ROAD TO BOARD

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# Studymate Foundation Paper

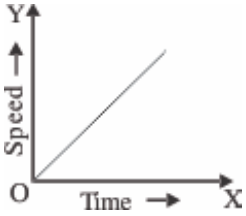
| Date : 20/01/2019<br>Duration : 90 Min.<br>Max. Marks : 90 | Physics, Chemistry & Mathematics/Biology (Set-1) | CLASS<br>XI |
|---|---|---|

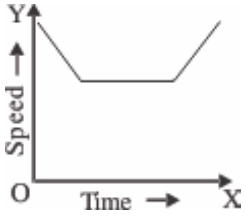
*General Instructions:*

1. All questions are compulsory.
2. Each question is allotted ONE mark for each correct response.
3. No deduction from the total score will be made if no response is indicated for the question in the answer sheet.
4. There is only **ONE** correct response for each question. Filling up **MORE THAN ONE** response in each question will be treated as wrong response.
5. The paper contains 90 questions (Physics 1-30, Chemistry 31-60, Mathematics 61-90 / Biology 61-90).
6. **NON-MEDICAL** students attempt Physics, Chemistry and Mathematics and **MEDICAL** Students attempt Physics, Chemistry and Biology.
7. Use of calculators is not allowed.

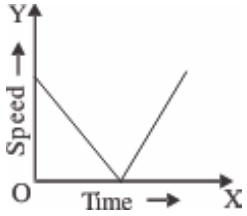
## Physics

**1.** Four speed-time graphs are given below. Which graph represents the case of a trolley decelerating to a constant speed and then accelerating uniformly.

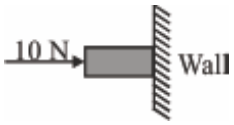
(A) 


(B) 


(C) 


(D) 


**2.** A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and wall is 0.2. The weight of the block is

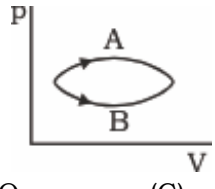



(A) 10 N (B) 50 N (C) 5 N (D) 2N

**3.** The escape velocity from a spherical planet is $v_0$. What is the escape velocity corresponding to another planet of twice the radius and half the mean density.

(A) $\sqrt{2}\, v_0$ (B) $\frac{v_0}{\sqrt{2}}$ (C) $v_0$ (D) $4\, v_0$

**4.** Figure shows two processes A and B on a system. Let $\Delta Q_1$ and $\Delta Q_2$ be the heat given to the system in processes A and B respectively. Then




(A) $\Delta Q_1 > \Delta Q_2$ (B) $\Delta Q_1 = \Delta Q_2$ (C) $\Delta Q_1 < \Delta Q_2$ (D) $\Delta Q_1 \leq \Delta Q_2$

**5.** Angular momentum vector $\vec{l}$ for a particle under projectile motion about the point of projection is

(A) constant in magnitude and direction both

(B) constant in direction, variable in magnitude

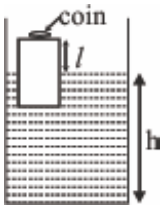
(C) constant in magnitude, variable in direction

(D) variable in magnitude and direction both

**6.** The units for $\frac{G}{g}$ will be :

(A) $m^2/kg$ (B) $kg/m$ (C) $kg/m^2$ (D) $m/kg$

**7.** A wooden block with a coin placed on its top, floats in water as shown in figure. The distances $l$ and h are shown there. After some time, the coin falls into the water. Then.




(A) $l$ decreases and h increases (B) $l$ increases and h decreases

(C) both $l$ and h decreases (D) both $l$ and h increases

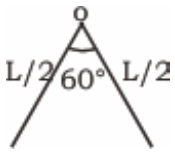
**8.** For a projectile thrown into space with a speed v, the horizontal range is $\frac{\sqrt{3}v^2}{2g}$. The vertical range is $\frac{v^2}{8g}$. The angle which the projectile makes with the horizontal initially is

(A) 15° (B) 30° (C) 45° (D) 60°

**9.** A body is moved along a straight line by a machine delivering constant power. The distance moved by the body in time t is proportional to

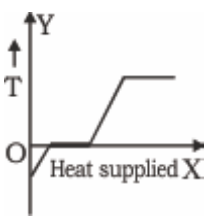
(A) $t^{1/2}$ (B) $t^{3/4}$ (C) $t^{3/2}$ (D) $t^2$

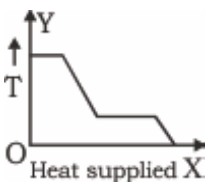
**10.** A thin rod of length L and mass M is bent at the middle point O at an angle of 60°, as shown in figure. The moment of inertia of the rod about an axis passing through O and perpendicular to the plane of the rod will be

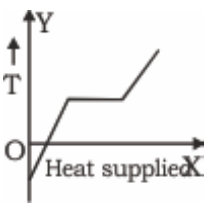


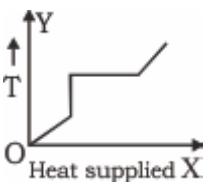

(A) $\frac{ML^2}{6}$ (B) $\frac{ML^2}{12}$ (C) $\frac{ML^2}{24}$ (D) $\frac{ML^2}{3}$

**11.** A block of ice at –10°C is slowly heated and converted to steam at 100°C. Which of the following curve represents the phenomenon qualitatively?

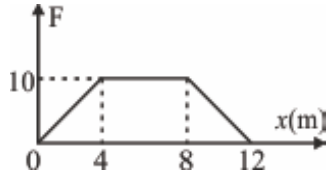
(A) 


(B) 


(C) 


(D) 

**12.** A particle of mass 0.1 kg is subjected to a force which varies with distance as shown in figure. If it starts its journey from rest at $x = 0$, its velocity at $x = 12$ m is




(A) 0 m/s (B) $20\sqrt{2}$ m/s (C) $20\sqrt{3}$ m/s (D) 40 m/s

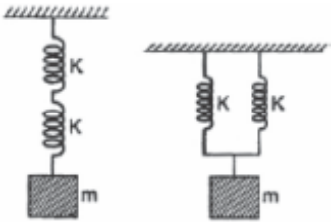
**13.** A stone is dropped into a well. If the depth of water below the top be h and velocity of sound in air be v, then the time after which splash of sound is heard is

(A) $\sqrt{\frac{2h}{g}}+\frac{h}{v}$ (B) $\sqrt{\frac{2h}{g}}-\frac{h}{v}$ (C) $\sqrt{\frac{2h}{g}}$ (D) $\sqrt{\frac{2h}{g}}\times\frac{h}{v}$

**14.** A man can swim in still water with the velocity of 5 km/h when the water of the river is flowing with the velocity of 3 km/h. In order to cross the river in shortest distance, the angle $\theta$ with the bank of the river will be

(A) $\theta = \cos^{-1}(5/3)$ (B) $\theta = \cos^{-1}\left(-\frac{3}{5}\right)$ (C) $\theta = \pi/2$ (D) $\theta = \cos^{-1}(-5/3)$

**15.** Two identical springs, each of spring constant K, are connected in series and parallel as shown in figure. A mass m is suspended from them. The ratio of their frequencies of vertical oscillations will be




(A) 2 : 1 (B) 1 : 1 (C) 1 : 2 (D) 4 : 1

**16.** A particle moves in a circular path with a uniform speed. Its motion is

(A) periodic (B) oscillatory

(C) simple harmonic (D) angular simple harmonic

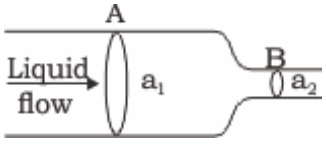
**17.** What is the % error in measurement of 'T' of a pendulum if maximum errors in measurements of length and 'g' are 2% and 4% respectively?

(A) 6% (B) 3% (C) 4% (D) 5%

**18.** The ratio of diameters of two wires of same material is n : 1. The length of each wire is 4m. On applying the same load, the increase in length of thin wire will be (n > 1)... to the length of thee thick wire.

(A) $n^2$ times (B) n times (C) 2n times (D) (2n + 1) times

**19.** A liquid flows steadily from left to right in a tube of uniform cross-section. If $a_1$ and $a_2$ are the cross-sectional areas of portions A and B of the tube, the ratio of velocities of liquid at A and B is given by




(A) $\left(\frac{a_1}{a_2}\right)^{\frac{1}{2}}$ (B) $\frac{a_1}{a_2}$ (C) $\left(\frac{a_2}{a_1}\right)^{\frac{1}{2}}$ (D) $\frac{a_2}{a_1}$

**20.** A particle performs SHM along a path, 2A = 20 cm (where A is the amplitude). If maximum velocity is 1 m/s, the time period of the particle is

(A) $2\pi$ sec (B) $\pi/2$ sec (C) $\pi/5$ sec (D) $5\pi$ sec

**21.** Two blocks of masses $m_1$ and $m_2$ are attached to the lower end of a light vertical spring of force constant k. The upper end of the spring is fixed. When the system is in equilibrium, the lower block ($m_2$) drop off. The other block ($m_1$) will

(A) Remain undisturbed

(B) Move up through a distance $\frac{mg}{k}$ and come to rest

(C) Undergo vertical SHM with a time period of $2\pi\sqrt{\frac{m_1}{k}}$

(D) Under vertical SHM with a time period $2\pi\sqrt{\frac{(m_1+m_2)}{k}}$

**22.** In stationary wave

(A) At node, strain is maximum (B) At node, velocity is maximum

(C) At antinode, strain is maximum (D) At antinode, velocity is minimum

**23.** The equation of progressive wave is $y = 0.01\sin\left(1100\pi t + \frac{10\pi x}{3}\right)$ where x is in meter and t is in second. The value of frequency is

(A) 550 Hz (B) 720 Hz (C) 310 Hz (D) None of these

**24.** Consider a two particle system with the particles having masses $m_1$ and $m_2$. If the first particle is pushed towards the centre of mass through a distance d, by what distance should the second particle be moved so as to keep the centre of mass at the same position?

(A) $\frac{m_2}{m_1}d$ (B) $\frac{m_1}{m_2}d$ (C) $\frac{m_1m_2}{d}$ (D) $\frac{(m_1+m_2)}{d}$

**25.** A non zero external force acts on a system of particles. The velocity and the acceleration of the centre of mass are found to be $v_0$ and $a_0$ at an instant t. it is possible that

(A) $v_0 = 0, a_0 = 0$ (B) $v_0 = 0, a_0 \neq 0$ (C) $v \neq 0, a \neq 0$ (D) Both (b) and (c)

**26.** When a particle moves in a circle with a uniform speed

(A) Its velocity and acceleration are both constant

(B) Its velocity is constant but the acceleration changes

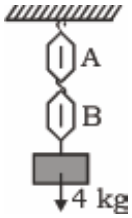
(C) Its acceleration is constant but the velocity changes

(D) Its velocity and acceleration both change

**27.** The heart is pumping blood at x kg per unit time, with constant velocity v. The force needed is

(A) x v (B) $v\frac{dx}{dt}$ (C) $x\frac{dv}{dt}$ (D) Zero

**28.** A block of mass 4 kg is suspended through two light spring balance A and B. Then A and B will read respectively, as shown in the figure.




(A) 4 kg and zero kg (B) Zero kg and 4 kg (C) 4 kg and 4 kg (D) 2 kg and 2 kg

**29.** For a given velocity, a projectile has the same range R for two angles of projection. If $t_1$ and $t_2$ are the time of flights in the two cases, then

(A) $t_1t_2 \propto \frac{1}{R^2}$ (B) $t_1t_2 \propto \frac{1}{R}$ (C) $t_1\, t_2 \propto R$ (D) $t_1\, t_2 \propto R^2$

**30.** The density of water is equal to

(A) $10^{-3}$ kg $m^{-3}$ (B) 10 kg $m^{-3}$ (C) $10^3$ kg $m^{-3}$ (D) $10^6$ kg $m^{-3}$

## Chemistry

**31.** $E^0$ values of some redox couple are given below. On the basis of these values, choose the correct option.

$E^0$ values: $Br_2/Br^- = +1.09$; $Ag^+/Ag = +0.80$; $Cu^{2+}/Cu = +0.34$; $I_2/I^- = +0.54$

(A) Cu will reduce $Br^-$ (B) Cu will reduce Ag

(C) Cu will reduce $I^-$ (D) Cu will reduce $Br_2$

**32.** Which of the following arragements represent increasing oxidation number of the central atom?

(A) $CrO_2^-$, $ClO_3^-$, $CrO_4^{2-}$, $MnO_4^-$ (B) $ClO_3^-$, $CrO_4^{2-}$, $MnO_4^-$, $CrO_2^-$

(C) $CrO_2^-$, $ClO_3^-$, $MnO_4^-$, $CrO_4^{2-}$ (D) $CrO_4^{2-}$, $MnO_4^-$, $CrO_2^-$, $ClO_3^-$

**33.** Metal hydride are ionic, covalent or molecular in nature. Among LiH, NaH, KH, RbH, CsH, the correct order of increasing ionic character is

(A) RbH < KH < CsH < NaH < LiH (B) CsH < RbH < KH < NaH < LiH

(C) LiH < KH < NaH < CsH < RbH (D) LiH < NaH < KH < RbH < CsH

**34.** Hydrogen peroxide is

(A) an oxidising agent (B) a reducing agent

(C) both an oxidising and a reducing agent (D) neither oxidising nor reducing agent

**35.** The reducing power of a metal depends on various factors. Suggest the factor which makes Li, the strongest reducing agent in aqueous solution.

(A) Sublimation enthalpy (B) Ionisation enthalpy

(C) Hydration enthalpy (D) Electron gain enthalpy

**36.** A substance which gives brick red flame and breaks down on heating to give oxygen and a brown gas is

(A) magnesium nitrate (B) calcium nitrate

(C) barium nitrate (D) strontium nitrate

**37.** Boric acid is an acid because its molecule

(A) contains replaceable $H^+$ ion (B) gives up a proton

(C) accepts $OH^-$ from water releasing proton (D) combine with protons from water molecule

**38.** The element which exists in liquid state for a wide range of temperature and can be used for measuring high temperature is

(A) B (B) Al (C) Ga (D) In

**39.** Which of the following is the correct IUPAC name?

(A) 3-Ethyl-4,4-dimethylheptane (B) 4,4-Dimethyl-3-ethylheptane

(C) 5-Ethyl-4,4-dimethylheptane (D) 4,4-Bis(methyl)-3-ethylheptane

**40.** In the hydrocarbon

$\overset{6}{CH_3}—\overset{5}{CH}=\overset{4}{CH}—\overset{3}{CH_2}—\overset{2}{C}\equiv\overset{1}{CH}$

The state of hybridisation of carbon 1, 3 and 5 are in the following sequence.

(A) sp, $sp^2$, $sp^3$ (B) $sp^3$, $sp^2$, sp (C) $sp^2$, sp, $sp^3$ (D) sp, $sp^3$, $sp^2$

**41.** Ionic species are stabilised by the dispersal of charge, which of the following carboxylate ion is the most stable?

(A) $CH_3—\overset{\overset{O}{\|}}{C}—O^-$ (B) $Cl—CH_2—\overset{\overset{O}{\|}}{C}—O^-$ (C) $F—CH_2—\overset{\overset{O}{\|}}{C}—O^-$ (D) $\begin{matrix}F\\F\end{matrix}\!\!\diagdown\!\!CH—\overset{\overset{O}{\|}}{C}—O^-$

**42.** Which of the following reactions of methane is incomplete combustion:

(A) $2CH_4(g)+O_2(g)\xrightarrow{Cu/523\ k/100\ atm}2CH_3OH(1)$

(B) $CH_4(g)+O_2(g)\xrightarrow{Mo_2O_3}HCHO(1)+H_2O(1)$

(C) $CH_4(g)+O_2(g)\longrightarrow C(s)+2H_2O(1)$

(D) $CH_4(g)+2O_2(g)\longrightarrow CO_2(g)+2H_2O(1)$

**43.** The alkene that exhibit geometrical isomerism is

(A) Propene (B) 2-Methylpropene (C) But-2-ene (D) 2-Methylbut-2-ene

**44.** In the reaction below, X is

Neopentyl alcohol $\xrightarrow{H_2SO_4}$ X

(A) 2-Methylpentane (B) 2-Methylpent-2-ene

(C) 2-Methylbut-2-ene (D) Neopentane

**45.** Which of the following gases is not a greenhouse gas?

(A) CO (B) $O_3$ (C) $CH_4$ (D) $H_2O$ vapour

**46.** Which of the following statements about photochemical smog is wrong?

(A) It has high concentration of oxidising agents.

(B) It has low concentration of oxidising agent.

(C) It can be controlled by controlling the release of $NO_2$, hydrocarbon, ozone, etc.

(D) Plantation of some plants like pinus helps in controlling photochemical smog.

**47.** If $3.01 \times 10^{20}$ molecules are removed from 98 mg of $H_2SO_4$, then the number of moles of $H_2SO_4$ left will be

(A) $0.1 \times 10^{-3}$ (B) $1.66 \times 10^{-3}$ (C) $9.05 \times 10^{-2}$ (D) $0.5 \times 10^{-3}$

**48.** How many moles of lead(II) chloride are formed from a reaction between 6.5 g of PbO are 3.2 g of HCl? [Atomic mass of Pb = 207 u]

(A) 0.011 (B) 0.029 (C) 0.044 (D) 0.333

**49.** The number of radial nodes for 3p orbital is

(A) 3 (B) 4 (C) 2 (D) 1

**50.** The pair of ions having same electronic configuration is

(A) $Cr^{3+}$, $Fe^{3+}$ (B) $Fe^{3+}$, $Mn^{2+}$ (C) $Fe^{3+}$, $Co^{3+}$ (D) $Sc^{3+}$, $Cr^{3+}$

**51.** Among halogens, the correct order of amount of energy released in electron gain enthalpy:

(A) F > Cl > Br > I (B) F < Cl < Br < I (C) F < Cl > Br > I (D) F < Cl < Br < I

**52.** Electronic configurations of four elements (i), (ii), (iii) and (iv) are given below:

(i) $1s^2\ 2s^2\ 2p^6$ (ii) $1s^2\ 2s^2\ 2p^4$ (iii) $1s^2\ 2s^2\ 2p^6\ 3s^1$ (iv) $1s^2\ 2s^2\ 2p^5$

Which of the following is the correct order of increasing tendency to gain electron:

(A) (i) < (iii) < (ii) < (iv) (B) (i) < (ii) < (iii) < (iv)

(C) (iv) < (ii) < (iii) < (i) (D) (iv) < (i) < (ii) < (iii)

**53.** The d-orbitals involved in $sp^3d$ hybridisation:

(A) $d_{x^2-y^2}$ (B) $d_{xy}$ (C) $d_{z^2}$ (D) $d_{zx}$

**54.** The hybridisation of phosphorous in $POCl_3$ is the same as

(A) P in $PCl_3$ (B) S in $SF_4$ (C) Cl in $ClF_3$ (D) B in $BCl_3$

**55.** At 27°C and under one atmosphere pressure, a gas occupies a volume of V mL. In case the temperature is increased to 177°C and pressure to 1.5 bar, the corresponding volume will be:

(A) V mL (B) 2V mL (C) V/2 mL (D) V/3 mL

**56.** The density of a gas A is twice that of gas B. Molecular mass of A is half of the molecular mass of B. The ratio of the partial pressure of A and B

(A) 1/4 (B) 1/2 (C) 4/1 (D) 2/1

**57.** The enthalpies of combustion of carbon and carbon monoxide are –393.5 kJ $mol^{-1}$ and –283 kJ $mol^{-1}$ respectively. The enthalpy of formation of carbon monoxide per mole is

(A) –676.5 kJ (B) 676.5 kJ (C) 110.5 kJ (D) –110.5 kJ

**58.** For a reaction,

$$2NH_3(g) \longrightarrow N_2(g) + 3H_2(g)$$

Which of the following statements is correct?

(A) $\Delta H = \Delta U$ (B) $\Delta H < \Delta U$ (C) $\Delta H > \Delta U$ (D) $\Delta H = O$

**59.** For the reaction

$$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$$

the value of $k_c$ at 250°C is 26 L $mol^{-1}$. The value of $k_p$ at the same temperature will be

(A) 0.61 $atm^{-1}$ (B) 0.57 $atm^{-1}$ (C) 0.83 $atm^{-1}$ (D) 0.46 $atm^{-1}$

**60.** Which is the correct representation for the solubility product constant of $Ag_2CrO_4$?

(A) $\left[Ag^+\right]^2\left[CrO_4^{2-}\right]$ (B) $\left[2Ag^+\right]\left[CrO_4^{2-}\right]$ (C) $\left[2Ag^+\right]\left[CrO_4^{2-}\right]$ (D) $\left[2Ag^+\right]^2\left[CrO_4^{2-}\right]$

# Mathematics

**61.** Each set $X_r$ contains 5 elements and each set $Y_r$ contains 2 elements and $\bigcap_{r=1}^{20} X_r = S = \bigcup_{r=1}^{n} Y_r$. If each element of S belong to exactly 10 of the $X_r$'s and to exactly 4 of the $Y_r$'s, then $n$ is

(A) 10 (B) 20 (C) 100 (D) 50

**62.** Let S = set of points inside the square, T = the set of points inside the triangle and C = the set of points inside the circle. If the triangle and circle intersect each other and are contained in a square. Then

(A) $S \cap T \cap C = \phi$ (B) $S \cup T \cup C = C$ (C) $S \cup T \cup C = S$ (D) $S \cup T = S \cap C$

**63.** Range of $f(x) = \dfrac{1}{1-2\cos x}$ is

(A) $\left[\frac{1}{3}, 1\right]$ (B) $\left[-1, \frac{1}{3}\right]$ (C) $(-\infty, -1] \cup \left[\frac{1}{3}, \infty\right)$ (D) $\left[-\frac{1}{3}, 1\right]$

**64.** The domain of the function f given by $f(x) = \dfrac{x^2 + 2x + 1}{x^2 - x - 6}$

(A) R – {3, – 2} (B) R – {–3, 2} (C) R – [3, – 2] (D) R – (3, – 2)

**65.** If $\tan\theta = \frac{1}{2}$ and $\tan\phi = \frac{1}{3}$, then the value of $\theta + \phi$ is

(A) $\frac{\pi}{6}$ (B) $\pi$ (C) 0 (D) $\frac{\pi}{4}$

**66.** The value of cos 1° cos 2° cos 3° ... cos 179° is

(A) $\frac{1}{\sqrt{2}}$ (B) 0 (C) 1 (D) –1

**67.** Which of the following is correct?

(A) sin 1° > sin 1 (B) sin 1° < sin 1 (C) sin 1° = sin 1 (D) sin 1° = $\frac{\pi}{18^\circ}$ sin 1

**68.** $\sin x + i\cos 2x$ and $\cos x - i\sin 2x$ are conjugate to each other for:

(A) $x = n\pi$ (B) $x = 0$ (C) $x = \left(n + \frac{1}{2}\right)\frac{\pi}{2}$ (D) No value of $x$

**69.** If $f(z) = \dfrac{7 - z}{1 - z^2}$, where $z = 1 + 2i$, then $|f(z)|$ is

(A) $\frac{|z|}{2}$ (B) $|z|$ (C) $2|z|$ (D) none of these.

**70.** If $\left(\dfrac{1+i}{1-i}\right)^x = 1$, then

(A) $x = 2n + 1$ (B) $x = 4n$

(C) $x = 2n$ (D) $x = 4n + 1$, where $n \in N$

**71.** If $|x + 2| \le 9$, then

(A) $x \in (-7, 11)$ (B) $x \in [-11, 7]$

(C) $x \in (-\infty, -7) \cup (11, \infty)$ (D) $x \in (-\infty, -7) \cup [11, \infty)$

**72.** The sum of the digits in unit place of all the numbers formed with the help of 3, 4, 5 and 6 taken all at a time is

(A) 432 (B) 108 (C) 36 (D) 18

**73.** The number of ways in which we can choose a committee from four men and six women so that the committee includes at least two men and exactly twice as many women as men is

(A) 94 (B) 126 (C) 128 (D) None

**74.** The two successive terms in the expansion of $(1 + x)^{24}$ whose coefficients are in the ratio 1:4 are

(A) $3^{rd}$ and $4^{th}$ (B) $4^{th}$ and $5^{th}$ (C) $5^{th}$ and $6^{th}$ (D) $6^{th}$ and $7^{th}$

**75.** The coefficient of $x^n$ in the expansion of $(1 + x)^{2n}$ and $(1 + x)^{2n-1}$ are in the ratio.

(A) 1 : 2 (B) 1 : 3 (C) 3 : 1 (D) 2 : 1

**76.** If $x, 2y, 3z$ are in A.P., where the distinct numbers x, y, z are in G.P. then the common ratio of the G.P. is

(A) 3 (B) $\frac{1}{3}$ (C) 2 (D) $\frac{1}{2}$

**77.** The third term of G.P. is 4. The product of its first 5 terms is

(A) 4 (B) $4^4$ (C) $4^5$ (D) None of these

**78.** The equations of the lines passing through the point (1, 0) and at a distance $\frac{\sqrt{3}}{2}$ from the origin, are

(A) $\sqrt{3}x + y - \sqrt{3} = 0, \sqrt{3}x - y - \sqrt{3} = 0$ (B) $\sqrt{3}x + y + \sqrt{3} = 0, \sqrt{3}x - y + \sqrt{3} = 0$

(C) $x + \sqrt{3}y - \sqrt{3} = 0, x - \sqrt{3}y - \sqrt{3} = 0$ (D) None of these.

**79.** Equations of diagonals of the square formed by the lines $x = 0$, $y = 0$, $x = 1$ and $y = 1$ are

(A) $y = x, y + x = 1$ (B) $y = x, x + y = 2$ (C) $2y = x, y + x = \frac{1}{3}$ (D) $y = 2x, y + 2x = 1$

**80.** The distance between the foci of a hyperbola is 16 and its eccentricity is $\sqrt{2}$ . Its equation is

(A) $x^2 - y^2 = 32$ (B) $\frac{x^2}{4} - \frac{y^2}{9} = 1$ (C) $2x - 3y^2 = 7$ (D) none of these

**81.** The area of the circle centred at (1, 2) and passing through (4, 6) is

(A) $5\pi$ (B) $10\pi$ (C) $25\pi$ (D) none of these

**82.** L is the foot of the perpendicular drawn from a point (3, 4, 5) on $x$-axis. The coordinates of L are

(A) (3, 0, 0) (B) (0, 4, 0) (C) (0, 0, 5) (D) none of these

**83.** $\lim_{x \to 0} \frac{\tan 2x - x}{3x - \sin x}$ is

(A) 2 (B) $\frac{1}{2}$ (C) $\frac{-1}{2}$ (D) $\frac{1}{4}$

**84.** Let $f(x) = x - [x]; \in \mathbf{R}$, then $f'\left(\frac{1}{2}\right)$ {where $[\cdot]$ shows greatest integer function}

(A) $\frac{3}{2}$ (B) 1 (C) 0 (D) $-1$

**85.** If $f(x) = 1 - x + x^2 - x^3 \ldots - x^{99} + x^{100}$, then $f'(1)$ is equal to

(A) 150 (B) –50 (C) –150 (D) 50

**86.** $\lim_{x \to 0} \frac{\sin x}{\sqrt{x+1} - \sqrt{1-x}}$ is

(A) 2 (B) 0 (C) 1 (D) –1

**87.** Let $a, b, c, d, e$ be the observations with mean $m$ and standard deviation $s$.

The standard deviation of the observations $a + k, b + k, c + k, d + k, e + k$ is

(A) $s$ (B) $k\,s$ (C) $s + k$ (D) $\frac{s}{k}$

**88.** If the probabilities for A to fail in an examination is 0.2 and that for B is 0.3, then the probability that either A or B fails is

(A) > . 5 (B) .5 (C) ≤ .5 (D) 0

**89.** The probability that at least one of the events A and B occurs is 0.6. If A and B occur simultaneously with probability 0.2, then $P(\overline{A}) + P(\overline{B})$ is

(A) 0.4 (B) 0.8 (C) 1.2 (D) 1.6

**90.** Three numbers are chosen from 1 to 20. Find the probability that they are not consecutive

(A) $\frac{186}{190}$ (B) $\frac{187}{190}$ (C) $\frac{188}{190}$ (D) $\frac{18}{{}^{20}C_3}$

**FOR MEDICAL STUDENTS ONLY**

## Biology

**61.** The receptors of steroid hormones lies

(A) In the cytoplasm (B) Within the plasma membrane

(C) Within the nuclear membrane (D) In the blood plasma

**62.** Regarding hypothalamus

(I) All vertebrate brains contain a hypothalamus

(II) One of the most important function of hypothalamus is to link the nervous system to the endocrine system via the pituitary gland.

(III) The hypothalamus controls body temperature, hunger, thirst, fatigue and circadian cycle.

Which of the following is the correct answer

(A) I, II, III are correct (B) I and II are correct

(C) I and III are correct (D) II and III are correct

**63.** In which joint the articular surfaces are molded to each other in such a manner as to permit motion only in one plane - backward and forward - the extent of motion at the same time being considerable?

(A) Gliding joint of planar joint (B) Hinge joint

(C) Pivot joint (D) Condyloid joint

**64.** Kidneys play an important role in the maintenance of concentration of various electrolytes in body fluids. Identify the electrolyte that is not primarily regulated by kidney.

(A) Phosphate (B) Potassium (C) Iron (D) Bicarbonate

**65.** The basic function of lymphatic system are

(I) Transporting interstitial fluid back to the blood.

(II) Preventing intravascular clot formation

(III) Transporting fat absorbed from the small intestine to the blood.

(IV) Providing lymphocytes to help in the defence against disease causing agents.

Which of the following is the correct answer

(A) I, II, III, IV (B) I, II, III (C) I, III, IV (D) II, III, IV

**66.** Which of the following muscular actions will bring about inspiration during pulmonary ventilation?

(A) Contraction of diaphragm and contraction of external intercostal muscles.

(B) Contraction of diaphragm and contraction of internal intercostal muscles.

(C) Contraction of diaphragm and relaxation of external intercostal muscles.

(D) Contraction of diaphragm and relaxation of internal intercostal muscles.

**67.** Bile produced in the liver is associated with which of the following

(A) Emulsification of fats into tiny globules in the small intestine.

(B) Digestive action of pancreatic amylase.

(C) Emulsification of fats into amino acids.

(D) Production of amino acids.

**68.** Large amoeboid cells, that are a part of our innate immune system, found in the areolar tissue are called as

(A) Macrophages (B) Mast cells (C) Fibroblasts (D) Adipocytes

**69.** Connecting link of Glycolysis and kreb's cycle is

(A) Oxalo acetic acid (B) Phospho enol pyruvate

(C) Acetyl's co A (D) All of the above

**70.** Which statement about photosynthesis in C4 plants is NOT true?

(A) The first product of carbon dioxide fixation is a compound with 4 carbon atoms.

(B) C4 photosynthesis is an adaptation for plants living in hot, arid climates.

(C) Carbon dioxide is initially fixed in mesophyll cells, but the Calvin cycle is active in bundle sheath cells in leaves of C4 plants.

(D) Less ATP is used overall for sugar biosynthesis in C4 than C3 plants.

**71.** A technique of growing plants without soil in which plant roots are intermittently mixed with nutrient solutions rather than being continuously immersed in solution is called

(A) Hydroponics (B) Aeroponics (C) Aquaporinics (D) Aquaporins

**72.** Turgor pressure is also referred to as

(A) Solute potential (B) Water potential

(C) Pressure potential (D) Osmotic potential

**73.** Jute of commercial importance is

(A) Primary phloem (B) Secondary phloem

(C) Secondary xylem (D) Primary xylem

**74.** Histones and non-histones are

(A) Basic proteins associated with DNA (B) Acidic proteins associated with DNA

(C) Basic proteins associated with RNA (D) Acidic proteins associated with RNA

**75.** Chiasmata formation is visible in

(A) Zygotene (B) Pachytene (C) Diplotene (D) Diakinesis

**76.** The hierarchical classification of species based on evolutionary ancestry is called as

(A) Cladistics (B) Phenetics

(C) Classical taxonomy (D) Systematics

**77.** The part of DNA molecule that varies among DNA molecules is its

(A) Glycerol attachment (B) Nitrogenous base

(C) Sugars (D) Phosphates

**78.** Transfer of genetic information through transduction involves

(A) Conjugation

(B) Bacteriophage released from donor cells

(C) Another bacterium

(D) Physical contact between donor and recipient strains

**79.** Which of the following is not a characteristic of Basidiomycetes?

(A) They are called as club fungi.

(B) Motile cells are absent

(C) Primary mycelium is diploid

(D) In secondary mycelium each cell has two nuclei.

**80.** Which of the following is not common to Funaria and Selaginella?

(A) Archegonium (B) Embryo (C) Flagellate sperms (D) Roots

**81.** Both a mouth and an anal pore (a one way digestive system) is present in

(A) Ctenophores (B) Cnidarians (C) Tapeworm (D) Planarians

**82.** According to fluid mosaic model, plasma membrane is composed of

(A) Phospholipids and oligosaccharides

(B) Phospholipids and hemicellulose

(C) Phospholipids and integral proteins

(D) Phospholipids, extrinsic proteins and intrinsic proteins

**83.** If the diploid number of chromosomes in a cell is 8, what shall be the number of chromatids in each daughter cell after meiosis I?

(A) 2 (B) 4 (C) 8 (D) 16

**84.** An essential amino acid is an amino acid that

(A) Is synthesised in the body (B) Is missing from the diet

(C) Must be provided in the diet (D) Does not exist as a zwitterion

**85.** Pneumatophores occur in plants of

(A) Sandy soil (B) Saline marshy soil

(C) Marshy soil (D) Water

**86.** An organized and differentiated cellular structure having cytoplasm but no nucleus is

(A) vessels (B) xylem parenchyma

(C) sieve tubes (D) tracheids

**87.** Though Nitrogen is not considered a true mineral, yet it is sometimes kept under the category of minerals because

(A) It occurs in abundance in atmosphere

(B) It is required in large amounts by the plants

(C) It is absorbed by plants in the form of nitrates from the soil

(D) Its deficiency cannot be cured by any other element

**88.** ATP and NADPH are converted to ADP + Pi and NADP+ during

(A) The light dependent reaction (B) The light independent reaction

(C) Both of the above (D) None of the above

**89.** Cyanide and carbon monoxide are poisons that affect oxidative phosphorylation by inhibiting:

(A) Electron transport chain

(B) Succinate dehydrogenase

(C) ATP synthesis

(D) Ionophores that disrupt the proton gradient by carrying protons across a membrane.

**90.** The digestive enzyme that is most active at pH of 2, is

(A) Salivary amylase (B) Pancreatic amylase

(C) Pepsin (D) Trypsin

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