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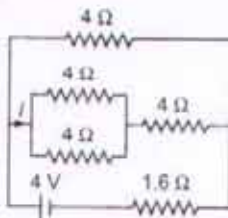
JIPMER MBBS
SAMPLE PAPER 2011

JIPMER
Medical Entrance Exam
Solved Paper 2011

Physics

1. The physical quantity having the dimensions $[M^{-1}L^{-3}T^{3}A^{2}]$ is
   (a) resistance
   (b) resistivity
   (c) electrical conductivity
   (d) electromotive force

2. In the circuit shown the value of I in ampere is

   (a) 1
   (b) 0.60
   (c) 0.4
   (d) 1.5

3. The specific charge of a proton is 9.6×10^{7} C/kg. The specific charge of an alpha particle will be
   (a) 9.6×10^{7} C/kg
   (b) 19.2×10^{7} C/kg
   (c) 4.8×10^{7} C/kg
   (d) 2.4×10^{7} C/kg

4. If λ_1 and λ_2 are the wavelengths of the first members of the Lyman and Paschen series respectively, then $\lambda_1 : \lambda_2$ is
   (a) 1 : 3
   (b) 1 : 30
   (c) 7 : 50
   (d) 7 : 108

5. Activity of a radioactive sample decreases to (1/3)rd of its original value in 3 days. Then, in 9 days its activity will become
   (a) (1/27) of the original value
   (b) (1/9) of the original value
   (c) (1/18) of the original value
   (d) (1/3) of the original value

6. A tuning fork A produces 4 beats/s with another tuning fork B of frequency 320 Hz. On filing one of the prongs of A, 4 beats/s are again heard when sounded with the same fork B. Then, the frequency of the fork A before filing is
   (a) 328 Hz
   (b) 316 Hz
   (c) 324 Hz
   (d) 320 Hz

7. If there were no gravity, which of the following will not be there for a fluid?
   (a) Viscosity
   (b) Surface tension
   (c) Pressure
   (d) Archimedes' upward thrust

8. A choke is preferred to a resistance for limiting current in AC circuit because
   (a) choke is cheap
   (b) there is no wastage of power
   (c) choke is compact in size
   (d) choke is a good absorber of heat

9. Velocity-time curve for a body projected vertically upwards is
   (a) parabola
   (b) ellipse
   (c) hyperbola
   (d) straight line

10. If r_1 and r_2 are the radii of the atomic nuclei of mass numbers 64 and 125 respectively, then the ratio (r_1 / r_2) is
    (a) $\dfrac{64}{125}$
    (b) $\sqrt{\dfrac{64}{125}}$
    (c) $\dfrac{5}{4}$
    (d) $\dfrac{4}{5}$

11. The ionization energy of Li^{2+} is equal to
    (a) $9hcR$
    (b) $6hcR$
    (c) $2hcR$
    (d) hcR

12. A current of 5 A is passing through a metallic wire of cross-sectional area 4×10^{-6} m^2. If the density of charge carriers of the wire is 5×10^{26} m^{-3}, then the drift velocity of the electrons will be
    (a) 1×10^{2} m/s
    (b) 1.56×10^{-2} m/s
    (c) 1.56×10^{-3} m/s
    (d) 1×10^{-2} m/s

13. The numerical ratio of displacement to the distance covered is always
    (a) less than one
    (b) equal to one
    (c) equal to or less than one
    (d) equal to or greater than one

14. 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) $\sin^{-1} (0.1)$

15. The principle of LASER action involves
    (a) amplification of particular frequency emitted by the system
    (b) population inversion
    (c) stimulated emission
    (d) All of the above

16. A train is moving towards east and a car is along north, both with same speed. The observed direction of car to the passenger in the train is
    (a) east-north direction
    (b) west-north direction
    (c) south-east direction
    (d) None of the above

17. Which of the following is unipolar transistor?
    (a) p-n-p transistor
    (b) n-p-n transistor
    (c) Field effect transistor
    (d) Point contact transistor

18. A solid sphere and a hollow sphere of the same material and of a same size can be distinguished without weighing
    (a) by determining their moments of inertia about their coaxial axes
    (b) by rolling them simultaneously on an inclined plane
    (c) by rotating them about a common axis of rotation
    (d) by applying equal torque on them

19. Point masses 1, 2, 3 and 4 kg are lying at the points (0, 0, 0), (2, 0, 0), (0, 3, 0) and (− 2, −2, 0) respectively. The moment of inertia of this system about X-axis will be
    (a) 43 kg-m^2
    (b) 34 kg-m^2
    (c) 27 kg-m^2
    (d) 72 kg-m^2

20. The radius of gyration of a body about an axis at a distance 6 cm from its centre of mass is 10 cm. Then, its radius of gyration about a parallel axis through its centre of mass will be
    (a) 80 cm
    (b) 8 cm
    (c) 0.8 cm
    (d) 80 m

21. A galvanometer can be changed into an ammeter by using
    (a) low resistance shunt in series
    (b) low resistance shunt in parallel
    (c) high resistance shunt in series
    (d) high resistance shunt in parallel

22. A bullet of mass 20 g and moving with 600 m/s collides with a block of mass 4 kg hanging with the string. What is velocity of bullet when it comes out of block, if block rises to height 0.2 m after collision?
    (a) 200 m/s
    (b) 150 m/s
    (c) 400 m/s
    (d) 300 m/s

23. Voltage in the secondary coil of a transformer does not depend upon
    (a) frequency of the source
    (b) voltage in the primary coil
    (c) ratio of number of turns in the two coils
    (d) Both (b) and (c)

24. In Carnot engine efficiency is 40% at hot reservoir temperature T. For efficiency 50%, what will be temperature of hot reservoir?
    (a) $\frac{T}{5}$
    (b) $\frac{2T}{5}$
    (c) $6T$
    (d) $\frac{6T}{5}$

25. A ball of mass 2 kg moving with velocity 3 m/s, collides with spring of natural length 2 m and force constant 144 N/m. What will be length of compressed spring?
    (a) 2 m
    (b) 1.5 m
    (c) 1 m
    (d) 0.5 m

26. A proton moving vertically downward enters a magnetic field pointing towards north. In which direction proton will deflect?
    (a) East
    (b) West
    (c) North
    (d) South

27. Induced emf in the coil depends upon
    (a) conductivity of coil
    (b) amount of flux
    (c) rate of change of linked flux
    (d) resistance of coil

28. X-rays are used in determining the molecular structure of crystalline because
    (a) its energy is high
    (b) it can penetrate the material
    (c) its wavelength is comparable to interatomic distance
    (d) its frequency is low

29. Light of frequency ν falls on material of threshold frequency $ν_0$. Maximum kinetic energy of emitted electron is proportional to
    (a) $ν - ν_0$
    (b) $ν$
    (c) $\sqrt{ν - ν_0}$
    (d) $ν_0$

30. A light movs from denser to rarer medium, which of the following is correct?
    (a) Energy increases
    (b) Frequency increases
    (c) Phase changes by 90°
    (d) Velocity increases

31. Which one of the following statements is true?
    (a) Both light and sound waves in air are transverse
    (b) The sound waves in air are longitudinal while the light waves are transverse
    (c) Both light and sound waves in air are longitudinal
    (d) Both light and sound waves can travel in vacuum

32. A metro train starts from rest and in 5 s achieves 108 km/h. After that it moves with constant velocity and comes to rest after travelling 45 m with uniform retardation. If total distance travelled is 395 m, find total time of travelling.
    (a) 12.2 s   (b) 15.3 s
    (c) 9 s   (d) 17.2 s

33. A closed organ pipe of length 20 cm is sounded with tuning fork in resonance. What is frequency of tuning fork? ($v = 332$ m/s)
    (a) 300 Hz   (b) 350 Hz
    (c) 375 Hz   (d) 415 Hz

34. The temperature of the sun can be found out by using
    (a) Wien's displacement law
    (b) Kepler's law of motion
    (c) Stefan's Boltzmann law
    (d) Planck's law

35. Pressure of an ideal gas is increased by keeping temperature constant. What is effect on kinetic energy of molecules?
    (a) Increase
    (b) Decrease
    (c) No change
    (d) Cannot be determined

36. Kirchhoff's law of junction, $\Sigma I = 0$, is based on
    (a) conservation of energy
    (b) conservation of charge
    (c) conservation of energy as well as charge
    (d) conservation of momentum

37. A transverse wave is expressed as,
    $$y = y_0 \sin 2\pi ft$$
    For what value of λ, maximum particle velocity equals to 4 times the wave velocity?
    (a) $y_0 \dfrac{\pi}{2}$ (b) $2y_0 \pi$ (c) $y_0 \pi$ (d) $y_0 \dfrac{\pi}{4}$

38. For a given lens, the magnification was found to be twice as large as when the object was 0.15 m distant from it as when the distance was 0.2 m. The focal length of the lens is
    (a) 1.5 m   (b) 0.20 m
    (c) 0.10 m   (d) 0.05 m

39. When sound waves travel from air to water which one of the following remains constant?
    (a) Time period   (b) Frequency
    (c) Velocity   (d) Wavelength

40. The Bulk modulus for an incompressible liquid is
    (a) zero   (b) unity
    (c) infinity   (d) between 0 and 1

Chemistry

1. 10^{-6} M NaOH is diluted 100 times. The pH of the diluted base is
    (a) between 7 and 8
    (b) between 5 and 6
    (c) between 6 and 7
    (d) between 10 and 11

2. An sp^3-hybrid orbital contains
    (a) $\dfrac{1}{4}$ s-character   (b) $\dfrac{1}{2}$ s-character
    (c) $\dfrac{2}{3}$ s-character   (d) $\dfrac{3}{4}$ s-character

3. Leaching is a process of
    (a) reduction   (b) concentration
    (c) refining   (d) oxidation

4. Electrolysis of fused NaCl will give
    (a) Na   (b) NaOH
    (c) NaClO   (d) NaClO₃

5. Which of the following fluorides does not exist?
    (a) NF_5 (b) PF_5
    (c) AsF_5 (d) SbF_5

6. Red lead is
    (a) PbO   (b) PbO_2
    (c) Pb_3O_4 (d) Pb_2O_3

7. Hybridisation states of C in CH_3^+ and CH_3^- are
    (a) sp^2, sp^3 (b) sp^3, sp^2
    (c) sp, sp^2 (d) sp^2, sp

8. Which one of the following complexes is outer orbital complex?
    (a) $[Co(NH_3)_6]^{3+}$ (b) $[Mn(CN)_6]^{4-}$
    (c) $[Fe(CN)_6]^{4-}$ (d) $[Ni(NH_3)_6]^{2+}$

9. A solution made by dissolving 40 g NaOH in 1000 g of H_2O is
    (a) 1 molar   (b) 1 normal
    (c) 1 molal   (d) None of these

10. 0.1 mol HCl is equal to
    (a) 3.65 g   (b) 36.5 g
    (c) 18 g   (d) 1.8 g

11. Which will liberate bromine from a solution of potassium bromide?
    (a) I_2 (b) Cl_2 (c) SO_2 (d) HI

12. Which of the following has the maximum number of unpaired electrons?
    (a) V^{3+} (b) Fe^{2+}
    (c) Mn^{2+} (d) Cu^+

13. The geometry of XeF_6 is
    (a) planar hexagon   (b) regular octahedron
    (c) distorted octahedron   (d) square bipyramid

14. The correct statement with regard to H_2^+ and H_2^- is
    (a) both H_2^+ and H_2^- are equally stable
    (b) both H_2^+ and H_2^- do not exist
    (c) H_2^- is more stable than H_2^+
    (d) H_2^+ is more stable than H_2^-

15. 2 g of a radioactive sample having half-life of 15 days was synthesised on 1st Jan 2009. The amount of the sample left behind on 1st March, 2009 (including both the days) is
    (a) 0 g
    (b) 0.125 g
    (c) 1 g
    (d) 0.5 g

16. The rate equation for a reaction,

    $$A \longrightarrow B$$

    is $r = k[A]^0$. If the initial concentration of the reactant is a mol dm^{-3}, the half-life period of the reaction is
    (a) $\dfrac{a}{2k}$
    (b) $\dfrac{k}{a}$
    (c) $\dfrac{a}{k}$
    (d) $\dfrac{2a}{k}$

17. For the reaction,

    $$H_2O(l) \rightleftharpoons H_2O(g)$$

    at 373 K and 1 atm pressure
    (a) $\Delta H = 0$
    (b) $\Delta E = 0$
    (c) $\Delta H = T\Delta S$
    (d) $\Delta H = \Delta E$

18. In electrophilic aromatic substitution reaction, the nitro group is *meta* directing because it
    (a) decreases electron density at *ortho* and *para* positions
    (b) decreases electron density at *meta* position
    (c) increases electron density at *meta* position
    (d) increases electron density at *ortho* and *para* positions

19. The best method for the conversion of an alcohol into an alkyl chloride is by treating the alcohol with
    (a) PCl_3
    (b) PCl_5
    (c) $SOCl_2$ in presence of pyridine
    (d) dry HCl in the presence of anhydrous $ZnCl_2$

20. The compound which is not formed during the dry distillation of a mixture of calcium formate and calcium acetate is
    (a) methanal
    (b) propanal
    (c) propanone
    (d) ethanal

21. The compound which forms acetaldehyde when heated with dilute NaOH, is
    (a) 1,1-dichloroethane
    (b) 1,1,1-trichloroethane
    (c) 1-chloroethane
    (d) 1,2-dichloroethane

22. The one which has least iodine value is
    (a) sunflower oil
    (b) ginger oil
    (c) ghee
    (d) groundnut oil

23. IUPAC name of $(CH_3)_3 CCl$ is
    (a) n-butyl chloride
    (b) 3-chloro butane
    (c) 2-chloro-2-methylpropane
    (d) t-butyl chloride

24. The condensation polymer among the following is
    (a) rubber
    (b) protein
    (c) PVC
    (d) polyethene

25. In which of the following, NH_3 is not used?
    (a) Tollen's reagent
    (b) Nessler's reagent
    (c) Group reagent for the analysis of IV group basic radicals
    (d) Group reagent for the analysis of III group basic radicals

26. Argon is used
    (a) in filling airships
    (b) to obtain low temperature
    (c) in high temperature welding
    (d) in radiotherapy for treatment of cancer

27. Hyperconjugation is most useful for stabilising which of the following carbocations?
    (a) *Neo*-pentyl
    (b) *Tert*-butyl
    (c) *Iso*-propyl
    (d) Ethyl

28. The isomerism that arises due to restricted bond rotation is
    (a) metamerism
    (b) optical isomerism
    (c) position isomerism
    (d) geometrical isomerism

29. Amine that cannot be prepared by Gabriel phthalimide synthesis is
    (a) aniline
    (b) benzylamine
    (c) methylamine
    (d) iso-butylamine

30. Lactose is made of
    (a) α-D-glucose only
    (b) α-D-glucose and β-D-glucose
    (c) α-D-galactose and β-D-glucose
    (d) β-D-galactose and β-D-glucose

31. Cetyltrimethyl ammonium bromide is a popular
    (a) anionic detergent
    (b) cationic detergent
    (c) non-ionic detergent
    (d) sweetener

32. The number of electrons, neutrons and protons in a species are equal to 10, 8 and 8 respectively. The proper symbol of the species is
    (a) $^{16}_{9}O$
    (b) $^{18}_{8}O$
    (c) $^{18}_{10}Ne$
    (d) $^{16}_{8}O^{2-}$

33. 56 g of nitrogen and 96 g of oxygen are mixed isothermally and at a total pressure of 10 atm. The partial pressures of oxygen and nitrogen (in atm) are respectively
    (a) 4, 6
    (b) 5, 5
    (c) 2, 8
    (d) 6, 4

34. Which of the following undergoes reduction with hydrogen peroxide in alkaline medium?
    (a) Mn^{2+}
    (b) I_2
    (c) PbS
    (d) Fe^{2+}

35. The metal that produces red-violet colour in the non-luminous flame is
(a) Ba
(b) Ag
(c) Rb
(d) Pb

36. According to the first law of thermodynamics which of the following quantities represents the change in a state function?
(a) q_{rev}
(b) $q_{rev} - W_{rev}$
(c) $\dfrac{q_{rev}}{W_{rev}}$
(d) $q_{rev} + W_{rev}$

37. The maximum oxidation state exhibited by actinide ions is
(a) +5
(b) +4
(c) +7
(d) +8

38. The dispersed phase and dispersion medium in soap lather are respectively
(a) gas and liquid
(b) liquid and gas
(c) solid and gas
(d) solid and liquid

39. The expression for the solubility product of Ag_2CO_3 will be
(a) $K_{sp} = s^2$
(b) $K_{sp} = 4s^3$
(c) $K_{sp} = 27s^4$
(d) $K_{sp} = s$

40. A 600 W mercury lamp emits monochromatic radiation of wavelength 331.3 nm. How many photons are emitted from the lamp per second? ($h = 6.626 \times 10^{-34}$ J-s; velocity of light $= 3 \times 10^8$ ms^{-1})
(a) 1×10^{19} (b) 1×10^{20} (c) 1×10^{21} (d) 1×10^{23}

Zoology

1. In mammals, histamine is secreted by
(a) fibroblasts
(b) histocytes
(c) lymphocytes
(d) mast cells

2. The layer of cells that secrete enamel of tooth is
(a) dentoblast
(b) ameloblast
(c) osteoblast
(d) odontoblast

3. Which important green house gas, other than carbon dioxide, is being produced from the agricultural fields?
(a) Arsine
(b) Sulphur dioxide
(c) Ammonia
(d) Nitrous oxide

4. The exchange of gases in the alveoli of the lungs takes place by
(a) osmosis
(b) simple diffusion
(c) passive transport
(d) active transport

5. Carbon monoxide is a pollutant because it
(a) reacts with oxygen
(b) inhibits glycolysis
(c) reacts with haemoglobin
(d) makes nervous system inactive

6. Total number of bones in the hindlimb of a man is
(a) 14
(b) 21
(c) 24
(d) 30

7. Calcitonin is a thyroid hormone which
(a) elevates potassium level in blood
(b) lowers calcium level in blood
(c) elevates calcium level in blood
(d) has no effect on calcium

8. A condition of failure of kidney to form urine is called
(a) deamination
(b) entropy
(c) anuria
(d) None of these

9. Solenocytes are the main excretory structures in
(a) annelids
(b) molluscs
(c) echinodermates
(d) platyhelminthes

10. A woman with two genes (one on each X-chromosome) for haemophilia and one gene for colour blindness on the X-chromosome marries a normal man. How will the progeny be?
(a) All sons and daughters are haemophilic and colourblind
(b) Haemophilic and colourblind daughters
(c) 50% haemophilic colourblind sons and 50% haemophilic sons
(d) 50% haemophilic daughters and 50% colourblind daughters

11. The functional unit of contractile system in striated muscle is
(a) cross birdge
(b) myofibril
(c) sacromere
(d) Z-band

12. The contraction of gall bladder is due to
(a) gastrin
(b) secretin
(c) cholecystokinin
(d) enterogastrone

13. The diversity in the type of beaks of finches adapted to different feeding habits on the Galapagos islands, as observed by Darwin, provides evidence for
(a) origin of species by natural selection
(b) intraspecific variations
(c) intraspecific competition
(d) interspecific competition

14. The most important component of the oral contraceptive pills is
(a) progesterone
(b) growth hormone
(c) thyroxine
(d) luteinising hormone

15. Sympathetic nervous system induces
(a) heart beat
(b) secretion of digestive juice
(c) secretion of saliva
(d) All of the above

16. The middle piece of the sperm contains
    (a) proteins   (b) centriole
    (c) nucleus   (d) mitochondria

17. The term 'aquaculture' means
    (a) aspergillosis
    (b) inland fisheries
    (c) marine fisheries
    (d) Both (b) and (c)

18. Active immunity means
    (a) resistance developed after disease
    (b) increasing quantity of blood
    (c) resistance developed before disease
    (d) increasing rate of heart-beat

19. The canal system is a characteristic feature of
    (a) echinoderms
    (b) helminthes
    (c) coelenterates
    (d) sponges

20. Which cranial nerve has the highest number of branches?
    (a) Facial nerve
    (b) Trigeminal
    (c) Vagus nerve
    (d) None of these

21. The problem due to Rh^- factor arises when the blood of two (Rh^+ and Rh^-) mixup
    (a) during pregnancy
    (b) through transfusion
    (c) in a test tube
    (d) Both (a) and (b)

22. Which of the following is mismatched?
    (a) Vitamin-K — Beri-beri
    (b) Vitamin-D — Rickets
    (c) Vitamin-C — Scurvy
    (d) Vitamin-A — Xerophthalmia

23. The joint between atlas and axis is called
    (a) pivot joint   (b) hinge joint
    (c) saddle joint   (d) angular joint

24. The blood group with antibody-a and antibody-b is
    (a) B   (b) A
    (c) O   (d) AB

25. Rate of heart beat is determined by
    (a) Purkinje fibres
    (b) papillary muscles
    (c) SA-node
    (d) AV-node

26. The junction between the axon of one neuron and the dendrite of the next is called
    (a) junction point
    (b) a synapse
    (c) a joint
    (d) constant bridge

27. Chondrichthyes is characterised by
    (a) placoid scale
    (b) ventral mouth
    (c) ctenoid scale and ventral mouth
    (d) placoid scale and ventral mouth

28. Secondary body cavity with segmented mesodermal lining is called
    (a) haemocoel   (b) neurocoel
    (c) true coelom   (d) pseudocoelom

29. Stratified epithelium is found in
    (a) seminiferous tubule
    (b) fallopian tube
    (c) nasal cavity
    (d) kidney tubules

30. Dead space air in man is
    (a) 500 mL   (b) 150 mL
    (c) 250 mL   (d) 1.5 L

31. Vetebrate brain differentiates from
    (a) endoderm   (b) mesoderm
    (c) ectoderm   (d) blastoderm

32. Animals of class—Mammalia have
    (a) seven cervical vertebrae
    (b) seven cranial nerve
    (c) single ventricular chamber
    (d) fourteen cervical vertebrae

33. Vaccine for tuberculosis is known as
    (a) PAS vaccine   (b) BCG vaccine
    (c) OPV   (d) DPT

34. Sir Godfrey Hounsfield developed the diagonostic technique of
    (a) CT scanning   (b) MRI
    (c) endoscopy   (d) bronchoscopy

35. Alcoholism may leads to
    (a) skin cancer   (b) liver cirrhosis
    (c) viral disease   (d) eye infections

36. The basic unit of classification is
    (a) species   (b) genus
    (c) family   (d) phylum

37. Age of fishes is also known as
    (a) Permian Era   (b) Silurian Era
    (c) Devonian Era   (d) Ordovician Era

38. A hereditary disease which is never passed on from father to son is
    (a) X-chromosomal linked disease
    (b) Autosomal linked disease
    (c) Y-chromosomal linked disease
    (d) None of the above

39. One animal that does not perform locomotion is
    (a) Sycon   (b) Nereis
    (c) Sepia   (d) Euglena

40. Amount of CO_2 in expired air is about
    (a) 0.04%   (b) 0.03%
    (c) 4.5%   (d) 21%

Botany

1. The codon for anticodon 3'-UUUA-5' is
   (a) 3'-AAU-5'
   (b) 5'-UAAA-3'
   (c) 5'-AAAU-3'
   (d) 3'-UAAU-5'

2. A kind of biotechnology involving manipulation of DNA is
   (a) DNA replication
   (b) genetic engineering
   (c) denaturation
   (d) renaturation

3. Minamata disease is caused due to presence of .... in water.
   (a) cadmium
   (b) lead
   (c) arsenic
   (d) mercury

4. The phrase 'Omnis cellula e cellula' was given by
   (a) Virchow
   (b) Pasteur
   (c) Schleiden
   (d) Brown

5. Intermediate community between pioneer and climax communities is called
   (a) seral community
   (b) biotic community
   (c) temporary community
   (d) ecosere

6. Ten percent law of energy transfer in a food chain is given by
   (a) Schimper
   (b) Elton
   (c) Haeckel
   (d) Lindemann

7. Apoenzyme is
   (a) protein
   (b) carbohydrate
   (c) vitamin
   (d) amino acid

8. Glycogenolysis involves
   (a) conversion of sugar into glycogen
   (b) oxidation of sugar
   (c) conversion of glycogen into sugar
   (d) conversion of glycogen into fat

9. A polygenic inheritance in human beings is
   (a) skin colour
   (b) sickle cell anaemia
   (c) colour blindness
   (d) phenylketonuria

10. Nucleic acid segment tagged with a radioactive molecule is called
    (a) clone
    (b) probe
    (c) plasmid
    (d) vector

11. Powdery mildew of wheat is caused by a species of
    (a) Puccinia
    (b) Erysphe
    (c) Ustilago
    (d) Albugo

12. Nucleic acid is absent in
    (a) virus
    (b) viroid
    (c) prion
    (d) mycoplasma

13. In most fungi, cell wall is chiefly made of
    (a) cellulose
    (b) chitin
    (c) protein
    (d) lipid

14. Heterocysts are present in
    (a) Riccia
    (b) Ulothrix
    (c) Albugo
    (d) Nostoc

15. Double fertilization occurs in
    (a) Riccia
    (b) Pteridium
    (c) Cycas
    (d) Capsella

16. In Ruscus, the stem is a
    (a) phyllode
    (b) cladode
    (c) offset
    (d) sucker

17. Catkin inflorescence is found in
    (a) wheat
    (b) oat
    (c) mulberry
    (d) fig

18. Epigynous flowers are present in
    (a) mustad
    (b) brinjal
    (c) China rose
    (d) cucumber

19. In Dianthus, placentation is
    (a) basal
    (b) free central
    (c) axile
    (d) marginal

20. The term 'keel' is used for special type of
    (a) sepals
    (b) petals
    (c) stamens
    (d) carpels

21. Coffee and quinine are obtained from the
    (a) Leguminosae
    (b) Asteraceae
    (c) Rubiaceae
    (d) Poaceae

22. Kranz anatomy can be obseved in leaves of
    (a) sorghum
    (b) spinach
    (c) mustrad
    (d) tulip

23. The term 'bark' refers to
    (a) phellem, phelloderm and vascular cambium
    (b) periderm and secondary xylem
    (c) cork cambium and cork
    (d) phellogen, phellem, phelloderm and secondary phloem

24. Light reaction in srroma lamellae of the chloroplast results in the formation of
    (a) $NADPH_2$
    (b) $ATP + NADPH_2$
    (c) ATP
    (d) O_2

25. In leaves of C_4 plants malic acid synthesis during CO_2 fixation occurs in
    (a) bundle sheath
    (b) mesophyll
    (c) epidermis
    (d) guard cells

26. Membrane is absent in
    (a) nucleus
    (b) nucleolus
    (c) vacuole
    (d) lysosome

27. The quiescent centre in root meristem serves as a
    (a) site for storage of food, which is utilised during maturation
    (b) reservoir of growth hormones
    (c) reserve for replenishment of damaged cells of the meristem
    (d) region for absorption of water

28. An example of competitive inhibition of an enzyme is the inhibition of
    (a) succinic dehydrogenase by malonic acid
    (b) cytochrome oxidase by cyanide
    (c) hexokinase by glucose-6-phosphate
    (d) carbonic anhydrase by carbon dioxide

29. Biological Oxygen Demand (BOD) is a measure of
    (a) industrial wastes poured into water bodies
    (b) extent to which water is polluted with organic compound
    (c) amount of carbon monoxide inseparably combined with haemoglobin
    (d) amount of oxygen needed by green plants during night

30. In prokaryotes, chromatophores are
    (a) specialised granules responsible for colouration of cells
    (b) structures responsible for organising the shape of the organism
    (c) inclusion bodies lying free inside the cells for carrying out various metabolic activities
    (d) internal membrane systems that may become extensive and complex in photosynthetic bacteria

31. The Montreal Protocol refers to
    (a) persistent organic pollutants
    (b) global warming and climate change
    (c) substances that deplete the ozone layer
    (d) biosafety of genetically modified organisms

32. In the sieve elements, which one of the following is the most likely function of P-proteins?
    (a) Deposition of callose on sieve plates
    (b) Providing energy for active translocation
    (c) Autolytic enzymes
    (d) Sealing off mechanism on wounding

33. Which one of the following precedes re-formation of the nuclear envelope during M-phase of the cell cycle?
    (a) Decondensation from chromosome and reassembly of the nuclear lamina
    (b) Transcription from chromosome and reassembly of the nuclear lamina
    (c) Formation of the contractile ring and formation of the phragmoplast
    (d) Formaition of the contractile ring and transcription from chromosomes

34. Viruses that infect bacterimal multiplication and cause their lysis, are called
    (a) lysozymes
    (b) lipolytic
    (c) lytic
    (d) lysogenic

35. A plant require magnesium (Mg) for
    (a) holding cells together
    (b) protein synthesis
    (c) chlorophyll synthesis
    (d) cell wall development

36. Which one of the following pairs, is not correctly matched?
    (a) Abscisic acid — Stomatal closure
    (b) Gibberellic acid — Leaf fall
    (c) Cytokinin — Cell division
    (d) IAA — Cell wall elongation

37. Two cells A and B are contigous. Cell A has osmotic pressure 10 atm, turgor pressure-7 atm and diffusion pressure deficit 3 atm. Cell B has osmotic pressure 8 atm, turgor pressure 3 atm and diffusion pressure deficit 5 atm. The result will be
    (a) movement of water from cell B to A
    (b) no movement of water
    (c) equilibrium between the two
    (d) movement of water from cell A to B

38. The Okazaki fragments in DNA chain growth
    (a) results in transcription
    (b) polymerise in the 3' to 5' direction and forms replication fork
    (c) prove semi-conservative nature of DNA replication
    (d) polymerise in the 5' to 3' direction and explain 3' to 5' DNA replication

39. One gene-one enzyme relationship was established for the first time in
    (a) *Neurospora crassa*
    (b) *Salmonella typhimurium*
    (c) *Escherichia coli*
    (d) *Diplococcus pneumoniae*

40. In gymnosperms, the pollen chamber represents
    (a) a cell in the pollen grain in which the sperms are formed
    (b) a cavity in the ovule in which pollen grains are stored after pollination
    (c) an opening in the megagametophyte through which the pollen tube approaches the egg
    (d) the microsporangium in which pollen grains develop

General English

Directions (Q. Nos. 1 to 5) *Four alternatives are given for the underlined idiom/phrase. Choose the alternative which best expresses the meaning of the underlined idiom/phrase.*

1. The principal has to carry out the orders issued by the higher authorities.
   - (a) obey
   - (b) communicate
   - (c) execute
   - (d) modify

2. The young engineer was hauled up for spilling the beans about the new project to the competitor.
   - (a) suppressing the information
   - (b) hiding the details
   - (c) revealing the information indiscreetly
   - (d) spoiling the plans

3. The Government claims that Indian industry is progressing by leaps and bounds.
   - (a) intermittently
   - (b) leisurely
   - (c) at a rapid pace
   - (d) at a desired pace

4. Laying off of thousands of workers is inevitable under the new economic policy.
   - (a) Dismissal from jobs of
   - (b) Offering new jobs to
   - (c) Reduction of worker's wages of
   - (d) Sending on leave

5. "I take thee at thy word", said Romeo to Juliet.
   - (a) Listen to you carefully
   - (b) Do not believe you
   - (c) Feel angry with you
   - (d) Truly believe you

Directions (Q. Nos. 6 to 10) *Out of the four alternatives, choose the one which can be substituted for the given words/sentence.*

6. To be biased against
   - (a) partial
   - (b) objective
   - (c) prejudiced
   - (d) predestined

7. Motion of head, hand etc, as a mode of expression indicating attitude
   - (a) Gesture
   - (b) Grin
   - (c) Gestation
   - (d) Grimace

8. Bitter and violet attack in words
   - (a) Diaspora
   - (b) Diacriticism
   - (c) Diadem
   - (d) Diatribe

9. Treatment by means of exercise and massage
   - (a) Chemotherapy
   - (b) Hydrotherapy
   - (c) Physiotherapy
   - (d) Psychotherapy

10. The abandonment of one's country or cause
    - (a) Defection
    - (b) Disloyalty
    - (c) Desertion
    - (d) Migration

Directions (Q. Nos. 11 to 12) *A part of the sentence is underlined. Below are given alternatives to the underlined parts at (a), (b) and (c) which may imporve the sentence. Choose the correct alternative. In case no improvement is needed, your answer is (d).*

11. He declined all the allegations against him.
    - (a) spurned
    - (b) refused
    - (c) refuted
    - (d) no improvement

12. It is time we leave.
    - (a) left
    - (b) have to leave
    - (c) would leave
    - (d) no improvement

13. We spent an hour discussing about his character.
    - (a) on his character
    - (b) of his character
    - (c) his character
    - (d) no improvement

14. Afer the letter reached me, I shall know the result.
    - (a) After the letter reaches
    - (b) After the letter will reach
    - (c) After the letter has reached
    - (d) No improvement

15. I have returned library books yesterday.
    - (a) had returned
    - (b) have had returned
    - (c) returned
    - (d) no improvement

Directions (Q. Nos. 16 to 20) *The first and the last parts of the sentence are numbered 1 to 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.*

16. 1. Early to bed, early to rise, makes a man healthy, wealthy and wise.
    - P. But for the morning tea, I had to wait for someone to get up before me.
    - Q. This saying inspired me to rise early.
    - R. That day I was the first to get up.
    - S. One day I got up early in the morning.
    - 6. Then I realised that it was a waste of time to get up early and wait for the morning tea.
    - (a) Q S R P
    - (b) Q P R S
    - (c) P Q R S
    - (d) S P Q R

17. 1. A wood-cutter was cutting a tree on a river bank.
    - P. He knelt down and prayed.
    - Q. His axe slipped and fell into the water.
    - R. God Mercury appeared before him and asked about the matter.
    - S. He could not get it back as the river was very deep.
    - 6. He dived into the water and came up with an axe of gold.
    - (a) R P Q S
    - (b) R P S Q
    - (c) Q S R P
    - (d) Q S P R

18. 1. A dog stole a piece of meat from a butcher's shop.
P. He barked in anger.
Q. He ran to the jungle with the place of meat.
R. He saw his reflection.
S. He crossed a river on the way.
6. He lost his piece of meat.
(a) Q P S R (b) Q S R P
(c) Q P R S (d) S R P Q

19. 1. Ramai and Samai were two poor young men.
P. On market day they sold their labour.
Q. They lived near Mahespu.
R. On other days, they remained in the village looking for work.
S. They wanted regular work.
6. The headman gave them two plots.
(a) Q P R S (b) R P Q S
(c) S P Q R (d) P Q R S

20. 1. Roger wanted to become a doctor.
P. He put away enough money to pay his first year fees.
Q. They could not afford the fees.
R. Undaunted, he got himself a job in the dockyard.
S. However, he came from a poor family.
6. Once enrolled, he was recognised as a gifted student, and scholarships took care of the rest of his studies.
(a) S R P Q (b) P R S Q
(c) S Q R P (d) Q R S P

Directions (Q. Nos. 21 to 25) *Out of the four alternatives, choose the one which expresses the right meaning of the given word.*

21. Dubious
(a) Doubtful (b) Disputable
(c) Duplicate (d) Dangerous

22. Flabbergasted
(a) Scared (b) Embarrassed
(c) Dumbfounded (d) Humiliated

23. Eternal
(a) Innumerable (b) Unmeasurable
(c) Prolonged (d) Perpetual

24. Genuine
(a) Authentic (b) Legitimate
(c) Reliable (d) Pure

25. Obscene
(a) Indecent (b) Incorrigible
(c) Ridiculous (d) Intolerable

Directions (Q. Nos. 26 to 30) *Choose the word opposite in meaning to the given word.*

26. Despair
(a) Belief (b) Trust
(c) Hope (d) Faith

27. In toto
(a) Bluntly (b) Partially
(c) Entirely (d) Strongly

28. Protean
(a) Amateur (b) Catholic
(c) Unchanging (d) Rapid

29. Predilection
(a) Acceptance (b) Attraction
(c) Dislike (d) Choice

30. Admonish
(a) Condemn (b) Bless
(c) Praise (d) Congratulate

Directions (Q. Nos. 31 to 35) *Sentences are given with 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.*

31. Are you really desirous .... visiting Japan?
(a) of (b) in
(c) to (d) about

32. When Indians from the South move North, they find certain aspects of life quite .... from their own.
(a) strange (b) separate
(c) different (d) divergent

33. The sky is overcast, we .... the storm will soon burst.
(a) expect (b) hope
(c) trust (d) suspect

34. Population increase .... with depletion of foreign reserves has led to great daily hardships.
(a) joined (b) mixed
(c) added (d) coupled

35. The National Anthem is .... at every official function.
(a) uttered (b) sung
(c) whispered (d) chanted

Directions (Q. Nos. 36 to 40) *Four words are given in each question, out of which only one word is wrongly spelt. Find the wrongly spelt word and indicate it in the answer sheet by blackening the appropriate rectangle.*

36. (a) Accomplice (b) Accompaniment
(c) Accomplishment (d) Accomodation

37. (a) Replaceable (b) Replaceing
(c) Replacement (d) Replaced

38. (a) Relieve (b) Protein
(c) Deceit (d) Frieght

39. (a) Labrinth (b) Laboratory
(c) Laborious (d) Library

40. (a) Comit (b) Comedian
(c) Committee (d) Comunication

Answers

Physics

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

Chemistry

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

Zoology

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

Botany

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

General English

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

Hints & Solutions

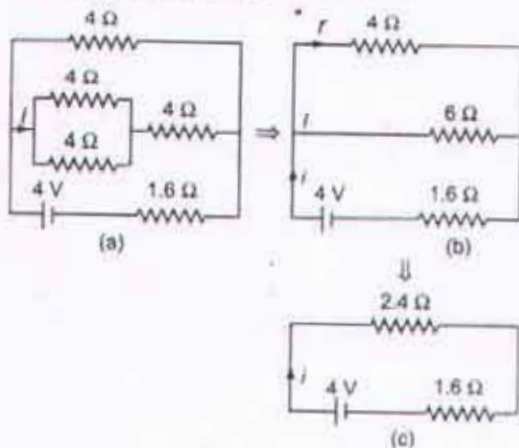## Physics

1. Resistivity, $\rho = \dfrac{m}{ne^2\tau}$

$$[\rho] = \dfrac{[M]}{[L^{-3}][AT]^2[T]}$$

$$= [ML^3A^{-2}T^{-3}]$$

So, electrical conductivity

$$\sigma = \dfrac{1}{\rho}$$

$$[\sigma] = \dfrac{1}{[\rho]} = [M^{-1}L^{-3}A^2T^3]$$

2. We can simplify the network as shown

(a) ⇒ (b)

⇓

(c)

So net resistance,

$$R = 2.4 + 1.6 = 4.0\,\Omega$$

Therefore, current from the battery,

$$i = \dfrac{V}{R} = \dfrac{4}{4} = 1\,A$$

Now from the circuit (b),

$$4I' = 6I$$

$$\Rightarrow \qquad I' = \dfrac{3}{2}I$$

But, $\quad i = I + I' = I + \dfrac{3}{2}I = \dfrac{5}{2}I$

$$1 = \dfrac{5}{2}I$$

$$\Rightarrow \qquad I = \dfrac{2}{5} = 0.4\,A$$

3. Specific charge on proton $= \left(\dfrac{e}{m}\right)_p$

$$= 9.6 \times 10^7 \ C/kg$$

Specific charge on α-particle,

$$\left(\dfrac{q}{m}\right)_\alpha = \dfrac{2e}{4m} = \dfrac{1}{2}\left(\dfrac{e}{m}\right)_p = \dfrac{1}{2} \times 9.6 \times 10^7$$

$$= 4.8 \times 10^7 \ C/kg$$

4. For first line of Lyman series,

$$n_1 = 1 \text{ and } n_2 = 2$$

$$\therefore \quad \dfrac{1}{\lambda_1} = R\left(\dfrac{1}{1^2} - \dfrac{1}{2^2}\right) = R\left(1 - \dfrac{1}{4}\right) = \dfrac{3R}{4}$$

For first line of Paschen series

$$n_1 = 3 \text{ and } n_2 = 4$$

$$\therefore \quad \dfrac{1}{\lambda_2} = R\left(\dfrac{1}{3^2} - \dfrac{1}{4^2}\right) = R\left(\dfrac{1}{9} - \dfrac{1}{16}\right)$$

$$= \dfrac{7R}{144}$$

$$\therefore \quad \dfrac{\lambda_1}{\lambda_2} = \dfrac{7R}{144} \times \dfrac{4}{3R} = \dfrac{7}{108}$$

5. $R = R_0\,e^{-\lambda t}$

$$\Rightarrow \qquad \left(\dfrac{1}{3}\right) = e^{-\lambda \times 3} = e^{-3\lambda} \qquad \qquad ...(i)$$

Again, $\dfrac{R'}{R_0} = e^{-\lambda \times 9} = e^{-9\lambda} = (e^{-3\lambda})^2$

$$= \left(\dfrac{1}{3}\right)^3 \qquad \text{[From Eq. (i)]}$$

$$= \dfrac{1}{27}$$

$$\therefore \qquad R' = \dfrac{R_0}{27}$$

Hence, in 9 days activity will become $\left(\dfrac{1}{27}\right)$ of the original value.

6. There are 4 beats between A and B, therefore the possible frequencies of A are 316 or 324 that is $(320 \pm 4)\,Hz$.
When the prong of A is filed, its frequency becomes greater than the original frequency. If we assume that original frequency of A is 324 then on filing its frequency will be greater than 324. The beats between A and B will be more than 4. But it is given that the beats are again 4, therefore, 324 is not possible.

Therefore, required frequency must be 316 Hz. (This is true, because on filing the frequency may increase so as to give 4 beats with B of frequency 320 Hz.)

7. Archimedes' upward thrust will be absent for a fluid, if there were no gravity.

8. In an AC circuit, the coil of high inductance and negligible resistance used to control current, is called the choke coil. The power factor of such a coil is given by

$$\cos\phi = \frac{R}{\sqrt{R^2 + \omega^2 L^2}}$$

$$= \frac{R}{\omega L} \qquad (as\ R << \omega L)$$

As $R << \omega L$, $\cos\phi$ is very small. Thus, the power absorbed by the coil is very small. The only loss of energy is due to hysteresis in the iron core, which is much less than the loss of energy in the resistance that can also reduce the current if placed instead of the choke coil.

10. $r = r_0\ (A)^{1/3}$

$$\therefore \quad \frac{r_1}{r_2} = \left(\frac{A_1}{A_2}\right)^{1/3} = \left(\frac{64}{125}\right)^{1/3}$$

$$= \left[\left(\frac{4}{5}\right)^3\right]^{1/3} = \frac{4}{5}$$

11. Ionization energy $= RchZ^2$

$$Z = 3\ \text{for}\ Li^{2+}$$

$$\therefore \text{Ionization energy} = (3)^2\ Rch$$

$$= 9\ Rch$$

12. Drift velocity, $v_d = \frac{I}{neA}$

$$\Rightarrow v_d = \frac{5}{(5 \times 10^{26}) \times (1.6 \times 10^{-19}) \times (4 \times 10^{-6})}$$
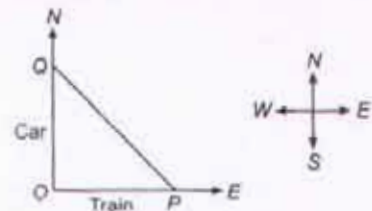
$$= \frac{1}{64} = 1.56 \times 10^{-2}\ ms^{-1}$$

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

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

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

$$\Rightarrow \qquad \theta = \sin^{-1}(0.001)$$
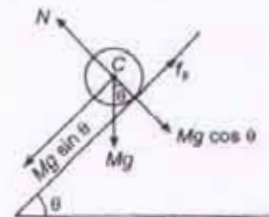
15. Laser action involves all the given phenomena
   (i) Amplification of particular frequency
   (ii) Population inversion
   (iii) Stimulated emission

16. Let O be the origin, then

passenger in the train at P observes the car at Q along direction PQ, where direction PQ is west north direction.

18. The acceleration of a body rolling down the plane $= a$.

$$\therefore \qquad a = \frac{g\sin\theta}{1 + \dfrac{K^2}{R^2}}$$

where K is radius of gyration and R the radius of sphere.

For solid sphere,

$$\frac{K^2}{R^2} = \frac{2}{5}$$

$$\therefore \qquad a = \frac{5}{7}\ g\sin\theta$$

$$= 0.7\ (g\sin\theta)$$

For hollow sphere,

$$\frac{K^2}{R^2} = \frac{2}{3}$$

$$= \frac{3}{5}\ g\sin\theta$$

$$= 0.6\ (g\sin\theta)$$

Since, acceleration of solid sphere is more than of hollow sphere, it rolls faster, and reaches the bottom of the inclined plane earlier.
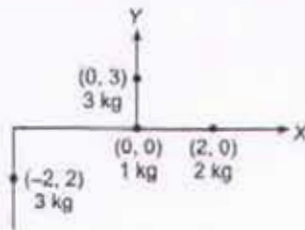
Hence, solid sphere and hollow sphere can be distinguished by rolling them simultaneously on an inclined plane.

19. Moment of inertia of the whole system about the axis of rotation will be equal to the sum of the moments of inertia of all the particles.

$$I = I_1 + I_2 + I_3 + I_4$$
$$\therefore \ I = m_1 r_1^2 + m_2 r_2^2 + m_3 r_3^2 + m_4 r_4^2$$
$$I = (1 \times 0) + (2 \times 0) + (3 \times 3^2) + 4(-2)^2$$
$$I = 0 + 0 + 27 + 16 = 43 \ \text{kg-m}^2$$

20. From the theorem of parallel axis, the moment of inertia I is equal to

$$I = I_{CM} + Ma^2$$

where I_{CM} is moment of inertia about centre of mass and a the distance of axis from centre.

$$\therefore \qquad I = MK^2 + M \times (6)^2$$
$$MK_1^2 = MK^2 + 36M$$
$$\Rightarrow \qquad K_1^2 = K^2 + 36$$
$$\Rightarrow \qquad (10)^2 = K^2 + 36$$
$$\Rightarrow \qquad K^2 = 100 - 36 = 64$$
$$\Rightarrow \qquad K = 8 \ \text{cm}$$

22. According to conservation of linear momentum,

$$m_1 v_1 = m_1 v + m_2 v_2$$

where v_1 is velocity of bullet before collision, v is velocity of bullet after the collision and v_2 is the velocity of block.

$$\therefore \qquad 0.02 \times 600 = 0.02v + 4v_2$$
Here, $\quad v_2 = \sqrt{2gh} = \sqrt{2 \times 10 \times 0.2} = 2 \ \text{m/s}$
$$\therefore \qquad 0.02 \times 600 = 0.02v + 4 \times 2$$
$$\Rightarrow \qquad 0.02v = 12 - 6$$
$$\Rightarrow \qquad v = \frac{4}{0.02} = 200 \ \text{m/s}$$

24. The efficiency of a heat engine is defined as the ratio of work done to the heat supplied, ie,

$$\eta = \frac{\text{Work done}}{\text{Heat input}} = \frac{W}{Q}$$

or $\qquad \eta = 1 - \dfrac{T_2}{T_1}$

where T_2 is temperature of sink, and T_1 is temperature of hot reservoir.

$$\therefore \qquad \frac{40}{100} = 1 - \frac{T_2}{T_1}$$
$$\Rightarrow \qquad \frac{T_2}{T_1} = 0.6$$
$$\Rightarrow \qquad T_1 = 0.6 T_1$$

Again, $\qquad \dfrac{50}{100} = 1 - \dfrac{T_2}{T_1'}$

$$\Rightarrow \qquad \frac{T_2}{T_1'} = 0.5$$
$$\Rightarrow \qquad \frac{0.6 T_1}{T_1'} = 0.5$$
$$\therefore \qquad T_1' = \frac{0.6}{0.5} T_1 = \frac{6}{5} T$$

25. Let spring is compressed by a length x.

Kinetic energy of ball
$$= \text{Potential energy of spring}$$
ie, $\qquad \dfrac{1}{2} mv^2 = \dfrac{1}{2} kx^2$

Given, $m = 2 \ \text{kg}, v = 3 \ \text{m/s}, k = 144 \ \text{N/m}$

$$\therefore \qquad \frac{1}{2} \times 2 \times (3)^2 = \frac{1}{2} \times 144 \times x^2$$
or $\qquad 9 = 72 x^2$
$$\therefore \qquad x = \sqrt{\frac{9}{72}} = \frac{1}{2\sqrt{2}} \ \text{m}$$

Hence, length of compressed spring

$$= 2 - \frac{1}{2\sqrt{2}}$$
$$= \frac{4\sqrt{2} - 1}{2\sqrt{2}}$$
$$= 1.5 \ \text{m}$$

26. Proton will represent the direction of current. So, the direction of current is vertically downward. According to Fleming's left hand rule, if middle finger represents the direction of current and fore-finger represents the direction of magnetic field then thumb will represent the direction of Lorentz force acting on the proton which deflects the proton in east direction.

27. According to Faraday's law, "the induced emf in a closed loop equals the time rate of change of magnetic flux through the loop".

i.e., $\qquad e = -\dfrac{d\phi_B}{dt}$

Hence, induced emf in a coil depends on rate of change of flux.

28. Crystal structure is explored through the diffraction of waves having a wavelength comparable with the interatomic spacing (10^{-10} m) in crystals. Radiation of longer wavelength cannot resolve the details of structure, while radiation of much shorter wavelength is diffracted through in conveniently small angles. Usually diffraction of X-rays is employed in the study of crystal structure as X-rays have wavelength comparable to interatomic spacing.

29. When light falls on a metallic surface, ejection of photoelectron results. In this process, conservation of energy holds.

Thus, from law of conservation of energy, Energy imparted by the photon

= Maximum kinetic energy of the emitted electron + work function of the metal

or $\qquad hv = (KE)_{max} + \phi$

but $\phi = hv_0$, v_0 being threshold frequency.

∴ $\qquad (KE)_{max} = hv - hv_0$

or $\qquad (KE)_{max} = v - v_0$

30. When a ray of light moves from one medium to other, its velocity changes. This change depends on refractive index of the medium.

Light travels from denser to rarer medium, ie, from medium of higher refractive index to lower refractive index. So, in second (rarer) medium, its velocity increases.

32. Given, $v = 108$ km/h $= 30$ m/s

For first equation of motion

$\qquad v = u + at$

∴ $\qquad 30 = 0 + a \times 5$ $\qquad (\because u = 0)$

or $\qquad a = 6$ m/s^2

So, distance travelled by metro train in 5 s

$$s_1 = \frac{1}{2}at^2 = \frac{1}{2} \times (6) \times (5)^2 = 75 \text{ m}$$

Distance travelled before coming to rest

$$= 45 \text{ m}$$

So, from third equation of motion

$$0^2 = (30)^2 - 2a' \times 45$$

or $\qquad a' = \dfrac{30 \times 30}{2 \times 45} = 10$ m/s^2

Time taken in travelling 45 m is

$$t_3 = \frac{30}{10} = 3 \text{ s}$$

Now, total distance $= 395$ m

ie, $\qquad 75 + s' + 45 = 395$ m

or $\qquad s' = 395 - (75 + 45) = 275$ m

∴ $\qquad t_2 = \dfrac{275}{30} = 9.2$ s

Hence, total time taken in whole journey

$$= t_1 + t_2 + t_3$$
$$= 5 + 9.2 + 3$$
$$= 17.2 \text{ s}$$

33. If we adjust the length of air-column in closed organ pipe as such its any natural frequency equals to the frequency of tuning fork, then the amplitude of forced vibrations of air-column increases very much. This is the state of resonance.

At first resonance

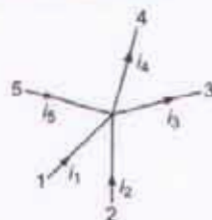$$l = \frac{\lambda}{4}$$

So, frequency of tuning fork

$$f = \frac{v}{\lambda} = \frac{v}{4l}$$

Given, $l = 20$ cm $= 0.2$ m, $v = 332$ m/s

Hence, $\qquad f = \dfrac{0.332}{4 \times 0.2} = 415$ Hz

35. Kinetic energy of an ideal gas depends only on its temperature. Hence, it remains constant whether its pressure is increased or decreased.

36. Kirchhoff's first law states that in an electric circuit, the algebraic sum of the currents meeting at any junction in the circuit is zero.

i.e., $\qquad \Sigma i = 0$

Hence, according to Kirchhoff's law

$$i_1 + i_2 = i_3 + i_4 + i_5$$

Thus, the sum of currents flowing towards the junction is equal to the sum of the currents flowing away from the junction. In other words, when a steady current flows in a circuit, then there is neither any accumulation of charge at any point in the circuit, nor any charge is removed from there. Thus, Kirchhoff's first law expresses the conservation of charge.

37. Given equation is

$$y = y_0 \sin 2\pi ft$$

where $A = y_0$, $k = \dfrac{2\pi}{\lambda}$

According to question,

$$v = 4v_p$$

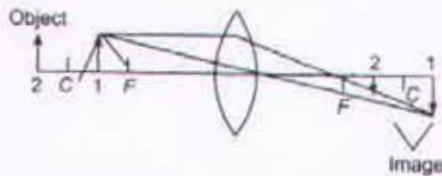$$\therefore \quad A\omega = 4\frac{\omega}{k}$$

$$\therefore \quad y_0\omega = \frac{4\omega}{k}$$

$$\Rightarrow \quad y_0 = \frac{4}{k} = \frac{4}{2\pi} \times \lambda$$

Therefore, wavelength $\lambda = \frac{\pi y_0}{2}$

38. Let as shown, 1 and 2 are positions of objects and images in two different situations.

It is given

$$\left|\frac{v_1}{u_1}\right| = 2\left|\frac{v_2}{u_2}\right|$$

Here, $u_1 = -15$ cm, $u_2 = -20$ cm

$$\therefore \quad v_1 = 2v_2 \times \frac{u_1}{u_2}$$

$$= 2v_2 \times \frac{15}{20} = \frac{3}{2}v_2$$

Now, $$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\therefore \quad \frac{1}{f} = \frac{1}{v_1} - \frac{1}{u_1}$$

and $$\frac{1}{f} = \frac{1}{v_2} - \frac{1}{u_2}$$

So, $$\frac{1}{v_1} - \frac{1}{u_1} = \frac{1}{v_2} - \frac{1}{u_2}$$

$$\Rightarrow \quad \frac{2}{3v_2} + \frac{1}{15} = \frac{1}{v_2} + \frac{1}{20}$$

$$\Rightarrow \quad v = 20 \text{ cm}$$

Chemistry

1. $[OH^-]$ in the diluted base $= \frac{10^{-6}}{10^2} = 10^{-8}$

Total $[OH^-] = 10^{-8} + [OH^-]$ of water

$$= (10^{-8} + 10^{-7}) \text{ M}$$

$$= 10^{-8}[1 + 10] \text{ M}$$

$$= 11 \times 10^{-8} \text{ M}$$

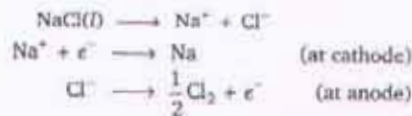$$pOH = -\log(11 \times 10^{-8})$$

$$= -\log 11 + 8\log 10$$

$$= 6.9586$$

$$pH = 14 - 6.9586$$

$$= 7.0414$$

2. Each sp^3-hybrid orbital has 25% $\left(\text{or } \frac{1}{4}\right)$ s-character

and 75% $\left(\text{or } \frac{3}{4}\right)$ p-character.

3. Leaching is a process used for concentration or benefaction of ore. In this process, a powdered ore is treated with a suitable reagent, which can selectively dissolve the ore, but not the impurities.

4. When molten or fused NaCl is electrolysed, it yields metallic sodium and gaseous chlorine. Industrially, this process is called Down's process. Reactions occurring in Down's cell are as follows

$$NaCl(l) \longrightarrow Na^+ + Cl^-$$

$$Na^+ + e^- \longrightarrow Na \quad \text{(at cathode)}$$

$$Cl^- \longrightarrow \frac{1}{2}Cl_2 + e^- \quad \text{(at anode)}$$

5. P, As and Sb form pentahalides of the general formula EX_5 (where, $E = $ P, As and Sb) due to the presence of vacant d-orbitals in their respective valence shell. N does not form pentahalides due to the absence of d-orbitals in its valence shell.

6. Red lead (minimum or sindhur), i.e., Pb_3O_4 is a red powder, insoluble in water.

7. In $CH_3^+ = lp + bp = 0 + 3 = 3$

So, the hybridisation is sp^2.

In $CH_3^- = lp + bp = 1 + 3 = 4$

So, the hybridisation is sp^3.

8. Generally weaker field ligands form outer orbital complex. Between $[Co(NH_3)_6]^{3+}$ and $[Ni(NH_3)_6]^{2+}$, the later form outer orbital complex because of its d^8 configuration. (The configuration of $Co^{3+} = d^6$)

9. Number of moles of NaOH (n)

$$= \frac{\text{weight in g}}{\text{molar mass}}$$

$$= \frac{40}{40} = 1$$

As molality of a solution is defined as the number of moles of the solute dissolved in 1000 g (1 kg) of the solvent, thus the given solution of NaOH is '1 molal' solution.

10. Molecular mass of HCl

$$= 35.5 \text{ (at. wt. of chlorine)}$$
$$+ 1 \text{ (at. wt. of hydrogen)}$$
$$= 36.5$$

As 1 mole is the amount of the substance which has mass equal to gram molecular mass.

∴ 1 mol HCl is equal to 36.5 g.

and 0.1 mole HCl is equal to 3.65 g.

11. Since, $E°$ of Cl_2 is higher than that of Br_2, therefore Cl_2 has a higher tendency to accept electrons than Br_2. Conversely, Br^- ion has a higher tendency to lose electrons than Cl^- ion. Therefore, the following reaction will occur
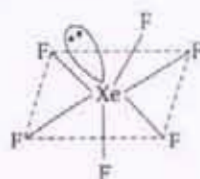
$$KBr \longrightarrow K^+ + Br^-$$
$$2Br^- + Cl_2 \longrightarrow 2Cl^- + Br_2$$

Thus, Br^- ions are oxidised to Br_2 by Cl_2, which itself is reduced to Cl^- ions.

12. The outer electronic configuration of the given ions is as
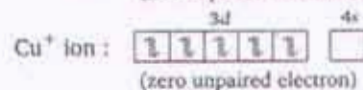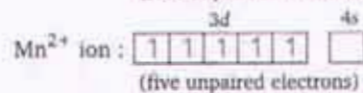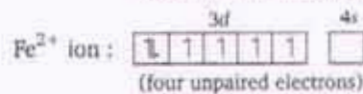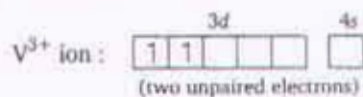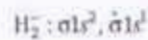

13. The geometry of XeF_6 is distorted octahedral in which all the six positions are occupied by fluorine atoms and the lone pair of electrons of Xe atom is present at the corner of one of the triangular faces.

Structure of XeF_6.

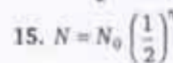14. $H_2^+ : \sigma 1s^1, \overset{*}{\sigma} 1s^0$

$$\text{Bond order} = \frac{1}{2}$$

$H_2^- : \sigma 1s^2, \overset{*}{\sigma} 1s^1$
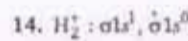
$$\text{Bond order} = \frac{2-1}{2} = \frac{1}{2}$$

The bond order of H_2^+ and H_2^- are same but H_2^+ is more stable than H_2^-. It is due to the presence of one electron in the antibonding molecular orbital in H_2^-.

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

Given,

$$N_0 = 2 \text{ g}$$
$$t_{1/2} = 15 \text{ days}$$
$$t = 60 \text{ days}$$
$$\Rightarrow \quad n = \frac{60}{15} = 4$$
$$\therefore \quad N = 2\left(\frac{1}{2}\right)^4$$

or

$$N = 0.125 \text{ g}$$

16. $A \longrightarrow B$

$$\because \quad r = k[A]^0 \quad \text{or} \quad r = k$$

This is a zero order reaction.

$$\therefore \quad t_{1/2} = \frac{a}{2k}$$

17. $\Delta G = \Delta H - T \cdot \Delta S$

For the reaction,

$$H_2O(l) \rightleftharpoons H_2O(g)$$
$$\Delta G = 0 \quad \text{(at equilibrium)}$$
$$\therefore \quad \Delta H = T \cdot \Delta S$$

18. When nitro group is present in the benzene nucleus, it withdraws electrons from o and p-positions. Thus, the electron density at the o and p-positions decreases. m-positions become positions of comparatively higher electron density and therefore, electrophilic attack occurs at m-positions.

19. The best method for the conversion of an alcohol into an alkyl chloride is by treating the alcohol with $SOCl_2$ in the presence of pyridine.
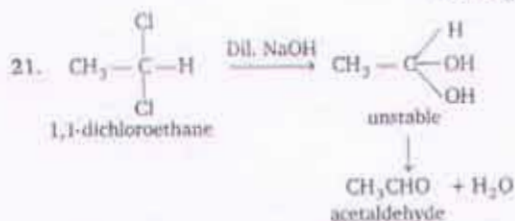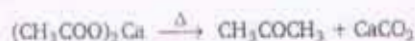
$$ROH + SOCl_2 \longrightarrow RCl + HCl + SO_2$$

The other products being gases escape leaving behind pure alkyl halide.

20. Propanal is not formed during the dry distillation of a mixture of calcium formate and calcium acetate.

$$(HCOO)_2 Ca \xrightarrow{\text{Dry distillation}} HCHO + CaCO_3$$

$(CH_3COO)_2Ca \xrightarrow{\Delta} CH_3COCH_3 + CaCO_3$

$(HCOO)_2Ca + (CH_3COO)_2Ca \xrightarrow{\Delta} 2CH_3CHO + 2CaCO_3$

21.

1,1-dichloroethane → unstable

$CH_3CHO + H_2O$
acetaldehyde

22. Ghee has least iodine value among the given options because it is the least unsaturated.

23.

2-chloro-2-methylpropane
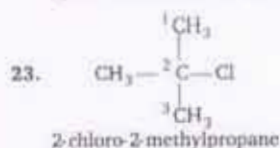
24. Proteins are the condensation polymers of α-amino acids. Proteins contain peptide

 linkages.
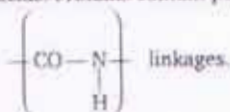
25. Potassium tetraiodo mercurate (II), i.e., $K_2[HgI_4]$ dissolves in KOH solution to give Nessler's reagent. Nessler's reagent is used to test NH_4^+ ions.

26. Argon is used in high temperature welding and other operations which require a non-oxidising atmosphere and the absence of nitrogen.

27. On the basis of hyperconjugation, stability order of different alkyl carbocations is

$3° > 2° > 1° >$ methyl

In t-butyl cation, the C-atom bearing the positive charge is attached to three methyl groups, thus it will have maximum hyperconjugate structures, which give it maximum stability.

28. Basic needs for geometrical isomerism are
(i) Presence of double bond, i.e., restricted rotation which also may be in case of single bond as in cycloalkanes.
(ii) Doubly bonded carbon atom must be linked to two different groups.

29. Only aliphatic primary amines can be prepared by Gabriel synthesis. Aniline cannot be prepared by this method because aryl halides (C_6H_5Cl or C_6H_5Br) do not undergo nucleophilic substitution with potassium phthalimide under ordinary conditions to give N-phenyl phthalimide

(i.e., cleavage of C—X bond in haloarenes is quite difficult).
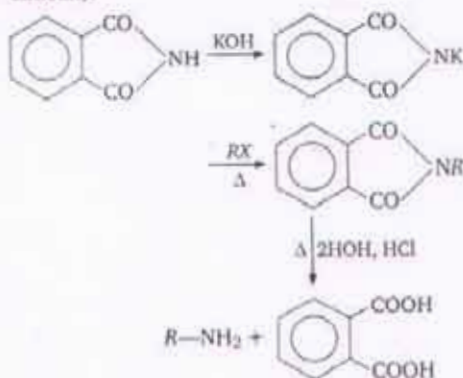
(RX = aliphatic halide)

30. Lactose (milk sugar) is a disaccharide, obtained by the condensation of one molecule of β-D-galactopyranose and one molecule of β-D-glucopyranose.

β-D-galactopyranose   β-D-glucopyranose

Lactose
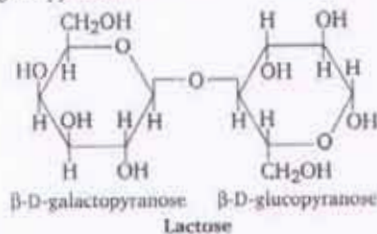
31. Cetyltrimethyl ammonium bromide which is a germicide, is a popular cationic detergent.

32. From the given data, it is clear that the atomic number, Z or number of protons of the species is 8. Number of neutrons is also 8, hence atomic mass is 16. Since, the number of electrons are two more than the number of protons, hence it is a binegative species. Thus, the species is $^{16}_{8}O^{2-}$.

33. According to Dalton's law,

$$p_{solute} = x_{solute} \times p$$

Given, mass of $N_2 = 56\,g$

$\therefore$ Moles of $N_2 (n_{N_2}) = \dfrac{56}{28} = 2\,mol$

Mass of $O_2 = 96\,g$

$\therefore$ Moles of $O_2 (n_{O_2}) = \dfrac{96}{32} = 3\,mol$

$$x_{N_2} = \frac{2}{2+3} = 0.4$$

$$x_{O_2} = \frac{3}{2+3} = 0.6$$

∴ $P_{N_2} = x_{N_2} \times p = 0.4 \times 10 = 4$ atm
$p_{O_2} = x_{O_2} \times p = 0.6 \times 10 = 6$ atm

34. It reduces iodine to iodide ion in alkaline medium.

$I_2(s) + H_2O_2(aq) + 2OH^- \longrightarrow$
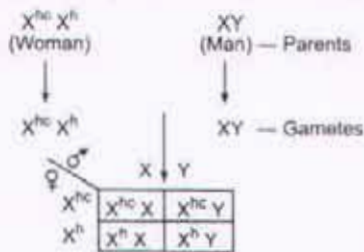
$$2I^-(aq) + 2H_2O(l) + O_2(g)$$
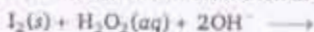
35. Alkali metals and their salts impart a characteristic colour to flame. The reason for flame colouration is that the energy of the flame causes an excitation of the outermost electrons which when return to their original position, give out the energy so absorbed in the visible region. Thus, Rb gives red-violet colour to the flame.

36. $\Delta E = q_{rev} + W_{rev}$
ΔE is a state function.

37. Actinoids exhibit variable oxidation states, which vary from $+3$ to $+7$.

38. Soap lather is an example of colloidal system foam, in which the dispersed phase is gas and dispersion medium is liquid.

39. $Ag_2CO_3(s) \rightleftharpoons 2Ag^+ + CO_3^{2-}$
$\qquad\qquad\quad 2s \qquad s$

$K_{sp} = [Ag^+]^2 [CO_3^{2-}] = (2s)^2 \cdot s$

∴ $\qquad K_{sp} = 4s^3$

40. Given, power $= 600$ W

$\lambda = 331.3$ nm $= 331.3 \times 10^{-9}$ m

$\text{Power} = \dfrac{\text{energy}}{\text{time}}$

$\qquad\quad = \dfrac{nh\nu}{t} = \dfrac{nhc}{\lambda t}$

or $\qquad n = \dfrac{\text{power} \times \lambda t}{hc}$

$\qquad\quad = \dfrac{600 \times 331.3 \times 10^{-9} \times 1}{6.626 \times 10^{-34} \times 3 \times 10^8}$

$\qquad n = 1 \times 10^{21}$

Zoology

1. **Histamine** is a potent vasodilator formed by decarboxylation of the amino acid histidine and released by mast cells in response to appropriate antigens.
Mast cells which secrete histamine are especially prevalent in the connective tissue of the skin and respiratory tract and in surrounding blood vessels.

2. The pulp cavity contains a mass of dense but soft connective tissue which is called **pulp**. A single layer of **odontoblast** cells line the pulp cavity. These cells secrete **enamel**, which is a bluish-white shiny translucent and the hardest substance of the body.

3. In addition to carbon dioxide some other gases also contribute to green-house effect. These include ozone, CFCs, nitrous oxide.

4. Oxygen diffuses from alveoli to deoxygenated blood, and carbon dioxide diffuses from deoxygenated blood to alveoli by **simple diffusion**. Diffusion is defined as, the flow of the substance (gases) from a region of their higher concentration to a region of lower concentration.

5. Carbon monoxide, when inhaled, **combines with blood haemoglobin** to form carboxyhaemoglobin at a rate 210 times faster than the rate of oxygen forms oxyhaemoglobin. Thus, respiration is impaired.

6. 1 femur + 1 fibula + 1 tibia + 1 patella + 7 tarsals + 5 metatarsals + 14 phalanges make one hind limb of man.

7. **Calcitonin** is a polypeptide hormone which **lowers calcium and phosphate levels** of plasma by inhibiting bone degradation and stimulating their uptake by bone. Parathyroid hormone elevates calcium level in blood.

8. The terms **anuria, oligonuria, polynuria** and **dysuria** are used for absence of urine, scanty urine, large amounts of urine, and painful urination respectively. Deamination is the removal of amino ($-NH_2$) group frequently from an amino acid by transaminase enzymes.

9. Solenocytes (also called **flame cells**) are meant for excretion and osmoregulation in **Platyhelminthes**. Annelids have **metanephridia** for excretion. Molluscs have **kidneys** (although different from vertebrate kidneys) for excretion.
In echinodermates, no special excretory organs are found for excretion. In them, excretion takes place through diffusion or osmosis or through active transport.

10. Haemophilia and colour blindness both are recessive X-linked traits. They express in males when present in single copy (heterozygous) but in females, they express only when present in homozygous condition.

$X^{hc} X^h$ (Woman)   XY (Man) — Parents

$X^{hc} X^h$ XY — Gametes

	X	Y
X^{hc}	$X^{hc} X$	$X^{hc} Y$
X^h	$X^h X$	$X^h Y$

Results

(a) 50% sons are colourblind and haemophilic.

(b) 50% sons are haemophilic only.

(c) 50% daughters are carrier for colour blindness and haemophilia.

(d) 50% daughters are carrier for haemophilia only.

11. A skeletal muscle consists of a bundle of long fibres running the length of the muscle. Each fibre is a single cell with many nuclei.

Skeletal muscle is also called as striated muscle because the regular arrangement of the myofilaments creates as repeating pattern of light and dark bands. Each repeating unit is a **sarcomere**, the basic functional unit of the muscle. The borders of the sarcomere, the **Z-lines** are lined up in adjacent myofibrils and contribute to the striations visible with a light microscope. The thin filaments are attached to the Z-lines and project toward the centre of the sarcomere while the thick filaments are centered in the sarcomere. At rest, the thick and thin filaments do not overlap completely, and the area near the edge of the sarcomere where there are only thin filaments is called the **I-band**. The **A-band** is the broad region that corresponds to the length of the thick filaments. The thin filaments do not extend completely across the sarcomere. So, the **H-zone** in the centre of the A-band contains only thick filaments. This arrangement of thick and thin filaments is the key to how the sarcomere and hence, the whole muscle contracts.

12. **Cholecystokinin** (also called **pancreozymin**) is a hormone of mucosa of small intestine. It is released in response to chyme. It causes pancreas to release pancreatic enzymes and gall bladder to eject bile.

13. Birds of Galapagos islands (Darwin's finches) are believed to have evolved from ancestors on the South American mainland as a result of natural selection due to different feeding niches available to them.

14. Use of contraceptive pills is a widespread form of birth control. Contraceptive pills contain oestrogen and **progesterone**. The production of the pituitary hormones FSH and LH in the normal sexual cycle of a female is shut down by these hormones. In the absence of FSH, the ovarian follicles do not ripen and ovulation does not occur in the absence of LH.

15. Medulla of brain has two regions affecting heart rate—(i) cardiac inhibitory centre, (ii) cardiac accelerator centre. Sensory nerves originating from the accelaertor centre run parallel to the spinal cord and enter the sino-artial node. Stimulation by these nerves, which are the part of sympathetic nervous system cause an increase in heart beat.

16. The middle piece of human sperm contains **mitochondria**, which are coiled around an axial filament called as mitochondrial spiral. These provide energy for the movement of sperms.

17. The term 'aquaculture' refers to the systematic method of cultivation of aquatic organisms to obtain maximum yield of best quality. It includes 'pisciculture' (fish farming) both **inland** and **marine**.

18. **Immunity** is described as an 'active immunity' when an organism's own body manufactures its own antibodies. It may be natural (developing when organism is exposed to an infectious agent) or artificial (achieved by injecting small amount of antigen called vaccine into the body of the individual).

19. **Sponges** possess an extensive system of interconnected cavities called **canal system**, which typically consists of incurrent canals, radial canals, excurrent canals and spongocoel. The system is useful for nutrition, respiration and excretion.

20. **Vagus** nerve has five branches

(i) Superior laryngeal nerve

(ii) Recurrent laryngeal nerve

(iii) Cardiac nerve

(iv) Pneumogastric nerve

(v) Depresser nerve.

21. **Landsteiner** and **Weiner** (1940) disovered Rh antigens in the rhesus monkey.

Now, it is found in most human beings. Human with this factor are said to be Rh^+ and humans without this factor are said to be Rh^-.

The problem due to Rh incompatibility arises when the blood of Rh^+ person and Rh^- women mixes up during **pregnancy** or through **blood transfusion**.

22. Beri-beri is caused by the deficiency of vitamin-B_1 (thiamine).

Vitamin-K is also known as antihaemorrhagic factor. The main sources of vitamin-K are green leafy vegetables such as cauliflower, cabbage, spinach, etc. It is also found in animal sources like egg yolk, liver, etc. Vitamin-K is essential for blood clotting and deficiency of it causes **haemorrhage**.

23. Axis vertebra possesses a peg-like structure called the odontoid process which projects forward from the centrum. It fits into the cavity of the atlas below

the ligament so that it is separated from the neural canal. Such an arrangement gives a **pivot joint** which allows head to shake (rotate from one side to the other).

24. Persons having **blood group-O** have no antigens but have both antibodies a and b in their plasma.

25. The contraction of heart depends on small cluster of specialised muscle cells which are embedded in the upper wall of the right atrium. This cluster of cells is called the **sino-atrial node** (SA-node). It automatically and rhythmically sends out impulses that initiate each heart beat.

26. The end-to-end position of the axon of one neuron and the dendrites of another neuron called the **synapse.**
Most neurons do not actually touch other neurons with which they communicate, instead there is a minute space, separating these two called the **synaptic cleft.**

27. Chondrichthyes is one of the classes of super-class–Pisces, sub-phylum–Vertebrata and phylum–Chordata. The members of class–Chondrichthyes are marine animals with streamlined body and have cartilaginous endoskeleton. Mouth is located ventrally. The skin is tough, containing minute placoid scales. The teeth aremodified placoid scales which are backwardly directed, *e.g.*, Dog fish (*Scoliodon*), saw fish (*Pristis*), great white shark (*Carcharodon*), sting ray (*Trygon*), etc.

28. The body cavity which is lined by mesoderm is called coelom. Animals possessing coelom are called coelomates, *e.g.*, annelids, molluscs, arthropods, echinoderms, hemichordates and chordates.

29. Epithelium made up of a series of layers is called stratified epithelium. The cells of each layer vary in size and shape. It is also called **laminated epithelium.** It is found in olfactory region of the nasal cavity and contains the receptors for the sense of smell.

30. Dead space is the air that is inhaled by the body in breathing but does not take part in gas exchange. In man, it is 150 mL.

31. The brain is the centre of the nervous system in all vertebrates and most invertebrate animals. The neural plate of ectoderm forms the brain, spinal cord and nerves.

32. The number of cervical vertebrae are seven in almost all mammals including human beings.

33. **Baccillus Calmette Guerin** (BCG) is the vaccine for tuberculosis. It was first used in 1921. BCG is the only vaccine available today for protection against tuberculosis. It is most effective in protecting children from the disease. BCG contains a live attenuated (weakened) strain of *Mycobacterium bovis*. This vaccine was developed by **Calmette** and **Guerin** at Pasteur Institute, Paris.

34. **Sir Godfrey Newbold Hounsfield,** an English electrical engineer who shared th 1979 Nobel Prize for Physiology or Medicine with **Allan MacLeod Cormak** for his part in developing diagnostic technique of X-ray computed tomogrpahy (CT) scanning. He died in August 2004.

35. Alcoholism is a chronic, often progressive disease in which a person craves alcohol and drinks despite repeated alcohol related problems. It involves a physical dependence on alcohol. It may lead to liver cirrhosis. Cirrhosis is build up of scar tissue that changes the structure of the liver and blocks blood flow.
Cirrhosis can cause varicose veins, which can rupture and potentially triggering internal bleeding.

36. The basic unit of classification is species. It is the lowest category of classification. It is a group of closely related individuals with similar morphological, anatomical, biochemical and cytological characters. It is a group of naturally interbreeding population with ability to produce fertile offsprings. Individuals of a species share a common gene pool. Species is reproductively isolated, thus genetically closed system. Species has the real existence in nature. The term 'species' was given by **John Ray,** an English naturalist.

37. The Devonian Perioid is known as 'the age of fishes'. It is famous for the thousands of species of fish that developed in Devonian sea. The Devonian Period of Palaeozonic Era lasted from 417 million years ago to 354 million years ago.

38. Man has only one X-chromosome that is inherited to his daughter. Therefore, a hereditary disease, which is X-chromosomal linked, is never passed on from father to son.

39. Sycon (*Scypha*) is a sponge and does not perform locomotion. It is a genus of calcareous sponges belonging to family–Scyettidae, Class–Calcaronea and phylum–Porifera. These sponges are small, growing upto 5 cm in total length, and are tube shaped and often white to cream in colour.

40. Amount of CO_2 in expired air is 4.4%. The air we breathe in contain about 0.04% CO_2. The air we breathe out contains about 4% CO_2. In other words, exhaled air contains about 100 times the concentratioon of CO_2 that inhaled air does.

Botany

1. In RNA the thymine of DNA is replaced by uracil. Codon and anticodon both found on RNA and are complementary to each other so, the codon for anticodon 3'-UUUA-5' will be 5'-AAUU-3'.

2. In genetic engineering rDNA technology is applied to several biotechnological processes for obtaining particular biochemical improvement of genetic make up of an organism and fighting genetic defects.

3. In water mercury gets changed into water soluble dimethyl form and enters the food chain accompanied by biological amplification. It develops a crippling deformity called **Minamata disease.**

4. In 1855 Rudolf Virchow extended the cell theory and stated that all cells arise from pre-existing cells, i.e., Omnis cellula e cellula.

5. The first biotic community which develops in a bare area is called pioneer community. Climax community is the stable, self perpetuating and final biotic community that develops at the end of biotic succession. The various biotic communities that develop during biotic succession are termed as seral or transitional communities.

6. According to Lindeman's law of trophic efficiency, the efficiency of energy transfer from one trophic level to next is about 10%.

7. Enzymes are proteinaceous molecules. Simple enzymes are composed of only protein, while holoenzymes are composed of protein part (apoenzyme) and non-protein part (prosthetic group).

8. Glycogenesis—conversion of sugar to glycogen. Glycogenolysis—conversion of glycogen to sugar.

9. Genes that when acting individually have a small effect but that collectively produce a significant phenotypic expression are called polygenes, e.g., inheritance of kernel colour in wheat and skin colour in human.

10. Probe are 15-30 bases long radioactive labelled oligonucleotides (RNA or DNA) used to detect complementary nucleotide sequence, used for disease diagonsis, etc.

11. Powdery mildew of wheat–Erysiphe graminis. Loose smut of wheat–Ustilago tritici. Black rust of wheat–Puccinia graminis tritici.

12. Prions are disease causing proteinaceous molecules. These lack nucleic acid and are formed due to abnormal folding of proteins.

13. The cell wall of fungi consists of fungal cellulose or chitin (a polymer of N-acetyl glucosamine).

14. Heterocysts are modified vegetative cells specified for nitrogen fixation. These are found in blue-green algae, e.g., Nostoc.

15. Double fertilization is the characteristic feature of angiosperms, e.g., Capsella. It includes fusion of one male gamete with egg and second male gamete with secondary nucleus (this forms endosperm).

16. When the stem becomes green, flattened or fleshy and carry out photosynthesis, this is called phylloclade. The short, green, cylindrical or flattened phylloclade with one or two internode is called clodode, e.g., Ruscus.

17. In catkin inflorescence the flowers are sessile and unisexual with pendulous axis, e.g., Morus (mulberry).

18. In epigynous type of flowers the thalamus enclosed the ovary entirely and fuses. The sepals, petals and stamens arise from the top of ovary. Such flowers known as epigynous and ovary as inferior, e.g., Oenothera, Cucurbita.

19. In free central placentation the syncarpous gynoecium is unilocular and the placentae are borne on a central column formed by extension of base of the gynoecium where the carpels fuse or the suppression of septa. e.g., Stellaria, Dianthus.

20. Keel is a special type of petal found in papilionaceous type of corolla. Papilionaceous type is butterfly like, the corolla has one large posterior standard, two lateral wings, two innermost and smaller keels.

21. Coffea arabica (Rubiaceae) yields the well known beverage coffee. Cinchona sp. (Rubiaceae) yields the quinine which is used in treatment of malaria.

22. Kranz anatomy is found in C_4-plants, e.g., Sorghum, Zea mays, Saccharum officinarum. It is characterised by connective, undifferentiated mesophyll around vascular bundles with chloroplast containing bundle sheath.

23. All the dead cells lying outside the phellogen constitute the bark of plant. It may include epidermis, cork, hypodermis and even part of cortex depending upon the position of origin of cork cambium or phellogen.

24. Photosystem-I is located in non-appressed part of grana and stroma lamellae. It is involved both in cyclic and non-cyclic photophosphorylation. Interrelationship of PS-I and PS-II produces ATP and $NADPH_2$.

25. In C_4-plants CO_2 combines with phosphoenol pyruvic acid to form oxaloacetic acid in mesophyll chloroplasts. It is further reduced to malic acid which is transferred to chloroplast in bundle sheath cells.

26. Nucleolus is a darkly stained granular, naked organelle with no limiting membrane. It is formed of proteinaceous part pars amorpha, fibrillar zone and granular zone of ribonucleoprotein and granules.

27. The quiescent centre is found in the centre of the root apex. Cells of this region have lower content of RNA and smaller nuclei. This represents inactive region of root apex (**Clowers;** 1958) and serves as a reserve for replenishment of damaged cells.

28. Classical example of competitive inhibition is reduction of activity of succinate dehydrogenase by malonate, oxaloacetate and other anions. In competitive inhibition, a competitive inhibitor which has the resemblance with substrate molecule, competes with the substrate for the active site of an enzyme. While the inhibitor (I) occupies the active site, it prevents binding of the substrate to the enzyme.

29. **Biological Oxygen Demand** (BOD) is a meaure of polluting organic matter present in a sample of water. BOD is higher in polluted sewage water and is connected with both microbes and organic matters. When larger amount of sewage is dumped in to water, the BOD will increase.

30. In some prokaryotes like, photosynthetic bacteria and blue-green algae possess small membrane lined chromatophores, which is similar to but chemically simpler than the chlorophyll of plants.

31. World's major producers and consumers of pollutants met at Montreal (Canada) on September 16, 1987 to solve the problem of ozone thining in stratosphere. 24 countries signed the protocol that came into force on january 1, 1989.
This protocol refers to the substances such as CFCs (chlorofluorocarbons), methane that deplete the ozone layer.

32. In most angiospermic plants, sieve tube elements of phloem, are P-proteins. Later is found in all dictos and in many monocots but it is absent in gymnosperms and cryptogams.
The main function of P-proteins is in sealing off damaged sieve elements by plugging up sieve plate pores.

33. At telophase stage, nuclear membrane vesicles associate with the surface of individual chromosomes and fuse to reform the nuclear membranes, which partially enclose clusters of chromosomes before coalescing to reform the complete nuclear envelope. During this process, the nuclear pores reassemble and (the dephosphorylated reassociate to form the nuclear lamina.) One of the lamina proteins (lamina-B) remains with the nuclear membrane fragments throughout mitosis and may help nucleate ressembly. After the nucleus reforms, the pores pump in nuclear proteins, the chromosome decondense and RNA synthesis resumes, causing the nucleolus to reappear.

34. When bacteriophage infects a bacterium, it entirely depends on the host for its multiplication. It utilises the host machinery for replication and produce a large number of progeny phage particles. The bacterium cell undergoes lysis and dies to liberate a large number of these phage particles, which are each ready to start another cycle by infecting new bacterial cell. This cycle is known as **lytic cycle.**

35. Magnesium is an important constituent of chlorophyll molecule.

36. Gibberellin helps in cell growth of stem, leaves and other aerial parts.

37. The water movs from lower DPD to higher DPD.

38. The Okazaki fragments in DNA chain growth polymerise in the 5' to 3' direction. The replicated DNA result in transcription.

39. One gene-one enzyme relationship was initially proposed by **Beadle** and **Tatum** and based on the experiments conducted on *Neurospora crassa.* They were awarded by Nobel Prize in 1958 for this achievement.

40. In gymnosperms, the pollen chamber is a cavity in the ovule in which pollen grains are stored after pollination.