1. A block is resting on a piston which is moving vertically with SHM of period 1 s. At what amplitude of motion will the block and piston separate?
   (a) 0.2 m (b) 0.25 m
   (c) 0.3 m (d) 0.35 m

2. Two simple harmonic motions are given by $x = A\sin(\omega t + \delta)$ and $y = A\sin\left(\omega t + \delta + \frac{\pi}{2}\right)$ act on a particle simultaneously, then the motion of particle will be
   (a) circular anti-clockwise
   (b) elliptical anti-clockwise
   (c) elliptical clockwise
   (d) circular clockwise

3. Two sources are at a finite distance apart. They emit sound of wavelength $\lambda$. An observer situated between them on line joining the sources, approaches towards one source with speed $u$, then the number of beats heard per second by observer will be
   (a) $\frac{2u}{\lambda}$ (b) $\frac{u}{\lambda}$
   (c) $\frac{u}{2\lambda}$ (d) $\frac{\lambda}{u}$

4. A man goes at the top of a smooth inclined plane. He releases a bag to fall freely and himself slides down on inclined plane to reach the bottom. If $u_1$ and $u_2$ are the velocities of the man and bag respectively, then
   (a) $u_1 > u_2$
   (b) $u_1 < u_2$
   (c) $u_1 = u_2$
   (d) $u_1$ and $u_2$ cannot be compared

5. Two planets $A$ and $B$ have the same material density. If the radius of $A$ is twice that of $B$, then the ratio of escape velocity $\frac{v_A}{v_B}$ is
   (a) 2 (b) $\sqrt{2}$
   (c) $\frac{1}{\sqrt{2}}$ (d) $\frac{1}{2}$

6. The given figure gives electric lines of force due to two charges $q_1$ and $q_2$. What are the signs of the two charges?


   (a) Both are negative
   (b) Both are positive
   (c) $q_1$ is positive but $q_2$ is negative
   (d) $q_1$ is negative but $q_2$ is positive

7. Three point charges $q, -2q$ and $-2q$ are placed at the vertices of an equilateral triangle of side $a$. The work done by some external force to increase their separation to $2a$ will be
   (a) negative (b) $\frac{1}{4\pi\varepsilon_0}\frac{2q^2}{a}$
   (c) $\frac{1}{4\pi\varepsilon_0}\frac{3q^2}{a}$ (d) zero

8. A radioactive element $x$ converts into another stable element $y$. Half-life of $x$ is 2 h, initially only $x$ is present. After time $t$, the ratio of atoms of $x$ and $y$ is found to be 1 : 4, then $t$ in hour is
   (a) 2 (b) 4
   (c) between 4 and 6 (d) 6

9. The shortest wavelength of the Brackett series of hydrogen like atom (atomic number = $Z$) is the same as the shortest wavelength of the Balmer series of hydrogen atom. The value of $Z$ is
   (a) 3 (b) 4 (c) 5 (d) 2

10. Radius of gyration of disc of mass 50 g and radius 2.5 cm about an axis passing through its centre of gravity and perpendicular to the plane is
(a) 6.54 cm (b) 3.64 cm
(c) 1.77 cm (d) 0.88 cm

11. Ray optics is valid, when characteristic dimensions are
(a) of the same order as the wavelength of light
(b) much smaller than the wavelength of light
(c) of the order of one millimetre
(d) much larger than the wavelength of light

12. A beam of electrons is moving with constant velocity in a region having electric and magnetic fields of strength 20 $Vm^{-1}$ and 0.5 T at right angles to the direction of motion of the electrons. What is the velocity of the electrons?
(a) 20 $ms^{-1}$ (b) 40 $ms^{-1}$
(c) 8 $ms^{-1}$ (d) 5.5 $ms^{-1}$

13. Gases begin to conduct electricity at low pressure because
(a) at low pressure, gases turn into plasma
(b) colliding electrons can acquire higher kinetic energy due to increased mean free path leading to ionisation of atoms
(c) atom breaks up into electrons and protons
(d) the electrons in atoms can move freely at low pressure

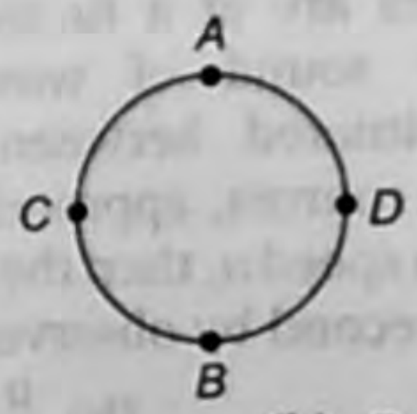
14. A light of wavelength 5890 Å falls normally on a thin air film. The minimum thickness of the film such that the film appears dark in reflected light is
(a) $2.945 \times 10^{-7}$ m
(b) $3.945 \times 10^{-7}$ m
(c) $4.95 \times 10^{-7}$ m
(d) $1.945 \times 10^{-7}$ m

15. For a black body at temperature 727°C its radiating power is 60 W and temperature of surrounding is 227°C. If the temperature of the black body is changed to 1227°C, then its radiating power will be
(a) 120 W (b) 240 W
(c) 304 W (d) 320 W

16. An object is moving through the liquid. The viscous damping force acting on it is proportional to the velocity. Then dimensional formula of constant of proportionality is
(a) $[ML^{-1}T^{-1}]$ (b) $[MLT^{-1}]$
(c) $[M^0LT^{-1}]$ (d) $[ML^0T^{-1}]$

17. A car moves on a circular road. It describes equal angles about the centre in equal intervals of time. Which of the following statements about the velocity of the car is true ?
(a) Magnitude of velocity is not constant
(b) Both magnitude and direction of velocity change
(c) Velocity is directed towards the centre of the circle
(d) Magnitude of velocity is constant but direction changes

18. A stone is attached to one end of a string and rotated in a vertical circle. If string breaks at the position of maximum tension, it will break at




(a) *A* (b) *B*
(c) *C* (d) *D*

19. A sealed container with negligible coefficient of volumetric expansion contains helium (a monoatomic gas). When it is heated from 300 K to 600 K, the average KE of helium atoms is
(a) halved
(b) unchanged
(c) doubled
(d) increased by factor $\sqrt{2}$

20. A convex lens of focal length 20 cm placed in contact with a plane mirror acts as a
(a) convex mirror of focal length 10 cm
(b) concave mirror of focal length 40 cm
(c) concave mirror of focal length 60 cm
(d) concave mirror of focal length 10 cm

**21.** A child is swinging a swing. Minimum and maximum heights of swing from earth's surface are 0.75 m and 2 m respectively. The maximum velocity of this swing is

(a) $5\ ms^{-1}$ (b) $10\ ms^{-1}$

(c) $15\ ms^{-1}$ (d) $17\ ms^{-1}$

**22.** At ordinary temperature, the molecules of an ideal gas have only translational and rotational kinetic energies. At high temperatures they may also have vibrational energy. As a result of this at higher temperatures ($C_V$ = molar heat capacity at constant volume)

(a) $C_V = \frac{3}{2}R$ for a monoatomic gas

(b) $C_V > \frac{3}{2}R$ for a monoatomic gas

(c) $C_V < \frac{5}{2}R$ for a diatomic gas

(d) $C_V = \frac{5}{2}R$ for a diatomic gas

**23.** Work done per mol in an isothermal change is

(a) $RT \log_{10} \frac{V_2}{V_1}$ (b) $RT \log_{10} \frac{V_1}{V_2}$

(c) $RT \log_e \frac{V_2}{V_1}$ (d) $RT \log_e \frac{V_1}{V_2}$

**24.** For a given plate-voltage, the plate current in a triode is maximum when the potential of

(a) the grid is positive and plate is negative

(b) the grid is positive and plate is positive

(c) the grid is zero and plate is positive

(d) the grid is negative and plate is positive

**25.** A wire is wound in the form of a solenoid of length $l$ and distance $d$. When a strong current is passed through a solenoid, there is a tendency to

(a) increase $l$ but decrease $d$

(b) keep both $l$ and $d$ constant

(c) decrease $l$ but increase $d$

(d) increase both $l$ and $d$

**26.** The seave of a galvanometer of resistance $100\ \Omega$ contains 25 divisions. It gives a deflection of one division on passing a current of $4 \times 10^{-4}$ A. The resistance in ohm to be added to it, so that it may become a voltmeter of range 2.5 V is

(a) 150 (b) 170

(c) 110 (d) 220

**27.** A train is moving with a constant speed along a circular track. The engine of the train emits a sound of frequency $f$. The frequency heard by the guard at rear end of the train is

(a) less than $f$

(b) equal to $f$

(c) is greater than $f$

(d) may be greater than, less than or equal to $f$ depending on the factors like speed of train, length of train and radius of circular track

**28.** If $\lambda_1$, $\lambda_2$ and $\lambda_3$ are the wavelengths of the waves giving resonance with the fundamental, first and second overtones respectively of a closed organ pipe. Then the ratio of wavelengths $\lambda_1 : \lambda_2 : \lambda_3$ is

(a) 1 : 3 : 5 (b) 1 : 2 : 3

(c) 5 : 3 : 1 (d) $1 : \frac{1}{3} : \frac{1}{5}$

**29.** By what percent the energy of a satellite has to be increased to shift it from an orbit of radius $r$ to $3/2\ r$ ?

(a) 15% (b) 20.3%

(c) 66.7% (d) 33.33%

**30.** The slope of plate characteristic of a vacuum diode is $2 \times 10^{-2}\ mAV^{-1}$. The plate resistance of diode will be

(a) $50\ \Omega$ (b) $50\ k\Omega$

(c) $500\ \Omega$ (d) $500\ k\Omega$

**31.** A stone is thrown vertically upwards. When stone is at a height half of its maximum height, its speed is $10\ ms^{-1}$, then the maximum height attained by the stone is ($g = 10\ ms^{-2}$)

(a) 5 m (b) 150 m

(c) 20 m (d) 10 m

**32.** Figures (1) and (2) show the displacement-time graphs of two particles moving along the $x$-axis. We can say that

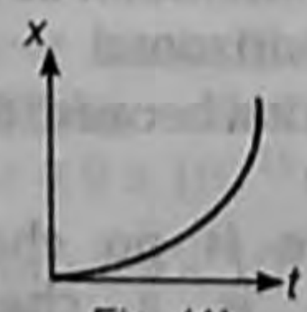


Fig. (1)

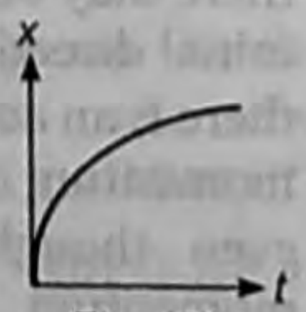


Fig. (2)

(a) both the particles are having a uniform accelerated motion
(b) both the particles are having a uniform retarted motion
(c) particle (1) is having uniform accelerated motion while particle (2) is having a uniform retarted motion
(d) particle (1) is having a uniformly retarted motion while particle (2) is having a uniformly accelerated motion

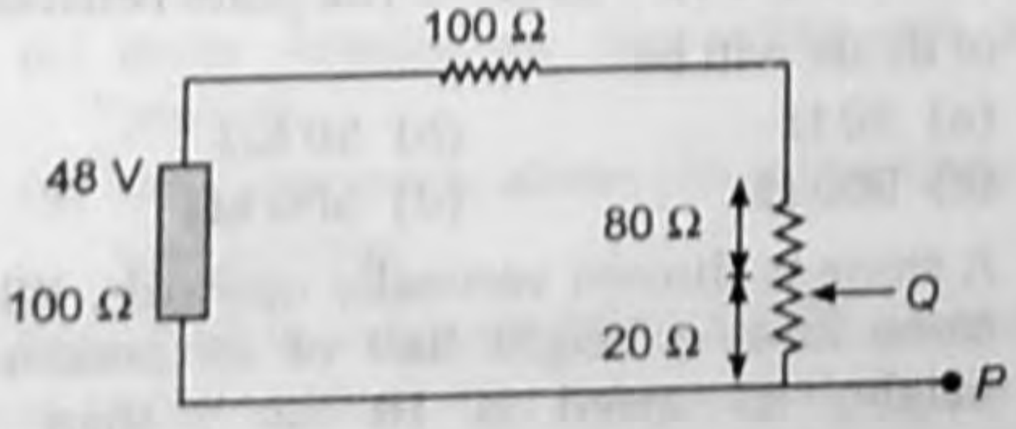
**33.** A particle of mass $m$ is executing uniform circular motion on a path of radius $r$. If $p$ is the magnitude of its linear momentum. The radial force acting on the particle is

(a) $pmr$ (b) $\frac{rm}{p}$
(c) $\frac{mp^2}{r}$ (d) $\frac{p^2}{rm}$

**34.** Water rises to a height $h$ in a capillary tube lowered vertically into a water to a depth $l$. The lower end of the tube is closed inside the water and the tube is taken out of water and opened. If $l < h$, then the length of water column remaining in the tube is

(a) zero (b) $l + h$
(c) $2h$ (d) $h$

**35.** In the circuit, the potential difference across $PQ$ will be nearest to




(a) 9.6 V (b) 6.6 V
(c) 4.8 V (d) 3.2 V

**36.** A ball hits a vertical wall horizontally at $10\ ms^{-1}$ and bounces back at $10\ ms^{-1}$, then
(a) there is no acceleration because $10\,ms^{-1} - 10\,ms^{-1} = 0$
(b) there may be an acceleration because its initial direction is horizontal
(c) there is an acceleration because there is a momentum change
(d) even though there is no change in momentum there is a change in direction. Hence it has an acceleration

**37.** Sodium and copper have work functions 2.3 eV and 4.5 eV respectively. Then the ratio of their threshold wavelengths is nearest to

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

**38.** Water flows along a horizontal pipe whose cross-section is not constant. The pressure is 1 cm of Hg where the velocity is $35\ cms^{-1}$. At a point where the velocity is $65\ cms^{-1}$, the pressure will be

(a) 0.89 cm of Hg (b) 8.9 cm of Hg
(c) 0.5 cm of Hg (d) 1 cm of Hg

**39.** In an inductor of self-inductance $L = 2$ mH, current changes with time according to relation $I = t^2 e^{-t}$. At what time emf is zero?

(a) 3 s (b) 4 s
(c) 1 s (d) 2 s

**40.** A capacitor of $10\,\mu F$ is charged to a potential 50 V with a battery. The battery is now disconnected and an additional charge $200\,\mu C$ is given to the positive plate of the capacitor. The potential difference across the capacitor will be

(a) 100 V (b) 60 V
(c) 80 V (d) 50 V

**41.** A lump of clay of mass 10 g travelling with a velocity of $10\ cms^{-1}$ towards east collides head on with another lump of clay of mass 10 g travelling with velocity of $20\ cms^{-1}$ towards west. If the two lumps coalesce after collision, what is its velocity, if no external force acts on the system?

(a) $15\ cms^{-1}$ towards west
(b) $15\ cms^{-1}$ towards east
(c) $5\ cms^{-1}$ towards west
(d) $5\ cms^{-1}$ towards east

**42.** A particle is fired with a speed of $2\ kmh^{-1}$. The speed with which it will move in intersteller space is ($v_e = 8\sqrt{2}\ kmh^{-1}$)

(a) $16.5\ kmh^{-1}$ (b) $11.2\ kmh^{-1}$
(c) $10\ kmh^{-1}$ (d) $8.8\ kmh^{-1}$

**43.** A car of mass 1500 kg is moving with a speed of $12.5\ ms^{-1}$ on a circular path of radius 20 m on a level road. The value of coefficient of friction between the tyres and road, so that the car does not slip, is

(a) 0.8 (b) 0.6
(c) 0.4 (d) 0.2

**44.** If $\vec{a}_1$ and $\vec{a}_2$ are two non-collinear unit vectors and if $|\vec{a}_1 + \vec{a}_2| = \sqrt{3}$, then the value of $(\vec{a}_1 - \vec{a}_2) \cdot (2\vec{a}_1 + \vec{a}_2)$ is

(a) 2 (b) 3/2
(c) 1/2 (d) 1

**45.** The energy of photon of light is 3 eV. Then the wavelength of photon must be

(a) 4125 nm (b) 412.5 nm
(c) 41.250 nm (d) 4 nm

**46.** The half-life of radioactive material is 3 h. If the initial amount is 300 g. Then after 18 h, it will remain

(a) 4.69 g (b) 46.8 g
(c) 9.375 g (d) 93.75 g

**47.** The wavelength of $K_a$ X-rays for lead isotopes $Pb^{208}$, $Pb^{206}$ and $Pb^{204}$ are $\lambda_1, \lambda_2$ and $\lambda_3$ respectively. Then

(a) $\lambda_1 = \lambda_2 = \lambda_3$ (b) $\lambda_1 > \lambda_2 > \lambda_3$
(c) $\lambda_1 < \lambda_2 < \lambda_3$ (d) $\lambda_1 = \lambda_2 > \lambda_3$

**48.** A wire 50 cm long and 1 $mm^2$ in cross-section carries a current of 4 A when connected to a 2 V battery. The resistivity of the wire is

(a) $2 \times 10^{-7}\ \Omega$ m (b) $5 \times 10^{-7}\ \Omega$ m
(c) $4 \times 10^{-6}\ \Omega$ m (d) $1 \times 10^{-6}\ \Omega$ m

**49.** A magnet 10 cm long and having a pole strength 2 Am is deflected through 30° from the magnetic meridian. The horizontal component of earth's induction is $0.32 \times 10^{-4}$ T, then the value of deflecting couple is

(a) $16 \times 10^{-7}$ Nm (b) $64 \times 10^{-7}$ Nm
(c) $48 \times 10^{-7}$ Nm (d) $32 \times 10^{-7}$ Nm

**50.** A closely wound flat circular coil of 25 turns of wire has diameter of 10 cm which carries current of 4 A, the flux density at the centre of a coil will be

(a) $2.28 \times 10^{-6}$ T (b) $1.679 \times 10^{-6}$ T
(c) $1.256 \times 10^{-3}$ T (d) $1.572 \times 10^{-5}$ T

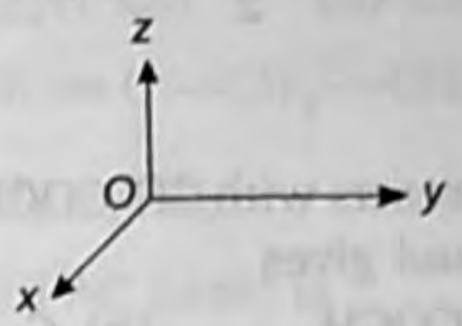
**51.** A particle of mass 100 g is thrown vertically upwards with a speed of 5 $ms^{-1}$. The work done by the force of gravity during the time the particle goes up is

(a) – 0.5 J (b) –1.25 J
(c) 1.25 J (d) 0.5 J

**52.** A mass of $M$ kg is suspended by a weightless string. The horizontal force that is required to displace it until the string makes an angle of 45° with the initial vertical direction is

(a) $Mg(\sqrt{2}+1)$ (b) $Mg\sqrt{2}$
(c) $\frac{Mg}{\sqrt{2}}$ (d) $Mg\,(\sqrt{2}-1)$

**53.** A force of $-F\,\hat{k}$ acts on $O$, the origin of the coordinate system. The torque about the point (1, – 1) is




(a) $F\,(\hat{i} - \hat{j})$ (b) $-F(\hat{i} + \hat{j})$
(c) $F(\hat{i} + \hat{j})$ (d) $-F(\hat{i} - \hat{j})$

**54.** If $M_O$ is the mass of an oxygen isotope $_8O^{17}$, $M_p$ and $M_n$ are the masses of a proton and a neutron, respectively, the nuclear binding energy of the isotope is

(a) $(M_O - 8M_p)c^2$
(b) $(M_O - 8M_p - 9M_n)c^2$
(c) $M_O c^2$
(d) $(M_O - 17M_n)c^2$

**55.** A sound absorber attenuates the sound level by 20 dB. The intensity decreases by a factor of

(a) 1000 (b) 10000
(c) 10 (d) 100

**56.** Which of the following parameters does not characterise the thermodynamic state of matter?

(a) Temperature (b) Pressure
(c) Work (d) Volume

**57.** A charged oil drop is suspended in uniform field of $3 \times 10^4$ $Vm^{-1}$, so that it neither falls nor rises. The charge on the drop will be (Take the mass of the charge $= 9.9 \times 10^{-15}$ kg and $g = 10\ ms^{-2}$)

(a) $3.3 \times 10^{-18}$ C (b) $3.2 \times 10^{-18}$ C
(c) $1.6 \times 10^{-18}$ C (d) $4.8 \times 10^{-18}$ C

58. A vertical spring with force constant $k$ is fixed on a table. A ball of mass $m$ at a height $h$ above the free upper end of the spring falls vertically on the spring, so that the spring is compressed by a distance $d$. The net work done in the process is

(a) $mg(h+d)+\frac{1}{2}kd^2$

(b) $mg(h+d)-\frac{1}{2}kd^2$

(c) $mg(h-d)-\frac{1}{2}kd^2$

(d) $mg(h-d)+\frac{1}{2}kd^2$

59. Dimensions of resistance in an electrical circuit, in terms of dimension of mass $M$, of length $L$, of time $T$ and of current $I$, would be

(a) $[ML^2T^{-3}I^{-1}]$ (b) $[ML^2T^{-2}]$

(c) $[ML^2T^{-1}I^{-1}]$ (d) $[ML^2T^{-3}I^{-2}]$

60. An alpha nucleus of energy $\frac{1}{2}mv^2$ bombards a heavy nuclear target of charge $Ze$. Then the distance of closest approach for the alpha nucleus will be proportional to

(a) $v^2$ (b) $1/m$

(c) $1/v^4$ (d) $1/Ze$

# CHEMISTRY

1. Benzene reacts with $CH_3COCl$ in the presence of $AlCl_3$ and gives

(a) $C_6H_5COCH_3$ (b) $C_6H_5CH_3$

(c) $C_6H_5OCH_3$ (d) $C_7H_{14}$

2. Lucas test is given fastly by

(a) butanol-2

(b) butanol-1

(c) *iso*-butanol

(d) 2-methyl-2-propanol

3. $NH_3$ gas is passed over heated copper oxide. It oxidises to

(a) $N_2$ (b) $NO_2$

(c) NO (d) $HNO_2$

4. Which of the following compounds shows optical isomerism?

(a) $CH_3—CH—BrCOOH$

(b) $CH_2OHCH_2—COOH$

(c) $COOHCHBr—COOH$

(d) $CH_2Br—CH_2—COOH$

5. $CH_2=CH_2 \xrightarrow{HBr} X \xrightarrow{\text{Aq. KOH}} Y \xrightarrow[I_2]{Na_2CO_3} Z$

In the above reaction sequence, $Z$ is

(a) $C_2H_5OH$ (b) $C_2H_5I$

(c) $CH_3CHO$ (d) $CHI_3$

6. $C_6H_5Cl + CH_3Cl \xrightarrow{\text{Na/dry ether}} C_6H_5CH_3 + 2NaCl$

This reaction is an example of

(a) Wurtz reaction

(b) Fittig reaction

(c) Wurtz-Fittig reaction

(d) Frankland reaction

7. The main difference between formic acid and acetic acid is that formic acid is

(a) less acidic (b) dehydrating agent

(c) reducing agent (d) bleaching agent

8. Hinsberg reagent, $C_6H_5SO_2Cl$ does not react with

(a) 1° amine (b) 2° amine

(c) 3° amine (d) $NH_3$

9. Ordinary glass is formed by mixing of

(a) $Na_2CO_3 + CaCO_3$

(b) $Na_2CO_3 + CaCO_3$ + silica

(c) silica + $Na_2CO_3$

(d) silica + borax

10. Correct order of freezing point of 1 M solution of sucrose, KCl, $BaCl_2$ and $AlCl_3$ is

(a) Sucrose > KCl > $BaCl_2$ > $AlCl_3$

(b) $AlCl_3$ > $BaCl_2$ > KCl > Sucrose

(c) $BaCl_2$ > KCl > $AlCl_3$ > Sucrose

(d) KCl > $BaCl_2$ > $AlCl_3$ > Sucrose

11. Table sugar is

(a) sucrose (b) glucose

(c) fructose (d) maltose

12. If $\frac{3}{4}$ quantity of a radioactive substance disintegrates in 60 min, its half-life period will be

(a) 15 min (b) half an hour

(c) one hour (d) one day

13. Element with atomic number 81, is present in which block?
(a) *s*-block (b) *p*-block
(c) *d*-block (d) *f*-block

14. Correct order of basic strength is
(a) $Mg(OH)_2 > NaOH > Al(OH)_3$
(b) $Mg(OH)_2 > Al(OH)_3 > NaOH$
(c) $NaOH > Mg(OH)_2 > Al(OH)_3$
(d) $Al(OH)_3 > Mg(OH)_2 > NaOH$

15. Which of the following will give carbylamine test ?
(a) N, N-dimethyl aniline
(b) 2, 4-dimethyl aniline
(c) N-methyl-2-methylaniline
(d) N-methyl benzylamine

16. Consider following reactions
$I: C(s) + \frac{1}{2}O_2(g) \longrightarrow CO(g); \Delta H_1 = a$
(b) $CO(g) + \frac{1}{2}O_2(g) \longrightarrow CO_2(g); \Delta H_2 = b$
(c) $C(s) + CO_2(g) \longrightarrow 2CO(g); \Delta H_3 = c$
Select correct statement
(a) Heat of formation of $CO_2$ is $(a + b)$
(b) Heat of combustion of C is $(a + b)$
(c) $\Delta H_3 = \Delta H_1 - \Delta H_2$
(d) All the above are correct statements

17. Following reaction is catalysed by $Br^-(aq)$.
$2H_2O_2(aq) \longrightarrow 2H_2O(l) + O_2(g)$
This is an example of
(a) homogeneous catalysis
(b) heterogeneous catalysis
(c) autocatalysis
(d) enzyme catalysis

18. Ethylidene dibromide $\xrightarrow{A}$ CH≡CH *A* is
(a) aq. KOH (b) alc. KOH
(c) conc. $H_2SO_4$ (d) All of these

19. $I_2 + 2S_2O_3^{2-} \longrightarrow S_4O_6^{2-} + 2I^-$
In the above reaction
(a) iodine is reduced; sulphur is reduced
(b) iodine is reduced; sulphur is oxidised
(c) iodine is oxidised; sulphur is reduced
(d) iodine is oxidised; sulphur is oxidised

20. Which is the strongest acid?
(a) $C_2H_6$ (b) $C_6H_6$
(c) CH≡CH (d) $CH_3OH$

21. Number of spectral lines of Lyman series of electron when it jumps from 6 to first level (in Lyman series), is
(a) 9 (b) 12
(c) 15 (d) 18

22. Which of the following compounds does liberate $CO_2$ from $NaHCO_3$?
(a) $CH_3OH$ (b) $CH_3NH_2$
(c) $(CH_3)_4N^+OH^-$ (d) $CH_3\overset{+}{N}H_3Cl^-$

23. $H_3C-CH=\underset{\displaystyle CH_3-CH_2-CH_2}{\overset{\displaystyle |}{C}}-CH_2-CH_3$
Correct IUPAC name is
(a) 3-ethylhex-2-ene
(b) 3-ethylpent-2-ene
(c) 3-ethylpent-3-ene
(d) 3-propylpent-2-ene

24. In an organic compound, C = 68.5% and H = 4.91% . Which empirical formula is correct for it?
(a) $C_6H_{10}$ (b) $C_7H_6O_2$
(c) $C_5H_8O$ (d) $C_9H_3O$

25. $E°$ for $Mg^{2+}/Mg = -2.37$ V, $Zn^{2+}/Zn = -0.76$ V and $Fe^{2+}/Fe = -0.44$ V. Which statement is correct?
(a) Zn reduces $Fe^{2+}$ (b) Zn reduces $Mg^{2+}$
(c) Mg oxidises Fe (d) Zn oxidises Fe

26. Enolic form of acetone has
(a) 8σ, 1π; 2 lone pairs
(b) 9σ, 2π; 1 lone pair
(c) 8σ, 2π; 1 lone pair
(d) 9σ, 1π; 2 lone pairs

27. 0.126 g of an acid is titrated with 0.1 N 20 mL of an base. The equivalent weight of the acid is
(a) 63 (b) 50 (c) 53 (d) 23

28. Darking of surfaces painted with white lead is due to
(a) $H_2S$ (b) $CO_2$
(c) Cu (d) $O_2$

29. Which of the following will give $H_2$ gas with dilute $HNO_3$?
(a) Mg (b) Zn
(c) Cu (d) Hg

30. When alkyl aryl ether is heated with HI, it gives
(a) alcohol and phenol
(b) alcohol and aryl halide
(c) phenol and alkyl halide
(d) alkyl halide and aryl halide

31. Which of the following is the purest commercial form of iron?
(a) Cast iron (b) Steel
(c) Wrought iron (d) Pig iron

32. What is the oxidation number of Fe in $Fe(CO)_5$?
(a) +3 (b) zero
(c) +2 (d) +5

33. Fog is a colloidal solution of
(a) gaseous particles dispersed in liquid
(b) liquid dispersed in gas
(c) gaseous particles dispersed in gas
(d) solid dispersed in gas

34. A petrol pump hose pipe for delivery of petrol is made up of
(a) natural rubber (b) vulcanised rubber
(c) neoprene (d) butadiene rubber

35. German silver is an alloy of
(a) Cu and Zn (b) Cu and Ag
(c) Cu and Sn (d) Cu, Zn and Ni

36. On increasing pressure, melting point of ice
(a) decreases
(b) increases
(c) remains unchanged
(d) changes in regular manner

37. Identify '*Z*' in the following sequence of reactions.

$$CH_3COOH \xrightarrow{NH_3} X \xrightarrow{\Delta} Y \xrightarrow{P_2O_5} Z$$

(a) $CH_4$ (b) $CH_3CHO$
(c) $CH_3CN$ (d) $CH_3COO^-NH_4^+$

38. Which of the following is the most stable carbocation?
(a) $C_6H_5CH_2^+$ (b) $CH_3CH_2^+$
(c) $(CH_3)_2\overset{+}{C}H$ (d) $(CH_3)_3C^+$

39. Dehydration of methyl alcohol with concentrated $H_2SO_4$ yields
(a) methane (b) ethane
(c) dimethyl ether (d) acetone

40. 60 mL of $\frac{N}{5}$ $H_2SO_4$, 10 mL of $\frac{N}{2}$ $HNO_3$ and 30 mL of $\frac{N}{10}$ HCl are mixed together. The strength of the resulting mixture is
(a) 0.1 N (b) 0.2 N
(c) 0.3 N (d) 0.4 N

41. A gas can be liquified
(a) at its critical temperature
(b) above its critical temperature
(c) below its critical temperature
(d) at 0°C

42. The compound that is considered as a true peroxide, is
(a) $PbO_2$ (b) $BaO_2$
(c) $MnO_2$ (d) $NO_2$

43. Which of the following oxides of nitrogen does react with $FeSO_4$ to form a brown compound in the test of nitrate?
(a) $N_2O$ (b) NO
(c) $NO_2$ (d) $N_2O_5$

44. For the equilibrium,
$2NO_2(g) \rightleftharpoons N_2O_4(g) + 14.6$ kcal,
increase in temperature
(a) favours the formation of $N_2O_4$
(b) favours the decomposition of $N_2O_4$
(c) does not affect equilibrium
(d) stop the reaction

45. A certain mass of the oxygen gas occupies 7 L volume under a pressure of 380 mm Hg. The volume of the same mass of the gas at standard pressure, with temperature remaining constant, shall be
(a) 26.60 L (b) 54.28 L
(c) 3.5 L (d) 7 L

46. Peroxide bond is absent in
(a) $(S_2O_7)^{2-}$ (b) $(S_2O_8)^{2-}$
(c) $CrO_5$ (d) $BaO_2$

47. Two acids *A* and *B* have $pK_a$ 4 and 6, then
(a) *A* is 4/6 times stronger than *B*
(b) *A* is 10 times stronger than *B*

(c) $A$ is 6/4 times stronger than $B$
(d) $B$ is 10 times stronger than $A$

**48.** Which compound is expected to be coloured?
(a) CuCl (b) $CuF_2$
(c) $Ag_2SO_4$ (d) $MgF_2$

**49.** Which compound is insoluble in dilute $HNO_3$ and dissolved in aqua regia?
(a) HgS (b) CuS
(c) $Bi_2S_3$ (d) PbS

**50.** The process of converting hydrated alumina into anhydrous alumina is called
(a) roasting (b) smelting
(c) dressing (d) calcination

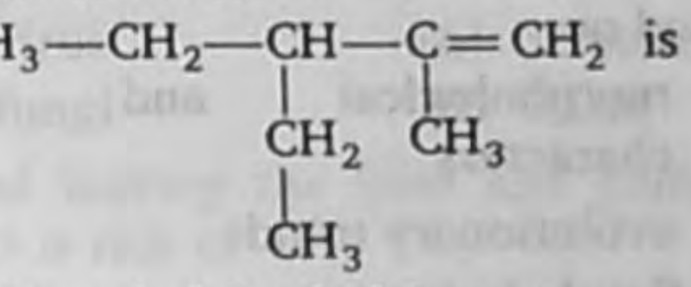
**51.** Oxidation state of oxygen in $F_2O$ is
(a) +1 (b) – 1
(c) + 2 (d) – 2

**52.** In III group precipitation, $NH_4Cl$ is added before adding $NH_4OH$ to
(a) decrease conc. of $OH^-$
(b) prevent interference of $PO_4^{3-}$
(c) increase conc. of $Cl^-$
(d) increase conc. of $OH^-$ ion

**53.** Steel is heated to below red heat and then, cooled slowly. The process refers to
(a) hardening (b) annealing
(c) tempering (d) nitriding

**54.** Which one of the following reactions is called Rosenmund reaction ?
(a) Aldehydes are reduced to alcohols
(b) Acids are converted to acid chlorides
(c) Alcohols are reduced to hydrocarbons
(d) Acid chlorides are reduced to aldehydes

**55.** IUPAC name of



(a) 2-methyl-3-ethyl-1-pentene
(b) 3-ethyl-4-methyl-4-pentene
(c) 3-ethyl-2-methyl-1-pentene
(d) 3-methyl-2-ethyl-1-pentene

**56.** Which of the following dissolves in water but does not give any oxyacid solution?
(a) $SO_2$ (b) $OF_2$
(c) $SCl_4$ (d) $SO_3$

**57.** The formula of Calgon, used for water softening is
(a) $Na_2[Na_4(PO_3)_6]$
(b) $Na_4[Na_2(PO_3)_6]$
(c) $Na_2[Na_4(PO_4)_5]$
(d) $Na_4[Na_4(PO_4)_6]$

**58.** A mixture of amylose and amylopectin is called
(a) lactose (b) starch
(c) cellulose (d) sucrose

**59.** Methyl alcohol when reacted with carbon monoxide using cobalt or rhodium as catalyst, compound '$A$' is formed. On heating '$A$' with HI in the presence of red phosphorus as catalyst '$B$' is formed. Identify '$B$'.
(a) $CH_3COOH$ (b) $CH_3 \cdot CHO$
(c) $CH_3 \cdot CH_2 \cdot I$ (d) $CH_3 \cdot CH_3$

**60.** One gas bleaches the colour of flowers by reduction and another gas by oxidation. The gases respectively are
(a) $SO_2$ and $Cl_2$ (b) CO and $Cl_2$
(c) $NH_3$ and $SO_2$ (d) $H_2S$ and $Br_2$

# BIOLOGY

**1.** The term totipotency refers to
(a) the capability of organism to regenerate its lost parts
(b) capability of somatic cells to produce complete organism
(c) the introduction of foreign gene in a cells DNA
(d) the technique of growing immature embryos

**2.** The deteriorative processes in plants, that naturally terminate their functional life, are collectively called
(a) wilting (b) abscission
(c) plasmolysis (d) sensescence

**3.** Which pigment involves in photoperiodic change in plants?
(a) Phytochrome (b) Cytochrome
(c) Chlorophyll (d) Anthocyanin

4. Linnaen system of plant classification is based on
   (a) morphological and anatomical characters
   (b) evolutionary trends
   (c) floral characters
   (d) None of the above

5. Succession on secondary base area is
   (a) primosere (b) subsere
   (c) xerosere (d) None of these

6. An unrestricted reproductive capacity is called
   (a) birth rate
   (b) biotic potential
   (c) carrying capacity
   (d) fertility

7. Alginic acid is found in the cell wall of
   (a) *Gigartina* (b) *Laminaria*
   (c) *Gelidium* (d) *Scytonema*

8. Lady finger (bhindi) belongs to
   (a) Malvaceae (b) Cruciferae
   (c) Solanaceae (d) Liliaceae

9. Ginger multiplies vegetatively by
   (a) bud (b) tuber
   (c) stem (d) rhizome

10. In *Cycas* stem, open vascular bundle is characterized by
   (a) phloem being sandwitched between xylem
   (b) cambium present in between xylem and phloem
   (c) xylem being sandwitched between phloem
   (d) xylem and phloem occurring on different radii

11. From which part of coconut coir is obtained?
   (a) Pericarp (b) Mesocarp
   (c) Epicarp (d) Endocarp

12. In *Funaria*, the stomata are found on
   (a) foot (b) seta
   (c) capsule (d) All of these

13. Tracheophyta consists of
   (a) bryophytes only
   (b) pteridophytes only
   (c) gymnosperms and angiosperms
   (d) Both (b) and (c)

14. Green-house effect is mainly caused by
   (a) *CFCs* (b) $CH_4$
   (c) $CO_2$ (d) CO

15. Male gametophyte of angiosperms is reduced to
   (a) one cell (b) two cells
   (c) three cells (d) four cells

16. In $C_3$ plants, the first stable product of photosynthesis during dark reaction is
   (a) PGAL (b) RuBP
   (c) PGA (d) OAA

17. The first $CO_2$ acceptor in $C_4$ cycle is
   (a) RuBP (b) PEP
   (c) PGA (d) OAA

18. The water available to plants for absorption is
   (a) gravitational water
   (b) hygroscopic water
   (c) capillary water
   (d) chemically bound water

19. Cell wall of fungi is made up of
   (a) fungal cellulose
   (b) hemicellulose
   (c) fungal chitin
   (d) Both 'a' and 'c'

20. During cell cycle, RNA and non-histone proteins are synthesized in
   (a) S-phase (b) $G_0$-phase
   (c) $G_2$-phase (d) M-phase

21. Bract is a modified
   (a) petal (b) sepal
   (c) leaf (d) involucre

22. Hormone replacing the requirement of vernalization is
   (a) ethylene (b) auxin
   (c) gibberellins (d) cytokinin

23. Thigmotropism is best seen in
   (a) tendrils (b) leaf apex
   (c) root apex (d) stem apex

24. Transpiration is measured by
   (a) potometrer (b) porometrer
   (c) auxanometrer (d) respirometrer

25. The most common type of ovule in angiosperms is
(a) amphitropous (b) atropous
(c) anatropous (d) circinotropous

26. When two hybrids rrTt and Rrtt are crossed, the phenotype ratio of offspring would be
(a) 3 : 1 (b) 9 : 3 : 3 : 1
(c) 1 : 1 (d) 1 : 1 : 1 : 1

27. One of the most resistant known biological material is
(a) lignin (b) hemicellulose
(c) sporopollenin (d) lignocellulose

28. Energy enters the ecosystem through
(a) herbivore (b) carnivore
(c) producer (d) decomposer

29. In soil profile, humus is present in
(a) horizon-O (b) horizon-A
(c) horizon-B (d) horizon-C

30. The smallest angiospermic flower is
(a) *Wolffia* (b) *Ranunculus*
(c) *Rafflesia* (d) *Stellaria*

31. The pyramid of energy is always
(a) opaque (b) horizontal
(c) upright (d) inverted

32. The transition zone between the two vegetations of ecosystem is called
(a) ecotone (b) ecocline
(c) ecosystem (d) ecesis

33. Thermoregulatory centre of human body is associated with
(a) cerebrum
(b) cerebellum
(c) hypothalamus
(d) medulla oblongata

34. Body cavity of adult *Ascaris* is
(a) haemocoel (b) amphicoel
(c) pseudocoel (d) schizocoel

35. Collar cells are characteristic of
(a) earthworm (b) roundworms
(c) coelenterata (d) sponges

36. In honey bee, the drones are
(a) sterile male (b) fertile male
(c) fertile female (d) sterile female

37. Plasmids are found in
(a) virus (b) bacteria
(c) fungi (d) viroid

38. Blood leaving the liver and going towards heart is rich in
(a) bile (b) urea
(c) ammonia (d) oxygen

39. Membrane that covers the vacuole in a plant cell is called
(a) tonoplast
(b) tonoplasm
(c) jacket
(d) cell membrane

40. In earthworm, gizzard is found, in which of the following segments?
(a) $9^{th}$ segment (b) $18^{th}$ segment
(c) $13^{th}$ segment (d) $16^{th}$ segment

41. The infective stage of *Entamoeba histolytica* is
(a) trophozoite stage
(b) binucleated cyst stage
(c) tetranucleated cyst stage
(d) None of the above

42. The initiation codon in eukaryotes is
(a) AUG (b) UGA
(c) UAG (d) UAA

43. The number of heart chambers found in cockroach is
(a) 4 (b) 7
(c) 5 (d) 13

44. % sign is used for
(a) actinomorphic flower
(b) zygomorphic flower
(c) incomplete flower
(d) epigynous flower

45. Nuclear membrane is continuous with
(a) rough endoplasmic reticulum
(b) smooth endoplasmic reticulum
(c) cell membrane
(d) Golgi bodies

46. XO chromosomal abnormality in humans causes
(a) Turner's syndrome
(b) Down's syndrome
(c) Darwin's syndrome
(d) Klinefelter's syndrome

47. Fertilization of ovum takes place in rabbit, man and other placental mammals in
(a) ovary
(b) fallopian tube
(c) cervix
(d) uterus

48. At what stage in test tube babies, the zygote is implanted in human female?
(a) 32-celled stage
(b) 64-celled stage
(c) 100-celled stage
(d) 164-celled stage

49. Pentoses and hexoses are common
(a) monosaccharides
(b) disaccharides
(c) polysaccharides
(d) oligosaccharides

50. Pheromone is
(a) a product of endocrine gland
(b) used for animal communication
(c) messenger RNA
(d) always protein

51. Secretion is under control of neurosecretory nerve axons in
(a) pineal gland
(b) adrenal cortex
(c) anterior pituitary
(d) posterior pituitary

52. The smallest endocrine gland is
(a) thyroid
(b) parathyroid
(c) pituitary
(d) adrenal

53. Gland responsible for calcium metabolism is
(a) thymus (b) thyroid
(c) parathyroid (d) adrenal

54. The daughter born to haemophilic father and normal mother could be
(a) normal
(b) carrier
(c) haemophilic
(d) None of the above

55. Mast cells secrete
(a) serotonin (b) heparin
(c) histamine (d) All of these

56. Role of spleen in mammal is
(a) to control blood pressure
(b) to assist liver
(c) to act as haemopoietic tissue
(d) to assist kidneys

57. Excretory product of spider is
(a) uric acid
(b) ammonia
(c) guanine
(d) None of the above

58. Green glands present in some arthropods help in
(a) respiration (b) excretion
(c) digestion (d) reproduction

59. Right lung of rabbit is divided into
(a) four lobes
(b) two lobes
(c) six lobes
(d) eight lobes

60. Haemoglobin is having maximum affinity with
(a) $CO_2$ (b) CO
(c) $O_2$ (d) $NH_3$