

- 84 Dinitrogen and dihydrogen react with each other to produce ammonia according to the following chemical equation:

$$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \longrightarrow 2\text{NH}_3(\text{g})$$
 (i) Calculate the mass of ammonia produced if 2.00×10^3 g of dinitrogen reacts with 1.00×10^3 g of dihydrogen.
 (ii) Will any of the two reactants remain unreacted?
 (iii) If yes, which one and what would be its mass?
- 85 (i) State Pauli's exclusion principle.
 (ii) Account for the following:
 (a) Chromium has configuration $3d^5 4s^1$ and not $3d^4 4s^2$.
 (b) Bohr's orbits are called stationary orbits or states.
- 86 (i) Give the number of electrons in the species H_2^+ and O_2^- .
 (ii) Using *s*, *p*, *d* notations, describe the orbital with the following quantum numbers:
 (a) $n = 3, l = 1, m = 0$,
 (b) $n = 1, l = 0$
 (iii) State Heisenberg's uncertainty principle.
- 87 A photon of wavelength 4×10^{-7} m strikes on metal surface, the work function of the metal being 2.13 eV. Calculate (i) the energy of the photon (eV), (ii) the kinetic energy of the emission, and (iii) the velocity of the photoelectron. (1 eV = 1.602×10^{-19} J).
- 88 Write the complete symbol for the atom with the given atomic number (Z) and atomic mass (A).
 (i) Z = 17, A = 35 (ii) Z = 92, A = 233 (iii) Z = 4, A = 9.
- 89 Following results are observed when sodium metal is irradiated with different wavelengths. Calculate (i) threshold wavelength and (ii) Planck's constant.
- | | | | |
|---------------------------------------|------|------|------|
| λ (nm) | 500 | 450 | 400 |
| $V \times 10^5$ (m s^{-1}) | 2.55 | 4.35 | 5.20 |
- 90 Chlorophyll present in green leaves of plants absorbs light at 4.620×10^{14} Hz. Calculate the wavelength of radiation in nanometre. Which part of the electromagnetic spectrum does it belong to?
- 91 Account for the following:
 (i) Ionization enthalpy of nitrogen is more than that of oxygen.
 (ii) A cation is always smaller than its parent atom.
 (iii) Noble gases have large positive electron gain enthalpies.
- 92 (i) Arrange the following ions in the order of increasing ionic radii.
 $\text{Na}^+, \text{Mg}^{2+}, \text{F}^-, \text{O}^{2-}$
 (ii) Explain why Be has higher ionization enthalpy than B.
 (iii) Predict the formula of compound which might be formed by silicon and bromine.
- 93 Give reason for the following:

- (i) Halogens act as good oxidising agent.
- (ii) Electron gain enthalpy of noble gas is almost zero.
- (iii) Na and Mg^+ have same number of electrons but removal of electron from Mg^+ requires more energy.

- 94 (i) Which is largest in size— Cu^+ , Cu^{2+} or Cu, and why?
 (ii) Which element in periodic table has highest I.E. (ionisation energy)?
 (iii) Which element is more metallic—Mg or Al and why?

3

- 95 The first (IE_1) and second (IE_2) ionisation enthalpies (kJ mol^{-1}) of three elements I, II and III are given below:

Element	IE_1	IE_2
I	403	2640
II	549	1060
III	1142	2080

3

Identify the element which is likely to be (i) non-metal (ii) an alkali metal (iii) an alkaline earth metal.

- 96 (i) Write the resonating structures for SO_3 and NO_2 .
 (ii) Which hybrid orbitals are used by C-atoms in the following molecules:
 (a) $CH_3-CH=CH_2$
 (b) CH_3CHO
 (iii) Although geometries of NH_3 and H_2O molecules are distorted tetrahedral, bond angle in water is less than that of ammonia. Discuss.

3

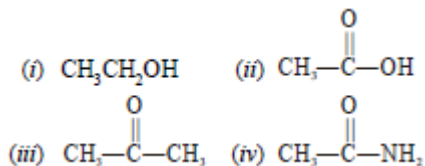
- 97 Arrange the following according to bond length and bond dissociation energy giving reasons:

- (i) $H-F$, $H-Cl$, $H-Br$, $H-I$
- (ii) $C-C$, $C=C$, $C\equiv C$
- (iii) $C-H$ bond length in CH_4 , C_2H_4 and C_2H_2

3

- 98 Which of the following substances exhibit Hbonding?

Draw the H-bonds between two molecules of the substance where appropriate.



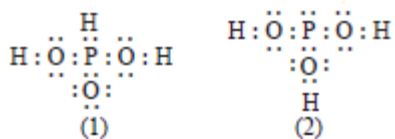
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- 99 Explain the important aspects of resonance with reference to the CO_3^{2-} ion.

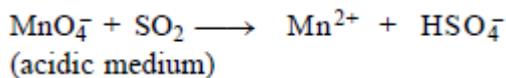
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- 100 H_3PO_3 can be represented by structures 1 and 2 shown below. Can these two structures be taken as the canonical forms of the resonance hybrid representing H_3PO_3 ? If not, give reasons for the same.

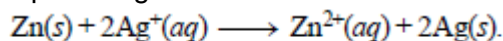
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101 (i) Balance the following redox reaction by ion-electron method.



(ii) Depict the galvanic cell in which the following reaction takes place.

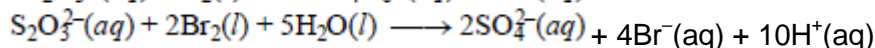
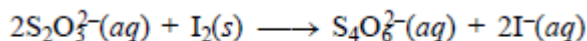


Show

- (a) which of the electrode is negatively charged?
 (b) the carrier of current in the cell.

3

102 Consider the reactions:



Why does the same reductant, thiosulphate react differently with iodine and bromine?

3

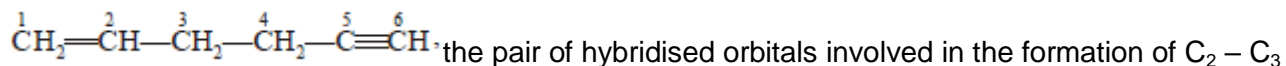
103 0.25 g of an organic compound gave 30 cm³ of moist dinitrogen at 288 K and 745 mm pressure. Calculate the percentage of nitrogen (Aq. tension at 288 K = 12.7 mm).

3

104 Discuss the principle of estimation of halogens, sulphur and phosphorus present in an organic compound.

3

105 In the organic compound:



bond is:

- (i) $sp - sp^2$ (ii) $sp - sp^3$
 (iii) $sp^2 - sp^3$ (iv) $sp^3 - sp^3$

3

106 (i) What is meant by H-bond? Explain giving example.

(ii) Why is o-nitrophenol steam volatile whereas p-nitrophenol is not steam volatile?

(iii) (a) Arrange the following in decreasing order of their bond angle:



(b) Sketch the bond moments and resultant dipole moment of the following molecule:



(c) Draw shape of the following molecules on the basis of VSEPR theory; XeF₄ and SF₄.

(At. No. of Xe = 54, At. No. of S = 16)

5

SATISH CHANDRA MEMORIAL SCHOOL

MODEL QUESTION PAPER 2019-20

PHYSICS-XI

MCQ QUESTIONS

- (1) A planet in a distant solar system is 10 times more massive than the earth and its radius is 10 times smaller. Given that the escape velocity from the earth is 11 km s^{-1} , the escape velocity from the surface of the planet would be
- (a) 1.1 km s^{-1}
 - (b) 11 km s^{-1}
 - (c) 110 km s^{-1}
 - (d) 0.11 km s^{-1}
- (2) Consider a uniform square plate of side 'a' and mass 'm'. The moment of inertia of this plate about an axis perpendicular to its plane and passing through one of its corners is
- (a) $\frac{4}{6} ma^2$
 - (b) $\frac{3}{4} ma^2$
 - (c) $\frac{2}{3} ma^2$
 - (d) $\frac{1}{5} ma^2$
- (3) A block of mass 0.50 kg is moving with a speed of 2.00 m/s on a smooth surface. It strikes another mass of 1.00 kg and then they move together as a single body. The energy loss during the collision is
- (a) 0.16 J
 - (b) 1.00 J
 - (c) 0.67 J
 - (d) 0.34 J
- (4) A particle of mass 100 g is thrown vertically upwards with a speed of 5 m/s . the work done by the force of gravity during the time the particle

goes up is

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

(5) An experiment is performed to find the refractive index of glass using a travelling microscope. In this experiment distance are measured by

- (a) a vernier scale provided on the microscope
- (b) a standard laboratory scale
- (c) a meter scale provided on the microscope
- (d) a screw gauge provided on the microscope

(6) A player caught a cricket ball of mass 150 g moving at a rate of 20 m/s. If the catching process is completed in 0.1 s, the force of the blow exerted by the ball on the hand of the player is equal to

- (a) 300 N
- (b) 150 N
- (c) 3 N
- (d) 30 N

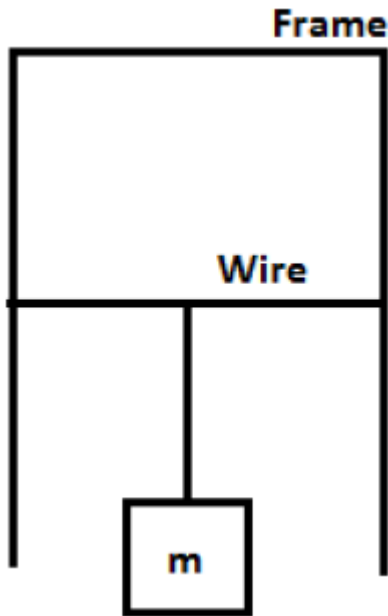
(7) The maximum velocity of a particle, executing simple harmonic motion with an amplitude 7 mm, is 4.4 m/s. The period of oscillation is

- (a) 100 s
- (b) 0.01 s
- (c) 10 s
- (d) 0.1 s

(8) A bomb of mass 16 kg at rest explodes into two pieces of masses of 4 kg and 12 kg. The velocity of the 12 kg mass is 4 ms⁻¹. The kinetic energy of the other mass is

- (a) 96 J
- (b) 144 J
- (c) 288 J
- (d) 192 J

(9) A soap film is trapped between a frame and a wire of length 10 cm as shown.



If the surface tension is given as 0.0049 N/m, what will be the value of m (in mg) such that the wire remains in equilibrium?

(10) A soap bubble of d mm diameter is observed inside a bucket of water. If the pressure inside the bubble is 0.075 N/cm^2 , what will be the value of d ? (Take surface tension as 0.075 N/m)

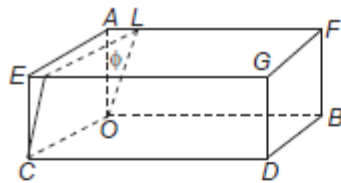
- a) 0.4
- b) 0.8
- c) 1.6
- d) 4

ANS OF MCQs

- 1. (c) 2. (c)
- 3. (c) 4. (c)
- 5. (a) 6. (d)
- 7. (b) 8. (c)
- 9. (d) 10. (b)

VERY SHORT ANSWER

vectors \vec{a} , \vec{b} and \vec{c} .



$$\begin{aligned} \text{Consider } \vec{OA} &= \vec{a} \\ \vec{OB} &= \vec{b} \\ \vec{OC} &= \vec{c} \end{aligned}$$

Then $\vec{b} \times \vec{c}$ is a vector perpendicular to the plane of \vec{b} and \vec{c} .

Let ϕ be the angle between \vec{a} and $\vec{b} \times \vec{c}$ and \hat{n} unit vector along $\vec{b} \times \vec{c}$.

$$\begin{aligned} \vec{a} \cdot (\vec{b} \times \vec{c}) &= (\text{area of parallelogram } OBDC) \\ &= \text{area of parallelogram } OBDC (\hat{n} \cdot \vec{a}) \\ &= \text{area of parallelogram } OBDC |\vec{a}| \cos \phi \end{aligned}$$

$$\begin{aligned} \text{ANS:} & \quad (\because |\hat{n}| = 1) \\ &= (\text{area of parallelogram } OBDC) (OL) \quad [\because OA \cos \phi = OL] \\ &= (\text{area of parallelogram } OBDC) \times (\text{height}) \\ &= \text{volume of parallelepiped with edges } \vec{a}, \vec{b}, \vec{c} \end{aligned}$$

2

Given $\vec{a} + \vec{b} + \vec{c} + \vec{d} = \vec{0}$. Which of the following statements are correct ?

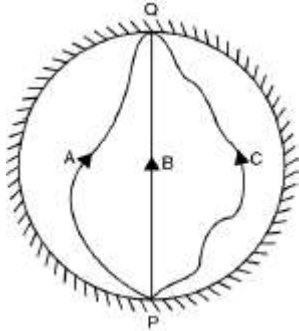
- (i) \vec{a} , \vec{b} , \vec{c} and \vec{d} must each be a null vector.
- (ii) The magnitude of $(\vec{a} + \vec{c})$ equals the magnitude of $(\vec{b} + \vec{d})$.
- (iii) The magnitude of \vec{a} can never be greater than the sum of the magnitudes of \vec{b} , \vec{c} and \vec{d} .
- (iv) $\vec{b} + \vec{c}$ must lie in the plane of \vec{a} and \vec{d} if \vec{a} , \vec{d} are not collinear, and in the line of \vec{a} and \vec{d} , if they are collinear?

ANS: (i) Incorrect, (ii) Correct, (iii) Correct, (iv) Correct.

3 What is the angular acceleration of a particle moving in a circle of radius 'r' with a angular speed 'ω' ?

ANS: Since ω is constant, angular acceleration will be zero.

4 Three girls skating on a circular ice ground of radius 200 m start from a point P on the edge of the ground and reach a point Q diametrically opposite to P following different paths shown in figure. What is the magnitude of the displacement vector for each ? For which girl is this equal to the actual length of path skated ?



ANS: Displacement of each girl = \vec{PQ}
 = Magnitude of the displacement for each girl.
 = PQ = diameter of a circular ice ground = $2 \times 200 = 400$ m
 For girl B, the magnitude of displacement is equal to the actual length of path skated.

5 Write the three laws of motion.

ANS: (i) A body at rest or uniform motion will continue to maintain the status, till an unbalanced force acts on it.
 (ii) The rate of change of momentum is a measure of the force acting on the body.

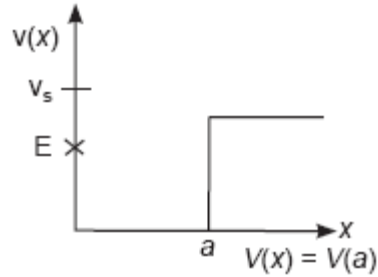
Or The total unbalanced external force acting on a body is the product of its mass and acceleration.

(iii) For every action there exists an equal and opposite reaction.

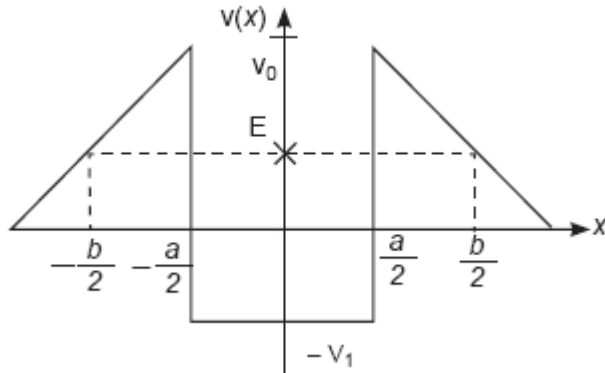
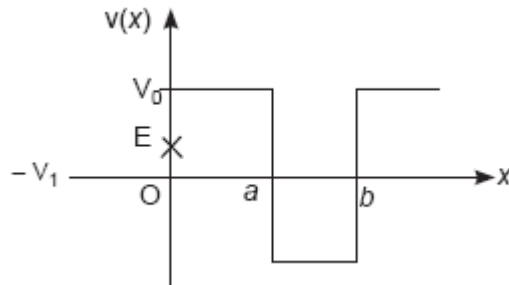
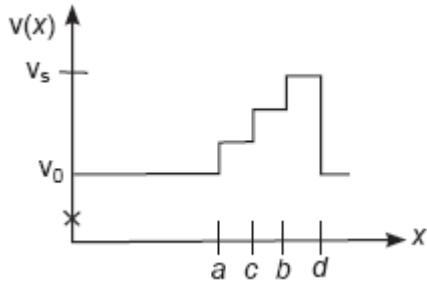
6 Why is it necessary to keep the rate of fuel consumption in a rocket constant ?

ANS: If the rate of fuel consumption is not kept the same, the energy produced every moment will be different and may lead to problem of controlling large energy or accelerating the rocket.

7 Given below are examples of some potential energy functions in one dimension. The total energy of the particle is indicated by a cross on the ordinate axis. In each case, specify the regions, if any, in which the particle cannot be found for the given energy. Also indicate the minimum total energy the particle must have in each case. Think of simple physical contexts for which these



potential energy shapes are relevant.



ANS: We know that total energy

$$E = \text{K.E.} + \text{P.E.} \text{ or } \text{K.E.} = E - \text{P.E.}$$

and K.E. can never be negative. The object cannot exist in the region, where its K.E. would become negative

(i) for $x > a$, P.E. (V_0) $> E$

\therefore K.E. becomes negative. Hence the object cannot exist in the region $x > a$.

(ii) For $x < a$ and $x > b$, P.E. (V_0) $> E$.

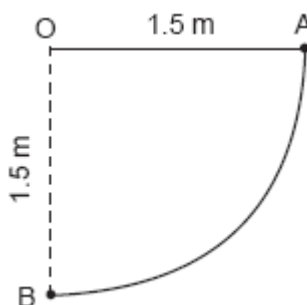
\therefore K.E. becomes negative. Hence the object cannot be present in the region $x < a$ and $x > b$.

(iii) Object cannot exist in any region because P.E. (V_0) $> E$ in energy region.

(iv) On the same basis, the object cannot exist in the region $-b < x < -a$ and $a < x < b$.

8

The bob of a pendulum is released from a horizontal A as shown. If the length of the pendulum is 1.5 m, what is the speed with which the bob arrives at the lowermost point B, given that it dissipates 5% of its initial energy against air resistance ?



Gravitational potential energy at A

$$= mg \times 1.5 \text{ J}$$

Kinetic energy at B

$$= \left[mg \times 1.5 - \frac{5}{100} \times mg \times 1.5 \right] \text{ J}$$

$$= mg \times 1.5 \times \frac{95}{100} \text{ J}$$

\therefore (P.E.)_A = (K.E.)_B and 5% of initial energy is dissipated against air resistance.

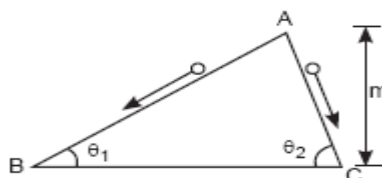
$$\therefore mv^2 = mg \times 1.5 \times \frac{95}{100}$$

$$\text{or } v^2 = \frac{2 \times 9.8 \times 1.5 \times 95}{100}$$

ANS: or $v = 5.285 \text{ ms}^{-1}$

9

Two inclined frictionless tracks, one gradual and the other steep, meet at A from where two stones are allowed to slide down from rest, one on each track. Will the stones reach the bottom at the same time? Will they reach there with the same speed? Explain. Given $\theta_1 = 30^\circ$, $\theta_2 = 60^\circ$ and $h = 10 \text{ m}$, what are the speeds and times taken by the two stones?



ANS: AB, AC \Rightarrow two smooth planes inclined to the horizontal at $\angle\theta_1$ and $\angle\theta_2$ respectively. As the height of both the planes is the same,

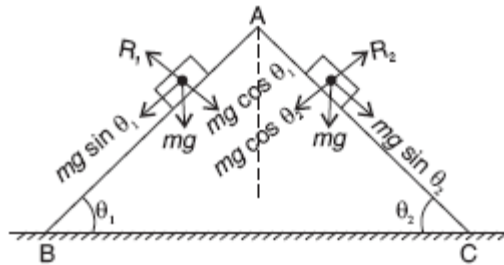
\therefore both the stones will reach the bottom with same speed.

SHORT ANSWER TYPE

$$\therefore \text{P.E} = \text{K.E}$$

$$mgh = \frac{1}{2}mv_1^2 = \frac{1}{2}mv_2^2$$

$$v_1 = v_2$$



from figure acceleration of two blocks are
 $a_1 = g \sin \theta_1$, and $a_2 = g \sin \theta_2$

as $\theta_2 > \theta_1 \therefore a_2 > a_1$

from $v = u + at = 0 + at$ or $t = \frac{v}{a}$

as $t \propto \frac{1}{a}$ and $a_2 > a_1$

$\therefore t_2 < t_1$

i.e. second stone will take lesser time and reach the

bottom earlier than first stone.

10

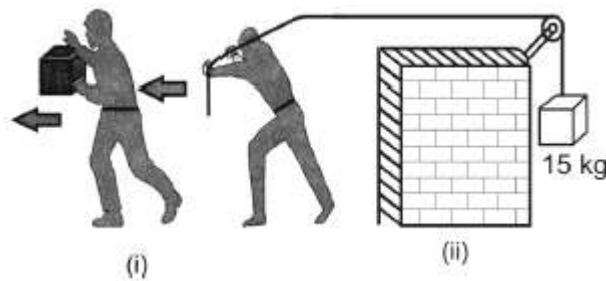
Answer the following :

(a) The casing of a rocket in flight burns up due to friction. At whose expense is the heat energy required for burning obtained-the rocket or the atmosphere ?

(b) Comets move around the sun in highly elliptical orbits. The gravitational force on the comet due to the sun is not normal to the comet's velocity in general, yet the work done by the gravitational force over every complete orbit of the comet is zero. Why ?

(c) An artificial satellite orbiting the earth in very thin atmosphere loses its energy gradually due to dissipation against atmospheric resistance, however small. Why then does its speed increase progressively as it comes closer and closer to the earth ?

(d) In Fig. (i), the man walks 2 m carrying a mass of 15 kg on his hands. In Fig. (ii), he walks the same distance pulling the rope behind him. The rope goes over a pulley, and mass of 15 kg hangs at its other end. In which case is the work done greater ?



ANS: (a) Friction due to atmosphere, brings burning of the rockets mass. The drop in mass of the rocket is the cause for loss of energy.

(b) Force is perpendicular to displacement at any point of time.

(c) Drop in P.E., rise in K.E. and drop in total energy is seen. The loss is due to friction.

(d) Against gravitational force work done in first case is zero and in second case is $15 \times g \times 2 = 300$ joule.

So more in II case only.

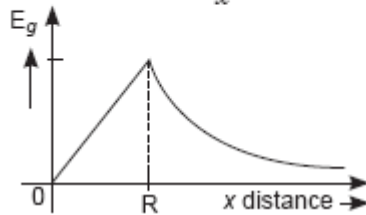
- 11 If suddenly the gravitational force of attraction between the earth and a satellite revolving around it becomes zero, what will happen to the satellite ?

ANS: Satellite will move tangentially with constant speed equal to its orbital velocity at the time the force ceases to act.

- 12 Show graphically how gravitational field strength varies with distance from the centre of earth, outwards. Give the relation also.

For points inside the earth,

$$E_{gi} = \frac{G \frac{4}{3} \pi x^3 \rho}{x^2} = \frac{4G}{3} \pi x \rho$$



For points outside the earth,

$$E_{go} = \frac{G \frac{4}{3} \pi R^3 \rho}{x^2} = \frac{GM}{x^2}$$

ANS:

- 13 If a planet existed whose mass and radius were both half of those of the earth, what would be the value of the acceleration due to gravity on its surface as compared to what it is on the earth's surface ?

We know,

$$g = \frac{GM}{R^2} \quad \dots(i)$$

$$g' = \frac{GM'}{(R')^2} \left[M' = \frac{1}{2}M, R' = \frac{1}{2}R \right] \dots(ii)$$

From (i) and (ii), we have

$$\frac{g'}{g} = \frac{1}{2} \cdot 2^2 = 2$$

ANS: $\therefore g' = 2g$

- 14 The mass and diameter of a planet are twice of those of the earth. What will be the period of oscillation of a pendulum on this planet, if it is a second's pendulum on the earth ?

We know, $g = \frac{GM}{R^2}$

$\therefore g_e = \frac{GM_e}{R_e^2}$

and $g_p = \frac{GM_p}{R_p^2}$

Given : $M_p = 2M_e$ and $R_p = 2R_e$

$\therefore \frac{g_p}{g_e} = \frac{1}{2}$

The time period of a simple pendulum is given by

$$T_e = 2\pi \sqrt{\frac{l}{g_e}}$$

and $T_p = 2\pi \sqrt{\frac{l}{g_p}}$

ANS: For $T_e = 1s$, $T_p = \sqrt{2} s$

15 Why does a cycle tube burst in summer?

ANS: Pressure in the tube increases with increasing temperature, but the volume expansion happens to a limited range. So, the cycle tube bursts in summer.

16 According to Stoke, the viscous force experienced by a sphere of radius r depends on the terminal velocity and viscosity of the liquid besides radius. Derive the formula.

$$F \propto v^a \gamma^b \eta^c \Rightarrow F = K v^a \gamma^b \eta^c,$$

Equating the dimensions, we have,

$$MLT^{-2} = K(LT^{-1})^a (L)^b (ML^{-1}T^{-1})^c$$

Equating the powers of :

$$M : 1 = c, L : 1 = a + b - c,$$

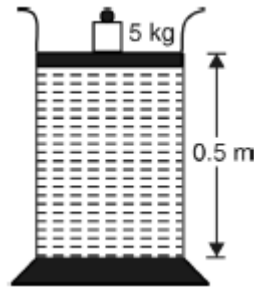
$$T : 2 = -a - c$$

$$c = 1, a = -c + 2 = 1, b = 1 - a + c = 1$$

$$\therefore F = K v r \eta = 6\pi \eta r v,$$

ANS: $K = 6\pi$ was found experimentally by Stoke.

17 A cylindrical jar of cross-sectional area 0.01 m^2 is filled with water to a height of 50 cm (given figure). It carries a tight fitting piston of negligible mass. Calculate the pressure at the bottom of the jar when a mass of 5 kg is placed on the piston.



Total force acting on the base = $hg \rho A + mg$

$$F = 0.5 \times 9.8 \times 1000 \times 0.01 + 5 \times 9.8$$

$$= 5 \times 9.8 + 5 \times 9.8 = 98.0 \text{ N}$$

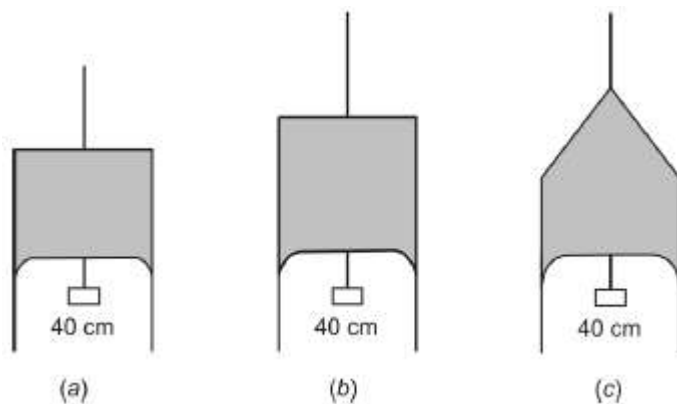
$$\therefore \text{Pressure} = \frac{\text{Force}}{\text{Area}} = \frac{98.0}{0.01} = 9800 \text{ Nm}^{-2}$$

ANS:

- 18 It is advised not to stand near a running train. Why ?

ANS: When fast moving train passes on a rail, then the velocity of air streams in between the rail and the person standing near rail will be very large as compared to the velocity of air streams on the other side of person away from the rail. According to Bernoulli's theorem, the pressure of air will become low in between person and rail and is high on the other side of person. As a result of the pressure difference, a thrust acts on the person which may push the person towards rail side and the person may meet with an accident.

- 19 Figures (a) shows a thin liquid film supporting a small weight = 4.5×10^{-2} N. What is the weight supported by a film of the same liquid at the same temperature in Fig. (b) and (c) ? Explain your answer physically.



ANS: Fig. (a) is incorrect.

According to law of continuity $a_1 v_1 = a_2 v_2$ where a_1 and a_2 are area of cross-section of two pipes and v_1 and v_2 are the speed of fluid in those pipes respectively. Thus, at constriction (i.e., where the area of crosssection of the tube is smaller) the speed of flow would be more.

According to Bernoulli's equation, if speed is more, the pressure is less and hence level of water in vertical tube attached at constriction should be less.

Hence, Fig. (a) is incorrect.

20 One often comes across the following kind of statement concerning circular motion. A particle moving uniformly along a circle experiences a force directed towards the centre and an equal and opposite force directed away from the centre. The two forces together keep the particle in equilibrium. Explain, what is wrong with this statement?

ANS: This statement is wrong relative to any inertial frame of reference that we normally use (e.g., laboratory frame that is approximately inertial). The particle in circular motion is not in equilibrium, it has a centripetal acceleration. Centrifugal force does not exist relative to an inertial frame. The statement is correct relative to the (non-inertial) frame rotating with the particle.

21 In Millikan's oil drop experiment, what is the terminal speed of an uncharged drop of radius 2.0×10^{-5} m and density $1.2 \times 10^3 \text{ kg m}^{-3}$? Take the viscosity of air at the temperature of the experiment to be 1.8×10^{-5} Pa s. How much is the viscous force on the drop at that speed? Neglect buoyancy of the drop due to air.

$$\text{Terminal velocity, } v_t = \frac{2}{9} \times \frac{r^2(\rho - \sigma)g}{\eta}$$

where σ is the density of the medium in which the drop is falling. If the buoyancy of the drop due to air is neglected, then

$$v_t = \frac{2}{9} \times \frac{r^2 \rho g}{\eta}$$

$$v_t = \frac{2 \times (2.0 \times 10^{-5})^2 \times 1.2 \times 10^3 \times 9.8}{9 \times 1.8 \times 10^{-5}}$$

$$v_t = 0.058 \text{ ms}^{-1}$$

Viscous force on the drop at speed v_t i.e.,

$$F = 6 \pi \eta r v_t$$

$$F = 6 \times 3.14 \times 1.8 \times 10^{-5} \times 2.0 \times 10^{-5} \times 0.058$$

$$F = 3.9 \times 10^{-10} \text{ N}$$

$$r = 2.0 \times 10^{-5} \text{ m;}$$

$$\rho = 1.2 \times 10^3 \text{ kg m}^{-3}$$

Viscosity of air,

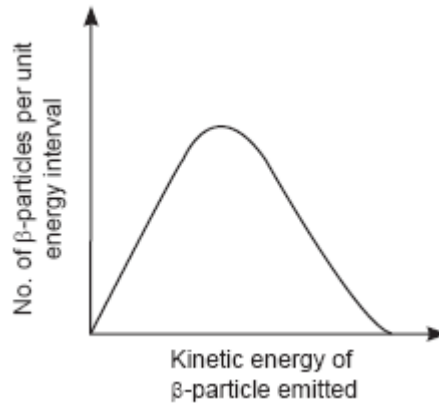
$$\eta = 1.8 \times 10^{-5} \text{ Nsm}^{-2}$$

ANS:

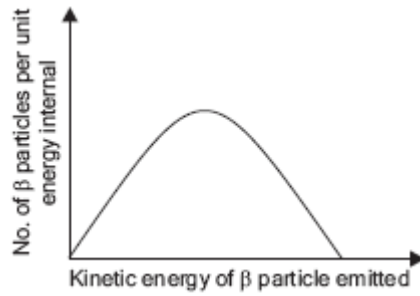
22 Give an example of Pseudo force.

ANS: Centrifugal force.

23 Consider the decay of a free neutron at rest : $n \rightarrow p + e^-$. Show that the two body decays of this type must necessarily give an electron of fixed energy, and therefore, cannot account for the observed continuous energy distribution in the β -decay of a neutron or a nucleus.



ANS: If the decay of a neutron (inside the nucleus) into proton and electron is according to the given scheme, then the available energy in the decay must be carried by the electron coming out of the nucleus and therefore the emitted electrons should always possess a fixed value of kinetic

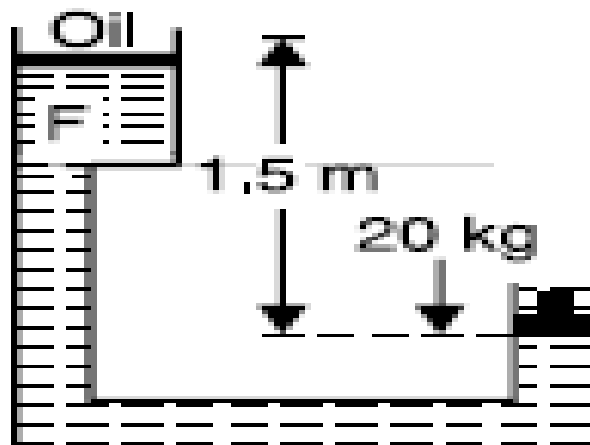


energy. However, the graph in figure shows that the emitted electron can have any value of energy between zero and maximum value. Therefore the given decay mode cannot account for the observed continuous energy spectrum in the beta-decay.

24 What is meant by mass energy equivalence ? Discuss its significance in Physics.

ANS: Energy and non-mass are interconvertible. In Physics, it gives explanation for the energy released in nuclear reactions.

25 The figure adjoining shows a hydraulic press with the larger piston of diameter 35 cm at a height of 1.5 m relative to the smaller piston of diameter 10 cm. The mass on the smaller piston is 20 kg. What is the force exerted on the load by the larger piston ? The density of oil in the press is 750 kg m^{-3} .



Pressure on the smaller piston

$$= \frac{20 \times 9.8}{\pi \times (5 \times 10^{-2})^2} \text{ N m}^{-2}$$

Pressure on the larger piston

$$= \frac{F}{\pi \times (17.5 \times 10^{-2})^2} \text{ N m}^{-2}$$

The difference between these two pressures is equal to $h\rho g$, where

$$h = 1.5 \text{ m}; \rho = 750 \text{ kg/m}^3;$$

and $g = 9.8 \text{ ms}^{-2}$

$$\therefore \frac{20 \times 9.8}{\pi \times (5 \times 10^{-2})^2} - \frac{F}{\pi \times (17.5 \times 10^{-2})^2}$$

$$\Rightarrow = 1.5 \times 750 \times 9.8$$

Simplifying, we get

ANS: $F = 1.3 \times 10^3 \text{ N}$

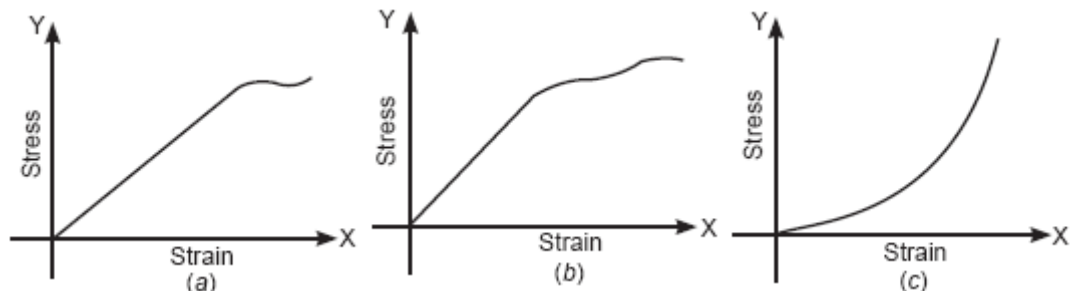
- 26 An artificial satellite is at a height of 36,500 km above earth's surface. What is the work done by earth's gravitational force in keeping it in its orbit ?

ANS: Zero.

- 27 The gravitational Potential energy of a body at a point in a gravitational field of another body is $-\frac{GMm}{r}$. What does the negative sign show ?

ANS: Negative sign means that the mass m is bound to M

- 28 Following are the graphs of elastic materials. Which one corresponds to that of brittle material ?



ANS: (a)

- 29 Crystalline solids are called true solids. Why ?

ANS: Because they have a well defined, regularly repeated three dimensional arrangement of ions/atoms/molecules.

- 30 A 5 cm cube has its upper face displaced by 0.2 cm by a tangential force of 8 N. Calculate the shearing strain, shearing stress and modulus of rigidity of the material of cube.

$$L = 5 \text{ cm} = 5 \times 10^{-2} \text{ m}$$

$$\Delta L = 0.2 \text{ cm} = 0.2 \times 10^{-2} \text{ m} ; F = 8 \text{ N}$$

$$\text{Shearing strain} = \frac{\Delta L}{L} = \frac{0.2}{5} = 0.04$$

$$\text{Shearing stress} = \frac{F}{L \times L} = \frac{8}{(5 \times 10^{-2})^2}$$

$$= 3200 \text{ N/m}^2$$

Modulus of rigidity

$$\eta = \frac{\text{Shearing Stress}}{\text{Shearing Strain}}$$

$$= \frac{3200}{0.04} = 80000 \text{ N/m}^2$$

$$= 8 \times 10^4 \text{ N/m}^2$$

ANS:

31 Bridges are declared unsafe after long use. Why ?

ANS: A bridge undergoes alternating stress and strain for a large number of times during its use. When bridge is used for long time, it loses its elastic strength. Therefore, the amount of strain in the bridge for a given stress will become large and ultimately, the bridge will collapse. So, they are declared unsafe after long use.

32 If a capillary tube of insufficient length is dipped into a liquid, what will happen to the liquid rising ?

ANS: The liquid will rise to the level available and form a meniscus of large value.

33 Why does mercury drop its level in a capillary tube ?

ANS: Excess pressure always acts on the concave side and for mercury there is upper convex surface. So, it drops its level in capillary tube.

34 When 200 g mass placed in a cylindrical beaker of base area 'a' is removed, the vertical length comes out of water by 2 cm. What is the radius of the cylinder ?

$$\text{Upthrust due to 2 cm} = 2 \times a^2$$

$$\text{This should be balanced by 200 g mass.}$$

$$\therefore 2a^2 = 200, \quad a = 10 \text{ m}^2$$

$$\pi r^2 = 10$$

$$r = \sqrt{\frac{10}{\pi}} \text{ cm}$$

ANS:

35 Does Archimedes' principle hold in a vessel in free fall or in a satellite moving in a circular orbit ?

ANS: No.

LONG ANSWER TYPE QUESTION

- 36 Two billiard balls each of mass 0.05 kg moving in opposite directions with speed 6 ms⁻¹ collide and rebound with the same speed. What is the impulse imparted to each ball due to the other ?

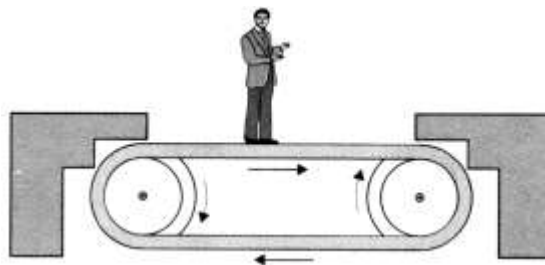
ANS: Mass of each billiard ball, $m = 0.05$ kg
 Speed of each ball before collision, $v_1 = 6$ ms⁻¹
 Speed of each ball after collision, $v_2 = 6$ ms⁻¹
 Hence, initial momentum of each ball before collision = $mv_1 = 0.05 \times 6 = 0.3$ kg ms⁻¹
 Final momentum of each ball after collision = $mv_2 = 0.05 \times 6 = -0.3$ kg ms⁻¹
 Impulse imparted to each ball due to other = Final momentum – Initial momentum
 = -0.3 kg ms⁻¹ – 0.3 kg ms⁻¹
 = -0.6 kg ms⁻¹ = 0.6 kg ms⁻¹ (In magnitude).

- 37 A cricket ball of mass 150 g is moving with a velocity of 12 ms⁻¹, and is hit by a bat, so that the ball is turned back with a velocity of 20 ms⁻¹. The force of the blow acts for 0.01 second on the ball. Find the average force exerted by the bat on the ball.

Change in momentum
 = $150 \times 10^{-3} [20 - 12]$
 = 1200×10^{-3} kg ms⁻¹
 Since $t = 0.01$ second
 \therefore Average force = $\frac{1200 \times 10^{-3}}{10^{-2}} = 120$ N

ANS:

- 38 Figure shows a man standing stationary with respect to a horizontal conveyor belt that is accelerating with 1 ms⁻². What is the net force on the man ? If the coefficient of static friction between the man's shoes and the belt is 0.2, up to what acceleration of the belt can the man continue to be stationary relative to the belt ? (Mass of the man = 65 kg.)

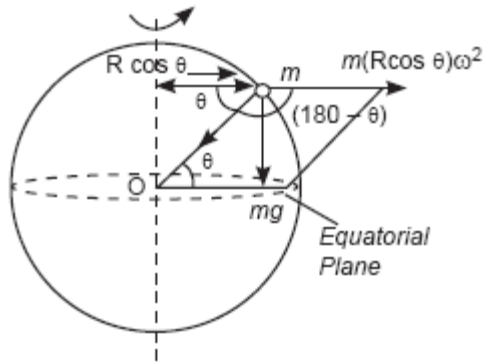


ANS: Acceleration of conveyor belt $a = 1$ ms⁻²
 Force on man = $ma = 65$ N
 Force of friction = $\mu_s mg$
 = $0.2 \times 65 \times 10$
 = 130 N
 The man can continue to be at rest till the force equals the frictional (limiting) force.

$$\therefore a_{\max} = \frac{F_f}{m} = \frac{130}{65} = 2 \text{ ms}^{-2}$$

- 39 What is the effect of rotation on the value of 'g' ? Derive the relation.

ANS: Consider a mass m placed at a latitude θ . Two forces are experienced by it namely,



- (i) The gravitational force 'mg' towards centre O.
(ii) The centrifugal force trying to lift the mass away.

$$mg_{\theta} = \sqrt{(mg)^2 + (mR \cos \theta \omega^2)^2}$$

The net force is given by, $+2 (mg) (mR \cos \theta \omega^2) \cos(180^{\circ} - \theta)$ The radius is $R \cos \theta$, since the centrifugal force is due to the rotation about the axis of the earth.

$$mg_{\theta} = mg \left(1 + \left(\frac{R\omega^2 \cos^2 \theta}{g} \right)^2 - 2 \frac{R\omega^2}{g} \cos^2 \theta \right)^{\frac{1}{2}}$$

$$\therefore g_{\theta} = g \left(1 - \frac{2R\omega^2}{g} \cos^2 \theta \right)^{\frac{1}{2}} \text{ Since } \left(\frac{R\omega^2}{g} \right)^2 \text{ is}$$

negligibly small.

$$g_{\theta} = g \left(1 - \frac{R\omega^2}{g} \cos^2 \theta \right)$$

40

A body weighs 90 kgf on the surface of earth. How much will it weigh on the surface of a planet whose mass is 1/9 and radius 1/2 that of earth ?

Let $M, R,$ be the mass and radius of earth.

$M_p, R_p,$ be the mass and radius of planet.

$$M_p = M/9$$

$$R_p = R/2$$

$F = \text{Wt. of body} = 90 \text{ kgf}$

$$= 90 \times 9.8 \text{ N}$$

$$F = mg \text{ and } g = \frac{GM}{R^2}$$

$$F = \frac{GMm}{R^2}$$

$$90 \times 9.8 = \frac{GMm}{R^2}$$

If F' is weight of body on surface of planet, then

$$F' = \frac{GM_p m}{R_p^2} = \frac{G(M/9)m}{(R/2)^2}$$

$$= \frac{4GMm}{9R^2} = \frac{4}{9} \times 90 \times 9.8$$

$$= 40 \text{ kgf}$$

ANS:

Subject : Computer Science(083)

PART - I

Topic :Python(Basic, Conditional Statement, Loop, String, List)

1. Name the function that tells the data type of an object.
2. Identify the type of Token:
 - i) D_o_j
 - ii) True
 - iii) *
 - iv) @
3. What are the supported data types in Python?
4. What are the key features of Python?
5. Find the output for the following::
 - a.

```
str="Kendriyavidyalaya GreaterNoida"
print("Line1",str[19], end='#')
print("\t",str[4:7])
print(str*3, str[27:], sep="**")
```
 - b.

```
x=20
x=x+5
x=x-10
print(x)
x,y=x-1,50
print (x,y)
```
6. Write a program to enter the side of a square and print its area and perimeter.
7. Evaluate the following expression with precedence of operator:

$$X = 2 * 3 / 5 + 10 // 3 - 1$$

i) Write the following expressions using operators used in Python:

(i) $x = a^3 + b^3 + c^3$

(ii) $A = \pi r(r+h)^2$

(iii) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

8. Find syntax error(s), if any, in the following code::

```
MAX='4'
a=int(input"Enter the value of a:") b=
int(input"Enter the value of b:")
if(a>b)
MAX=5
for x in range(0, MY_MESSAGE):
print("%d" %(x))
```
9. Write an appropriate for loop to be repeated 100 times, except the loop is to be terminated if the value of the variable P becomes 50.

10. What will be the value of a after executing the following codes?

```
i)    a=0
      for i in range(10):
          a=a+1
      for j in range(10):
          a=a+1
      print(a)
```

```
ii)   a=0
      for i in range(10):
          a=a+1
      for j in range(10):
          a=a+1
      print(a)
```

11. Name the error and error message:

- a. answer="Hello"+1
- b. while True print("Hello World")

12. WAP in python to delete all duplicate elements in a list.

For eg:

If Alist is:[5,2,4,-5,12,2,7,4]

After deleting duplicate elements, new list should be:[5,2,4,-5,12,7]

13. WAP in python to generate following series:

1+2+3+.....+n

14. WAP in python to find out a factorial of a given number.

15. WAP in python to find out first n prime numbers.

16. WAP in python to print a series of odd numbers of first N terms.

17. WAP in python to print the following pattern:

```
*
**
***
****
```

18. WAP in python to show how many alphabets, digits, spaces are there in a string.

19. WAP in python to print only the vowels of a string.

20. WAP in python to find out length of a list.

21. WAP in python to print a list.

22. WAP in python to show only the even elements in a number list.

PART-II

Topic : Basics of Computer

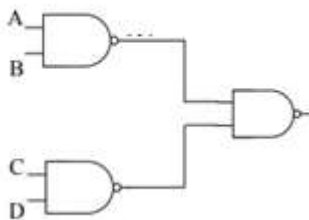
1. Describe basic computer architecture?
2. Define these terms: Biometric Sensor, QR code reader, Barcode Reader, Smart card Reader
3. What are Registers and cache memory?
4. What is a Nibble and Byte?
5. Enlist the Different types of Printers.
6. Define: Track, sector and cylinder.
7. What are Communication Bus?
8. Describe Mobile System Organization with its components?
9. Enlist functions of an Operating System.

10. What is Cloud Computing? What are its types?

Topic: Data Representation & Boolean Logic

1. Convert the following into decimal: $(10110)_2, (1001110)_2, (677)_8, (123)_8, (16C)_{16}, (3AE)_{16}$
2. Convert into Binary: $(69)_{10}, (10)_{10}, (15)_8, (123)_8, (16C)_{16}, (3AE)_{16}$
3. Convert into Octal : $(41)_{10}, (102)_{10}, (101101)_2$
4. Convert into Hexadecimal: $(723)_{10}, (192)_{10}, (678)_8, (10110100)_2$
5. What is ASCII? How it is different from ISCII?
6. What is Unicode? What do you mean by UTF8, UTF16 and UTF32?
7. What do you mean by logic? What is Boolean Logic? What are Boolean Operators?
8. What is Truth Table? Explain with example.
9. What is the Precedence of Boolean Operator? Rules for Evaluating Boolean Expression?
10. Enlist the different types of Logic Gates.
11. DeMorgan's Law and Demorgan's Theorem .
12. Verify the following using truth table:
 - a. $X+Y.Z=(X+Y).(X+Z)$
 - b. $X+X' = X+1$
 - c.

13. **Logic diagram for the expression**



14. Draw the logic circuit for this expression $F = (X + Y)(Z + W)$

Topic : Database Concept & My SQL Basics

1. What is a database?
2. What is a DBMS? Name any two DBMS.
3. What is file organization in a Database?
4. What is the need of a Database?
5. What is the term meant- Database Administrator , Application Developer, End User?
6. What are the major advantages of a DBMS? Explain any 6.
7. What is Data Model? Define data models in brief.
8. What are the limitations of Network datamodel?
9. Define the following: Cardinality of Relation, Degree of Relation, Domain of Relation.
10. What is Database Key? Define Primary Key, Foreign Key, Alternate Key & Candidate Key.
11. What is MySQL? What are the advantages of using SQL?
12. Categorize SQL Statements.
13. Write the SQL statement to create a database?
14. What are the SQL commands used under DML?
15. Differentiate between DDL and DML commands?
16. Write the SQL statement to create the following table:
17. Write an SQL query to create the table "Books" with the following structure-

Field	Type	Size
Book_Id	Char	6
Book_Name	Varchar	25
Author_Name	Varchar	30
Price	Integer	
PublishingDate	Date	

18. Insert any two record values of your choice into the table "Books"?
19. Write the command to describe the structure of a table?
20. What do you mean by the term "Data Integrity"?
21. Differentiate between "Delete" and "Drop" command? Also provide their syntax.
22. What do you mean by the term "Data type"? Enlist the datatypes in MySQL.
23. Which command is used to show the records in MySQL?

END

Model question for Half-yearly Examination Bengali

১। নির্দেশ অনুযায়ী বাক্য পরিবর্তন করো।

- (i) প্রজ্জলিত অগিড়বতে হাত দিতে নাই। (জটিল বাক্যে রূপান্তর কর)
- (ii) তুমি যে কথা বললে তা ঠিক। (সরল বাক্যে রূপান্তর কর)
- (iii) আমাদের এক চাকর ছিল; তাহার নাম ছিল শ্যাম। (সরল বাক্যে রূপান্তর কর)
- (iv) ইলিশের মরশুম ফুরাইলে বিপুলা পদ্মা কৃপণা হইয়া যায়। (যৌগিক বাক্যে রূপান্তর কর)
- (v) বন্যেরা বনে সুন্দর শিশুরা মাতৃক্রোড়ে। (জটিল বাক্যে রূপান্তর কর)
- (vi) রাজপন্ডিভেরা দক্ষিণা পাইয়া খুশি হইয়া বাসায় ফিরিলেন। (যৌগিক বাক্যে রূপান্তর কর)

২। কারক কাকে বলে? কারক কয় প্রকার ও কী কী?

৩। স্থূলান্ধর পদগুলির কারক ও বিভক্তি নির্ণয় কর।

- (i) মহর্ষি বাল্মীকিকে সবাই আদি কবি বলে।
- (ii) তর্কবিতর্কে বিরত হও।
- (iii) সকলে আসিয়া কাঁদিয়া পড়িল।
- (iv) আমি তোমার জীবন দান করিলাম।
- (v) হানো যদি কঠিন কুঠারে।

৪। নীচের যে কোনো একটি বিষয় নিয়ে ১০০-১২০ শব্দের মধ্যে একটি প্রতিবেদন রচনা করো :-

- (i) উত্তরবঙ্গের বন্যা পরিস্থিতি নিয়ে সংবাদপত্রে প্রকাশের জন্য একটি প্রতিবেদন রচনা কর।
- (ii) কল্যাণীতে চিকিৎসকের গাফিলতিতে রোগীমৃত্যুকে কেন্দ্র করে এলাকা রণক্ষেত্রের চেহারা।

৫। নিচের প্রশ্নগুলির সঠিক উত্তর বেছে নাও।

(i) “জলের মধ্যে যথোচিত জ্ববেদ্য সমেত বড়শি নামিয়ে দেবেন”- এখানে ‘জ্ববেদ্য’ বলতে কী বোঝানো হয়েছে?

বড়শিতে গাঁথা মাছের খাবার বা টোপ/ পূজার উপকরণ/ কলশি/ পুকুরের পানা

(ii) তেলেনাপোতায় যাওয়া তিন বন্ধুর সঙ্গে শোণিত সম্বন্ধ করতে আসবে- যামিনী ও তার বৃন্দ মা/ সাবালক মশারা/ তেলেনাপোতার বাসিন্দারা/ গাড়োয়ান

(iii) যে মেয়েটি জল নিতে এসেছে, তার অতিক্রান্ত হয়নি - জুশোর/ যৌবন/ বার্ষিক্য/ বাল্যকাল

(iv) সৌখীর জেলে থাকার মেয়াদ কমিয়ে দিয়েছিল- দারোগা/ পেশকার সাহেব/ হেড জমাদার/ লাটসাহেব

(v) সৌখীর মা নিদ্রাহীন বিছানায় শোনে কাছারির ঘড়িতে বাজে- দুটো/ বারোটা/ একটা/ তিনটে

(vi) তেলেনাপোতার জীর্ণ অট্টালিকার ধ্বংসের কাজ অনেকখানি এগিয়ে রেখেছে- প্রাকৃতিক বিপর্যয়/ অরণ্যের পঞ্চম বাহিনী/ আগন্তুক তিন বন্ধু/ যামিনী ও তার মা

(vii) তেলেনাপোতায় গারোয়ান লণ্ঠন ছাড়া আর কী দিয়ে গেল- এক গাস জল/ এক কলশি জল/ এক বালতি জল/ এক গড়া জল

(viii) “দারোগাবাবুর প্রশ্নে কানে গেল কি না, সে কথা বোঝাও যায় না তার মুখ দেখে।”- কারণ- প্রশ্নে উত্তর দিলে ডাকাতির মায়ের পক্ষে তা অসম্মানের ব্যাপার/ আত্মধিকার ও ছেলের অপমানের আশঙ্কায় সে নির্বাক হয়ে গেছে/ বয়সের কারণে সে কানে ভালো শোনে না/ সে জানে প্রশ্নে উত্তর না দিলেই রেহাই মিলবে

৭। নিচের প্রশ্নগুলির উত্তর নিজের ভাষায় লেখ।

(i) “সিংহেরে ভয়ে রাখে পিঞ্জরে

ব্যস্তেরে হানে অগিড়বশেল ”- স্তম্ভসজা ব্যাখ্যা লেখ।

(ii) “ বাণীর কমল খাটিবে জেল। ” ‘বাণীর কমল’ শব্দটির অর্থ কী? সে কেন জেল খাটবে?

(iii) “আমি বাঞ্ছা করি দেখব তারি”- বক্তা কাকে দেখতে চান? কীভাবে তার দর্শন পাওয়া যাবে?

(iv) “বলব কি সেই পড়শির কথা ”- পড়শী কে? উক্তিটির আলোকে ‘পড়শী’ স্বরূপ আলোচনা কর।

৬। নিচের প্রশ্নগুলির উত্তর নিজের ভাষায় লেখ।

(i) “ মা তখনও মেঝেতে পড়ে ডুকরে ডুকরে কাঁদছে”- মা কে? তিনি কাঁদছেন কেন?

(ii) “আপনার আসল উদ্দেশ্য আপনি নিশ্চয় বিস্মৃত হবেন না।”- বক্তা কে? কাকে উদ্দেশ্য করে বলেছে? বক্তার আসল উদ্দেশ্য কী ছিল? তা কি সফল হয়েছিল?

(iii) “এ এক আচ্ছা জ্বালাতন হয়েছে যা হোক। ” - বক্তা কে? কোন্ জ্বালাতন কথা বলা হয়েছে? কীভাবে সেই সমস্যার সমাধান হল?

(iv) “ তারপর দরজা খুলবি”- বক্তা কে? কোন প্রসঙ্গে এ কথা বলা হয়েছে?

৮। নিচের প্রশ্নগুলির উত্তর নিজের ভাষায় লেখ।

(i) “ওকে অচলায়তনের ভূতে পেছেছে ”- কার সম্পর্কে কে একথা বলেছে? উদ্দিষ্ট ব্যক্তি কীভাবে ভূতগ্রস্ত হয়েছে ?

(ii) “উনি গেলে তোমাদের অচলায়তনের পাথরগুলো সুস্থ নাচতে আরম্ভ করবে, পুঁথিগুলোর মধ্যে বাঁশি বাজবে”- বক্তা কে? “উনি বলতে কাকে চিহ্নিত করা হয়েছে? উক্তিটির তাৎপর্য ব্যাখ্যা কর।

(iii) “অচলায়তনে তাকে কোথাও ধরবে না”- কাকে অচলায়তনে ধরবে না ? কেন?

(iv) ‘ভয়ানক পুণ্য’- কোন্ পুণ্য? কেন তা ভয়ানক?