement is represented by AABBDD.
13. *Rafflesia* is a total root parasite, which remains attached to the roots of the host plants and derives all of its nutritions from them.

Cuscuta (dodder or amarbel) is a total stem parasite, while *Santalum album* (sandal wood) is a partial root parasite.
14. Companion cells are present between sieve tubes in the phloem of angiosperms. These are the living cells with large nucleus that controls the activity of non-nucleated sieve tubes.
15. Cotton is obtained from the epidermal hair present on the surface of seeds of *Gossypium* sp. These are made up of cellulose only and may be of two types, i.e., extractable lint and non-extractable fluffy fuzz. Cotton fibres are mainly used for textiles, celluloid, cellophane, rayon and paper pulp.
16. In pteridophytes, spore is a haploid structure, which develops after meiosis in the spore mother cell. On germination, it gives rise to a green haploid prothallus (gametophyte) which is monoecious, i.e., has both antheridia (male sex organs) and archegonia (female sex organs).

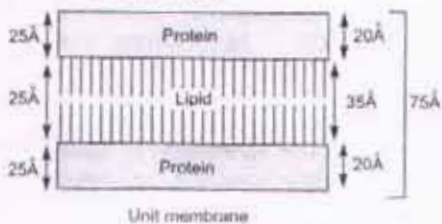


17. The pollen tube may enter the ovule by following one of three routes given below :
- Porogamy** Pollen tube enters the ovule through micropyle, e.g., most angiosperms.
 - Mesogamy** Pollen tube enters the ovule through integuments (e.g., *Cucurbita*) or through funiculus (e.g., *Pistacia*).
 - Chalazogamy** Pollen tube enters the ovule through chalazal tissues, e.g., *Casuarina*, *Beta vulgaris*, *Juglens regia*, etc.
18. A pollen grain contains two layered cell wall, the outer exine and inner intine. Sporopollenin is found in the exine of pollen grains, which is the most resistant biological material known, of microbial and chemical decomposition. Due to this, pollen grains are well preserved during fossilization. Intine of pollen grain is made up of pectocellulose.
19. The nucleotide is formed by the union of a phosphate group with a nucleoside. A nucleoside in fact contains a sugar molecule alongwith an organic nitrogenous base. Thus, a nucleotide contains an organic nitrogenous base (purine or pyrimidine) alongwith a sugar molecule and a phosphate group, i.e., Nucleoside = Sugar molecule + organic nitrogenous base.
- Nucleotide = Nucleoside + Phosphate group.
20. The S-phase of cell cycle is also called 'synthesis phase', in which the cell synthesizes the replica of its genome, i.e., DNA replication occurs during this stage, which ultimately results to the duplication of chromosomal material.
21. Gamete is the haploid reproductive cell that fuse with another gamete to form a diploid zygote. These are not surrounded by the cell wall. On the other hand, root hair cell, stem hair cell and bacterial cell, all possess a well defined cell wall.
22. Lysosomes are the single membrane bound cell organelles, which contain hydrolytic enzymes. These are also known as suicidal bags.
23. On the basis of the frequency of flowering or fruiting in the life time, plants may be either monocarpic or polycarpic. Monocarpic plants are those, in which flowering and fruiting occurs only once in their life, e.g., all annual and biennial plants and some perennial plants like bamboo and Agave. In contrast, polycarpic plants bear flowers and fruits repeatedly after attaining maturity, e.g., mango, *Acacia*, *Eucalyptus*, etc.
24. AIDS is caused by Human Immunodeficiency Virus (HIV). It is a lentivirus belonging to the family—Retroviridae. The core of this virus contains two single strands of RNA molecules (genetic material) proteins and the enzyme reverse transcriptase.
25. Calyptra is a covering developed from the ventre of archegonium in bryophytes and pteridophytes. It acts as a transpiration shield around the immature capsule and provides protection to the young capsule.
26. Protonema is the juvenile stage of moss resulting from the germinating meiospore and consists of a slender, green, branching system of filaments. In *Funaria*, the protonema stage is only vegetative and transitory, which precedes the upright, leafy gametophyte.
27. A fern (pteridophyte) differs from a moss (bryophyte) in having independent gametophyte, while in moss the sporophyte is simpler than the gametophyte and remains attached to the parent gametophyte throughout its life. This sporophyte is dependent upon gametophyte partially or wholly for its nutrition.
28. The female cone of *Pinus* is formed by the aggregation of megasporophylls, which bear ovules. Each megasporophyll consists of a lower bract scale and a larger upper ovuliferous scale.
29. Parthenogenesis (virgin origin) is the development of an embryo from an unfertilized egg or if a spermatozoan does penetrate the egg, there is no union of male and female pronuclei. It is found in many plants (dandelions and hawk weeds) and (aphids and honey bees).
30. After fertilization, the mature, ripened ovary develops into fruit. The ovary wall forms the covering of the fruit called fruit wall or pericarp. Some other post fertilization changes also occur like nucellus develops into perisperm, ovules develop into seeds, outer integument forms testa, inner integument forms tegmen, etc.
31. Prothallus is a small, flattened, multicellular structure that represents the independent

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gametophyte generation of a fern. The prothalli bear antheridia (male sex organs) and archegonia (female sex organs) which produce male and female gametes, respectively.

32. Photorespiration (C_2 -cycle) is a special type of respiration shown by many green plants (C_3 -plants) when they are exposed to light. It is a light dependent process during which O_2 is used and CO_2 is released. The process of photorespiration takes place only in chlorophyllous tissues of plants. Therefore, the main site for photorespiration is chloroplast. But mitochondria and peroxysomes are also required to complete the process.
33. The unit membrane, described by J David Robertson, was considered as 75 Å thick trilaminar (3 layered membrane). According to his unit membrane or trilaminar model, unit membrane consists of 35 Å thick bimolecular phospholipid layer between two protein layers, each with 20 Å thickness.



34. In plant cells, during metaphase chromosomes line up around the equator of the spindle and attached by their centromere to the spindle fibres (microtubules). In animal cells, during metaphase, smaller chromosomes are usually central in position with larger ones peripheral in position.
35. The 3-D structure of DNA is represented by a double helix, in which each turn has a diameter of 34 Å and contains 10 base pairs at a distance of 3.4 Å. The width of DNA molecule is 20 Å.
36. Gymnosperms are commonly known as 'naked seed plants' because the ovary wall is not present and hence, the ovules remain unprotected or naked.
37. The vertical conduction of water from root to aerial parts of plant is called ascent of sap. The water molecules remain joined to each other

due to a force of attraction called cohesion force. This attraction is due to the presence of hydrogen bonds between them. The magnitude of this force is very high therefore, the continuous water column in the xylem cannot be broken easily due to the force of gravity or other obstructions offered by internal tissues in the upward movement of water. This adhesive property of water, i.e., attraction between the water molecules and the walls of xylem ensures the continuity of water column in the xylem.

Due to transpiration water evaporates to outer atmosphere through stomata. As a result leaf cells develop low water potential and water from leaf veins moves into leaf cells. The xylem vessel in turn draw water from xylem of main stem. A pressure (pull) is thus, exerted by all the leaves on the stems, which is called transpiration pull. This is strong enough to pull up the column of water to a great height.

38. Syconus is a composite fruit develops from hypanthodium inflorescence, e.g., *Ficus carica*, *Ficus benghalensis*. The flask-shaped receptacle encloses female flowers that give rise to achene-like fruitlets. This fruit possesses a small pore protected by scaly leaves. The receptacle that becomes fleshy is edible.

Samara is a single seeded, dry indehiscent fruit. Its pericarp becomes membranous and flat-like wings that help in dispersal, e.g., *Ulmus*, *Holoptelia indica*.

A berry is a pulpy-indehiscent, few to multiseeded fruit derived from multicarpellary syncarpous gynoecium. The fleshy pericarp of berry consists of three parts-epicarp, mesocarp and endocarp.

Schizocarpic fruits are simple, dry, multiseeded fruits, which breakup into single seeded parts. The single seeded parts, which further do not dehisce are called mericarps.

39. Bordeaux mixture was discovered by Millardet in France in 1882. It is prepared by dissolving 40 g of copper sulphate and 40 g of calcium hydroxide in 5 L of water. It was first used to control downy mildew disease of grape-vine that is caused by a fungus *Plasmopara viticola*.



Black rust of wheat is caused by *Puccinia graminis tritici*. The use of fungicide dithane Z-78 and dithane M-45 control the disease even at lower concentration.

Loose smut of wheat is caused by *Ustilago tritici*. The use of fungicides (systemic fungicide like D-785 and F-461) give quite encouraging result.

40. The transfer of pollen from anther to stigma is called pollination. Autogamy also called self-pollination involves the transfer of pollen grains of one flower to the stigma of same flower. Self-pollination occurs only in bisexual or hermaphrodite flowers.

Geitonogamy involves the transfer of pollen grains from a male flower to stigma of female flower of same plant. Thus, geitonogamy operates only in monoecious plants, i.e., the plants having male and female flowers on different places.

Allogamy or xenogamy also known as cross-pollination involves the transfer of pollen grains of male flower to the stigma of genetically different female flower. It takes place via various agencies like wind, water, insects, etc.