

CBSE
Class IX Science
Term 2
Sample Paper – 3

Chemistry

- Q1. A solution is made by dissolving 60 g of sodium chloride in 360 g of water. Find the mass percentage of the solution.
- (a) 15.76%
 - (b) 17.56 %
 - (c) 14.28 %
 - (d) 18.36 %

Sol. (c)

Mass of sodium chloride = 60 g

Mass of water = 360 g

Mass of solution = Mass of solute + Mass of solvent = 60 g + 360 g = 420 g

Mass percentage of solution

$$= \frac{\text{Mass of solute} \times 100\%}{\text{Mass of solution}}$$

$$= \frac{60}{420} \times 100\% = 14.28 \%$$

- Q2. Which formula gives the maximum number of electrons in a shell?
- (a) n^2
 - (b) $2n^2$
 - (c) $3n^2$
 - (d) $4n^2$
 - (e) $4n^2$

Sol. (b)

The maximum number of electrons to be present in a shell is given by the formula $2n^2$, where 'n' is the orbit number or energy level index 1,2,3

The distribution of electrons in the first orbit will be $2 \times 1^2 = 2$,

Second orbit will be $2 \times 2^2 = 8$

Third orbit will be $2 \times 3^2 = 18$

Fourth orbit will be $2 \times 4^2 = 32$.

Q3. How many free surfaces exist in the case of solids?

- (a) 1
- (b) 2
- (c) 3
- (d) Infinitely many

Sol. (d)
Solids can have any number of surfaces

Q4. 2.8 g of calcium oxide prepared by heating limestone produces 0.8 g of oxygen. Calculate the mass percentage of calcium.

- (a) 71.4%
- (b) 61.4%
- (c) 81.6%
- (d) 91.2%

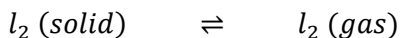
Sol. (a)
Mass of calcium oxide = 2.8 g
Mass of oxygen = 0.8 g
Mass of calcium = $2.8 - 0.8 \text{ g} = 2.0 \text{ g}$
Percentage of calcium = $\frac{2.0}{2.8} \times 100$
 $= 71.4 \%$

Q5. Which of the following are physical changes?

- (i) Heating of iodine crystals
 - (ii) Burning of wood
 - (iii) Melting of wax
- (a) Only (i) and (ii)
 - (b) Only (ii) and (iii)
 - (c) Only (i) and (iii)
 - (d) Only (ii)

Sol. (c)

When solid crystals are heated, they change to bright, purple vapours. It is a physical change as iodine crystals undergo sublimation from solid to gaseous state directly.



On heating wax in a vessel, it melts but no new substance is formed. It undergoes change in the state only. Hence, it is an example of physical change.

Wood, on burning produces new substances ash, carbondioxide, heat and light. This is an example of chemical change.

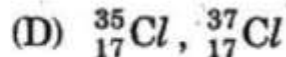
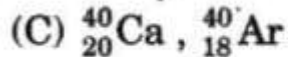
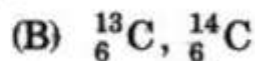
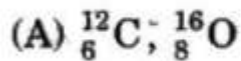
Q6. At what temperature on the Kelvin scale does liquid nitrogen boil? (Its boiling point is -196°C .)

- (a) 469 K
- (b) 273 K
- (c) 330 K
- (d) 77 K

Sol. (d)

$$K = ^{\circ}\text{C} + 273 = -196 + 273 = 77 \text{ K}.$$

Q7. Which of these is a pair of isobars?



Sol. (c)

Atoms of different elements with different atomic numbers, but have the same mass number are known as isobars.

Q8. What is the atomic radius of a hydrogen atom?

- (a) 0.00925 nm
- (b) 0.0185 nm
- (c) 0.037 nm
- (d) 0.074 nm

Sol. (c)

The atomic radius of a hydrogen atom is 0.037 nm

- Q9. In which of the following is centrifugation method employed?
- (a) Oil, Dairy and Sugar industries
 - (b) Textile industry
 - (c) Nuclear plant
 - (d) Rubber industry

Sol. (a)
Centrifugation method is employed in

- (i) Oil industry to remove solids from drilling fluids
- (ii) Dairy industry to separate cream from milk.
- (iii) Sugar industry to separate sugar crystals from its solution.

- Q10. Which of the following is added to LPG to detect its leakage?
- (a) Naphthalene
 - (b) Methyl ethyl sulphide
 - (c) Benzene
 - (d) Calcium

Sol. (b)
LPG is an odourless gas and when it leaks, it is difficult to detect. To detect leakage for LPG, any one of the organosulphur compounds is added to it. There are many such compounds which act as odorants like methyl mercaptan, ethyl mercaptan, methyl ethyl sulphide, dimethyl sulphide etc. Sulphur compounds have strong odour and their diffusion in air helps us to detect leakage of LPG easily.

- Q11. What is the mass of one mole of cane sugar? (Formula of cane sugar is $C_{12}H_{22}O_{11}$.)
- (a) 342 g
 - (b) 180 g
 - (c) 360 g
 - (d) 240 g

Sol. (a)
1 mole of $C_{12}H_{22}O_{11}$ = Molecular mass of $C_{12}H_{22}O_{11}$ in grams
= Mass of C \times 12 + Mass of H \times 22 + Mass of O \times 11
= $(12 \times 12) + (1 \times 22) + (16 \times 11)$
= $144 + 22 + 176 = 342$ g
The mass of 1 mole of cane sugar is 342 g.

- Q12. Which of the following elements has an isotope that does not have a neutron in its nucleus?
- (a) Helium
 - (b) Hydrogen
 - (c) Beryllium
 - (d) Magnesium

Sol. (b)
Protium, an isotope of hydrogen does not have a neutron in its nucleus. It has only one proton and one electron.

- Q13. What is the fifth state of matter called?
- (a) Rutherford – Einstein Condensate
 - (b) Bhaba – Einstein Condensate
 - (c) Bohr – Einstein Condensate
 - (d) Bose – Einstein Condensate

Sol. (d)
The fifth state of matter is called the Bose – Einstein Condensate (BEC) . This state of matter is exactly opposite to the plasma state. The particles in BEC can hardly be excited and are super – cold atoms.

- Q14. Find the element that has both minimum and maximum valencies.
- (a) Mg
 - (b) Ne
 - (c) P
 - (d) Cl

Sol. (c)
Element phosphorus has a minimum valency of 3 and a maximum valency of 5.

- Q15. In which of these applications are isotopes used?
- (i) Uranium as fuel in nuclear reactors
 - (ii) Iodine in the treatment of goiter
 - (iii) Cobalt in the treatment of cancer
 - (iv) Laboratory preparation of oxygen
- (a) Only (i) and (ii)
 - (b) Only (ii) and (iii)
 - (c) Only (i), (ii) and (iii)
 - (d) Only (i) and (iii)

Sol. (c)

Some isotopes have special properties which find use in the following fields.

- (i) Uranium - 235 isotope is used as a fuel in nuclear power plants for generating electricity.
- (ii) Iodine – 131 isotope is used as a tracer to find the functionary of thyroid gland
- (iii) Cobalt – 60 radioisotopes is used to cure cancer.

Q16. Which substances are incorrectly placed in the following table?

	Liquid-Liquid mixtures	Lighter liquid	Heavier liquid
(A)	Olive oil and water	Olive oil	Water
(B)	Benzene and Carbon tetrachloride	Benzene	Carbon -tetrachloride
(C)	Kerosene oil and water	Water	Kerosene oil
(D)	Alcohol and water	Alcohol	Water

Sol. (c)

Liquid mixture given in option (A) and (B) are immiscible. Olive oil, benzene and kerosene oil are lighter than water. Option (C) is wrongly matched. Kerosene oil is a lighter liquid with a density of $0.78 - 0.81 \text{ g cm}^{-3}$ whereas water is a denser and heavier liquid with a density of 1 g cm^{-3} . Alcohol and water are miscible liquids which mix together in all proportions.

Q17. Identify the factors affecting the rate of evaporation.

- (i) Temperature and humidity
 - (ii) Amount of the liquid
 - (iii) Wind speed
 - (iv) Surface area exposed to the atmosphere
- (a) Only (i) , (ii) and (iv)
 - (b) Only (ii), (iii) and (iv)
 - (c) Only (i), (iii) and (iv)
 - (d) Only (i), (ii) and (iii)

Sol. (c)

The rate of evaporation depends on the temperature, humidity, wind speed and surface area exposed to the atmosphere. The amount of liquid does not effect evaporation.

Q18. What is the mass of 1 mole of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$?

- (a) 69.5 g
- (b) 278 g
- (c) 34.75 g
- (d) 139 g

Sol. (b)

$$\begin{aligned} 1 \text{ mole of } \text{FeSO}_4 \cdot 7\text{H}_2\text{O} \text{ in grams} &= \text{Mass of Fe} + \text{Mass of S} + \text{Mass of O} \times 11 + \text{Mass of H} \times 14 \\ &= 56 + 32 + 16 \times 11 + 1 \times 14 \\ &= 56 + 32 + 176 + 14 = 278 \text{ g} \end{aligned}$$

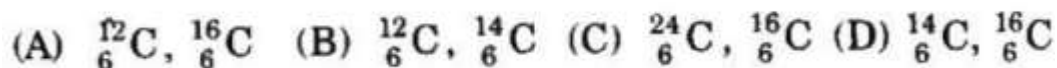
Q19. Identify the INCORRECT option.

	Type of mixture	Solute	Solvent	Solution
(A)	Solid - Solid	Tin	Copper	Bell metal
(B)	Liquid - Gas	Ammonia	Water	Ammonium hydroxide
(C)	Liquid - Liquid	Water	Acetic acid	Vinegar
(D)	Gas - Gas	Oxygen	Nitrogen	Air

Sol. (c)

Vinegar is a solution of 5 – 8 % acetic acid in water. Acetic acid is a solute and water is a solvent.

Q20. Identify the isotopes of carbon.

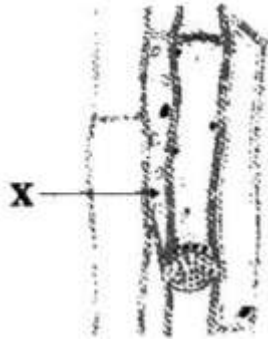


Sol. (b)

Isotopes are atoms of the same elements with different mass numbers. The isotopes of carbon are ${}^{12}_6\text{C}$, ${}^{14}_6\text{C}$.

Biology

Q21. The given diagram shows a type of vascular tissue found in a tree trunk.



What is the part labeled X?

- (a) Sieve tube
- (b) Sieve plate
- (c) Companion cell
- (d) Sieve pore

Sol.

(c)
The given figure is of a section of a phloem. The part labeled 'X' is companion cell.

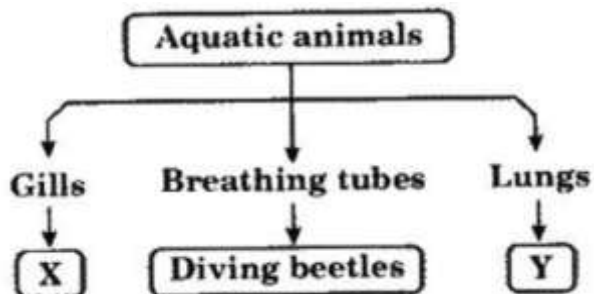
Q22. Which of the following animals has exoskeleton made of chitin?

- (a) Starfish
- (b) Snail
- (c) Cockroach
- (d) Snake

Sol.

(c)
The body of a cockroach is covered with a hard protective covering on the outside. This covering is made from a stiff but light material called the chitin.

Q23. Some aquatic animals are grouped according to the way they breathe.



Identify animals X and Y.

	X	Y
(A)	Tadpole	Dolphin
(B)	Whale	Fish
(C)	Dolphin	Whale
(D)	Frog	Fish

Sol.

(a)

Tadpole respire through gills and dolphin breathes through lungs.

Q24. Which of the following is true about the sites of synthesizing and destroying sites of erythrocytes in an adult human being?

	Synthesising site	Destroying site
(A)	Bone marrow	Stem cells
(B)	Liver	Spleen
(C)	Bone marrow	Spleen
(D)	Lymph nodes	Bone marrow

Sol.

(c)

Erythrocytes are synthesized in stem cells of bone marrow and are destroyed in spleen. By the phagocytic activities of macrophages in the liver, spleen and lymph nodes.

Q25. Which of the following help to keep a healthy cardiovascular system?

- (i) Avoid exercising
 - (ii) Maximise sodium intake
 - (iii) Minimize high cholesterol foods
 - (iv) Eat more fruits and vegetables
- (a) Only (i) and (ii)
(b) Only (ii) and (iii)
(c) Only (i) and (iv)
(d) Only (iii) and (iv)

Sol.

(d)

Low intake of sodium and cholesterol food and eating more fruits and vegetable and doing exercise regularly help to keep a healthy cardio vascular system.

- Q26. What is the feature of the fish that helps it overcome resistance during its movement in water?
- (a) Having a small head.
 - (b) Having hollow bones
 - (c) Having a streamlined body.
 - (d) Having a fluid in the body cavity

Sol. (c)
The streamlined body of fish helps it to swim in water.

- Q27. In which of the following animals does respiration occur without any respiratory organ?
- (a) Snake
 - (b) Fish
 - (c) Prawn
 - (d) Earthworm

Sol. (d)
Earthworms lack specialized breathing structures and hence depend on cutaneous respiration.

- Q28. I am an animal cell that needs to travel fast from one place to another in an organism. I need to be able to travel through small spaces quickly. I do not have a nucleus. My function is to distribute a gas essential for life. Who am I?
- (a) Monocyte
 - (b) Leucocyte
 - (c) Erythrocyte
 - (d) Thrombocyte

Sol. (c)
Erythrocytes or RBC help to distribute oxygen throughout the body. The erythrocytes of mammals are circular, biconcave, disc-like and lack nuclei; they have the increased area for gaseous exchange.

- Q29. Which of the following will result in loss of soil fertility?
- (i) Crop rotation
 - (ii) Shifting cultivation
 - (iii) Excessive use of chemical fertilisers
- (a) Only (i) and (ii)
 - (b) Only (i) and (iii)
 - (c) Only (ii) and (iii)
 - (d) (i), (ii) and (iii)

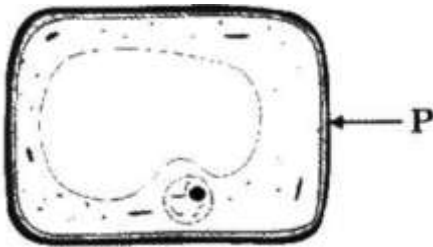
Sol. (c)
Shifting cultivation and excessive use of chemical fertilizers reduces soil fertility and makes soil barren.

Q30. Who proposed the cell theory?

- (a) Schleiden and Schwann
- (b) Watson and Crick
- (c) Darwin and Wallace
- (d) Mendel and Morgan

Sol. (a)
Schleiden and Schwann proposed the cell theory.

Q31. Look at the given cell.



- Identify the function of the part labeled P.
- (a) It forms the cell plate during cell division
 - (b) It controls all the activities of the cell.
 - (c) It contains many small parts
 - (d) It prevents desiccation of the cell.

Sol. (d)
In the given figure parte labeled P is cell wall. It is found in plant cell and forms a protective covering outside the cell membrane. It provides rigidity to the cell and protects the internal structure and cell membrane.

Q32. Which of the following includes the production and management of fish?

- (a) Aquaculture
- (b) Pisciculture
- (c) Horticulture
- (d) Sericulture

Sol. (b)
The production and management of fish is called Piscicultrue.

Q33. What is the function of flame cells in Platyhelminthes?

- (a) To dissolve the wastes.
- (b) To produce the wastes.
- (c) To excrete the wastes.
- (d) To burn the wastes.

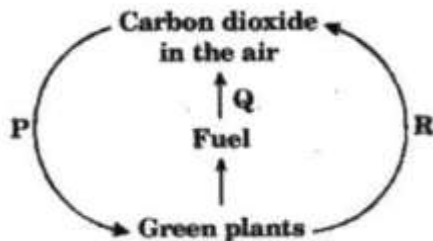
Sol. (c)
Flame cells are the excretory organs in Platyhelminthes.

Q34. How do animals get their nitrogen?

- (a) By absorbing nitrogen gas through their skin.
- (b) By eating carbohydrates like sugars and starch.
- (c) From nitrates in their drinking water.
- (d) By eating plants and other animals.

Sol. (d)
Animals get their nitrogen by eating plants and other animals.

Q35. The figure given shows a part of the carbon cycle.



Which of the following processes is represented by P?

- (a) Respiration
- (b) Photosynthesis
- (c) Combustion
- (d) Transpiration

Sol. (b)
Plants take in carbon dioxide during photosynthesis.

Q36. Abhi observed the following cell parts of two different cells under a microscope. He recorded his observation in the table given.

Parts of cell	Cell X		Cell Y	
	Present	Absent	Present	Absent
Cell wall	✓			✓
Cytoplasm	✓		✓	
Nucleus	✓		✓	
Cell membrane	✓		✓	
Chloroplast		✓		✓

Identify X and Y.

	X	Y
(A)	Animal cell	Plant cell
(B)	Plant cell	Animal cell
(C)	Fungal cell	Animal cell
(D)	Animal cell	Fungal cell

Sol. (c)
Chloroplast is absent in fungal and animal cells. Cell wall is absent in animal cell and chitinous cell wall is present in fungi.

Q37. Which of the following describes about the first line defense?

- (a) It involves lymphocytes in the blood.
- (b) It involves phagocytic white blood cells.
- (c) It involves skin and mucous membrane
- (d) It produces antibodies that destroy bacteria and viruses.

Sol. (c)
The first line of defense involves skin and mucous membranes.

Q38. What do the conducting tissues of a plant have?

- (i) Xylem
 - (ii) Phloem
 - (iii) Cortex
 - (iv) Epidermis
- (a) Only (i) and (ii)
 - (b) Only (ii) and (iv)
 - (c) Only (i) and (iii)
 - (d) Only (iii) and (iv)

Sol. (a)
Xylem and phloem are the vascular tissues of a plant.

Q39. Which of the following always involve the process of diffusion in living things?

- (i) The movement of minerals from the soil into root hair cells.
 - (ii) The movement of water into the cells of living things
 - (iii) The movement of dissolved oxygen from the surrounding water into an amoeba.
 - (iv) The movement of carbon dioxide from the air into leaf cells.
- (a) Only (i) and (ii)
 - (b) Only (i) and (iii)
 - (c) Only (ii) and (iii)
 - (d) Only (iii) and (iv)

Sol. (d)
Diffusion is a spontaneous movement of particles from an area of high concentration to an area of low concentration. Hence, statement only III and IV are true.
In the given statements in the statements I the movement of minerals from the soil into root hair cells cannot be absorbed by osmosis and diffusion because the minerals are in very low concentration instead active transport of substance is used.
Statements II in living things water often move in and out across a semipermeable by osmosis.

Q40. Lysosomes are reservoirs of

- (a) Fat
- (b) RNA
- (c) Hydrolytic enzymes
- (d) Cellulose.

Sol. (c)
Lysosomes are small vesicles surrounded by a single membrane and contains powerful hydrolytic enzymes that are capable of digesting or breaking down of all organic materials.

Physics

Q41. The acceleration due to gravity on planet A is nine times the acceleration due to gravity on planet B. A man jumps to a height 2 m on the surface of A. What is height of jump by same person on planet B?

- (a) 2/3 m
- (b) 2/9 m
- (c) 18 m
- (d) 6 m

Sol. (c)

Since the initial velocity of jump is same on both planets

$$\text{So, } 0 = u^2 - 2gh \quad \text{for A}$$

$$0 = u^2 - 2gH \quad \text{for B}$$

$$\text{or } \frac{g_A \times h_A}{g_B} = h_B \Rightarrow h_B = \frac{9}{1} \times 2 = 18 \text{ m}$$

Q42. A ball is released from the top of a tower of height h metres. It takes T seconds to reach the ground. What is the position of the ball at $\frac{T}{3}$ second.

- (a) $\frac{8h}{9}$ metres from the ground
- (b) $\frac{7h}{9}$ metres from the ground
- (c) $\frac{h}{9}$ metres from the ground
- (d) $\frac{17h}{18}$ metres from the ground

Sol. (a)

$$h = \frac{1}{2} gT^2$$

now for $t = \frac{T}{3}$ second vertical distance moved is

$$\text{given by, } h' = \frac{1}{2} g \left(\frac{T}{3}\right)^2 \Rightarrow h' = \frac{1}{2} \times \frac{gT^2}{9} = \frac{h}{9}$$

$$\therefore \text{ position of ball from ground} = h - \frac{h}{9} = \frac{8h}{9}$$

Q43. An automobile travelling with a speed of 60 km/h, can brake to stop within a distance of 20 m. If the car is going twice as fast i.e., 120 km/h, the stopping distance will be

- (a) 60 m
- (b) 40 m
- (c) 20 m
- (d) 80 m

Sol. (d)

$$\text{Speed } v_1 = 60 \times \frac{5}{18} \text{ m/s} = \frac{50}{3} \text{ m/s}$$

$$d_1 = 20 \text{ m}, v_1' = 120 \times \frac{5}{18} = \frac{100}{3} \text{ m/s}$$

Let deceleration be a

$$\therefore 0 = V_1^2 - 2ad_1 \quad \dots\dots (1)$$

$$\text{or } v_1^2 = 2ad_1$$

$$(2v_1)^2 = 2ad_2 \quad \dots\dots(2)$$

(2) divided by (1) gives,

$$4 = \frac{d_2}{d_1} \Rightarrow d_2 = 4 \times 20 = 80 \text{ m}$$

Q44. The motion of a particle is described by the equation $u = at$. The distance travelled by particle in first 4 sec is

- (a) $4a$
- (b) $12a$
- (c) $6a$
- (d) $8a$

Sol. (d)

Equation of motion is $u = at$

$$\text{We know that } u = \frac{ds}{dt} \Rightarrow \frac{dx}{dt} = at \text{ or } ds = atdt$$

$$\text{Integrating, it we get, } \int_0^s ds = \int_0^4 t dt$$

$$s = \frac{a}{2} [t^2]_0^4 = 8a$$

Q45. A rider on horse falls back when horse starts running, all of a sudden because

- (a) Rider is taken back
- (b) Rider is suddenly afraid of falling
- (c) Inertia of rest keeps the upper parts of body at rest while lower part of the body moves forward with the horse
- (d) None of these

Sol. (c)

Q46. A man getting down a running bus falls forward because

- (a) Due to inertia of rest, road is left behind and man reaches forward
- (b) Due to inertia of motion upper part of body continues to be in motion in forward direction while feet come to rest as soon as they touch the road
- (c) He leans forward as a matter of habit
- (d) Of the combined effect of all the three factors stated in (a), (b) and (c)

Sol. (b)

- Q47. The heart is pumping blood at x kg per unit time, with constant velocity v . The force needed is
- (a) xv
 - (b) $v \frac{dx}{dt}$
 - (c) $x \frac{dv}{dt}$
 - (d) zero

Sol. (a)

- Q48. A parrot is sitting on the floor of a closed glass cage which is in a boy's hand. If the parrot starts flying with a constant speed, the boy will feel the weight of the cage as
- (a) Unchanged
 - (b) Reduced
 - (c) Increased
 - (d) Nothing can be said

Sol. (a)

- Q49. The mass of moon is $1/81$ of earth's mass and its radius $1/4$ of the earth. If the escape velocity from the earth's surface is 11.2 km/sec. its value for the moon will be
- (a) 0.14 kms^{-1}
 - (b) 0.5 kms^{-1}
 - (c) 2.5 kms^{-1}
 - (d) 5.0 kms^{-1}

Sol. (c)

$$V_e = \sqrt{\frac{2GM_e}{R_e}}; \quad v_m = \sqrt{\frac{2G \frac{M_e}{81}}{\frac{R_e}{4}}} = \frac{2}{9} v_e$$
$$= \frac{2}{9} \times 11.2 \text{ kms}^{-1} = 2.5 \text{ kms}^{-1}$$

- Q50. The potential energy of a satellite of mass m and revolving at a height R above the surface of earth where $R_e = \text{radius of earth}$ is
- (a) $-mgR_e$
 - (b) $\frac{-mgR_e}{2}$
 - (c) $\frac{-mgR_e}{3}$
 - (d) $\frac{-mgR_e}{4}$

Sol. (b)

At a height h above the surface of earth the gravitational potential energy of the particle of mass m is

$$U_h = -\frac{GM_em}{R_e+h}$$

Where M_e & R_e are the mass & radius of earth respectively.

In this question, since $h = R_e$

$$\text{So, } U_{h=R_e} = -\frac{GM_em}{2R_e} = \frac{-mgR_e}{2}$$

- Q51. Two particles m_1 and m_2 are at initially at rest at infinite separation. They start moving towards each other due to mutual force of gravitation. Find their relative velocity of approaches when separation between them is 'd'.

(a) $\sqrt{\frac{2G(m_1+m_2)}{d}}$

(b) $\sqrt{\frac{2G(m_1-m_2)}{d}}$

(c) $\sqrt{\frac{3G(m_1+m_2)}{d}}$

(d) $\sqrt{\frac{3G(m_1-m_2)}{d}}$

Sol. (a)

Using conservation of energy principle at infinite separation and at distance 's'

$$0 + 0 = \frac{1}{2} m_1 v_1^2 + m_2 v_2^2 - \frac{Gm_1 m_2}{d} \dots\dots\dots(i)$$

As there is no external force is not acting so using conservation of linear momentum.

$$0 + 0 = m_1 v_1 - m_2 v_2 \dots\dots(ii)$$

Using (i) and (ii) to solve for v_1 and v_2 then

Relative velocity of approaches = $v_1 - (-v_2)$

$$= \sqrt{\frac{2G(m_1+m_2)}{d}}$$

- Q52. Three particles of masses 1 kg, 2 kg and 3 kg are placed on the verticals of an equilateral of side 2m. now these masses are moved towards the vertices of an equilateral triangle of side 1 m, then find the work done.

(a) $9.184 \times 10^{11} J$

(b) $9.185 \times 10^{10} J$

(c) $9.183 \times 10^{11} J$

(d) $9.185 \times 10^{11} J$

Sol. (d)

In this case the work done will be change in potential energy between two configuration of masses

$$U_1 = \frac{-G1 \times 2}{2} - \frac{G2 \times 3}{2} - \frac{G1 \times 3}{2}$$

$$U_1 = \frac{11}{2} G$$

$$\text{Now, } U_f = -\frac{G1 \times 2}{1} - \frac{G2 \times 3}{1} - \frac{G1 \times 3}{1}$$

$$U_f = 11G$$

So the work done, $W = U_f - U_i$

$$W = -11G - \left(-\frac{11G}{2}\right) W = \frac{11G}{2}$$

$$W = 9.185 \times 10^{11} J$$

Q53. A wave of frequency 100 Hz is sent along a string towards a fixed end. When this wave travels back reflection a node is formed at a distance of 10 cm from the fixed end of the string. The speeds of incident (and reflected) waves are

- (a) 5m/s
- (b) 10 m/s
- (c) 20 m/s
- (d) 40 m/s

Sol. (c)

As fixed end is a node, therefore, distance between two consecutive nodes = $\frac{\lambda}{2} = 10 \text{ cm}$

$$\lambda = 20 \text{ cm} = 0.2 \text{ m}$$

$$\text{As } v = n \lambda \therefore v = 100 \times 0.2 = 20 \text{ m/s}$$

Q54. What is the effect of humidity on sound waves when humidity increases?

- (a) Speed of sound waves is more
- (b) Speed of sound waves is less
- (c) Speed of sound waves remains same
- (d) Speed of sound waves becomes zero

Sol. (a)

$$\text{Velocity of sound} = \sqrt{\frac{\gamma RT}{M}}$$

When water vapor are present in air average molecular weight of air decreased and hence velocity increases.

Q55. Two waves having the intensities in the ratio of 9: 1 produce interference. The ratio of maximum to the minimum intensity is equal to

- (a) 2 : 1
- (b) 4 : 1
- (c) 9 : 1
- (d) 10 : 8

Sol. (b)

As intensity of wave $\propto (\text{amplitude})^2$

$$\frac{I_1}{I_2} = \frac{9}{1} = \frac{a_1^2}{a_2^2} \Rightarrow \frac{a_1}{a_2} = \frac{3}{1}$$

$$\frac{I_{max}}{I_{min}} = \frac{(a_1+a_2)}{(a_1-a_2)} = \frac{16}{4} \Rightarrow \text{ratio is } 4 : 1$$

Q56. A spring has a force constant k , and a m is suspended from one of the halves. Is the frequency of vibration the same before and after the spring is cut? How the frequencies are related?

- (a) $\frac{1}{\sqrt{3}}$
- (b) $\frac{1}{\sqrt{5}}$
- (c) $\frac{1}{\sqrt{2}}$
- (d) $\frac{1}{\sqrt{3}}$

Sol. (c)

$$f = \frac{1}{2\pi} \sqrt{\left(\frac{k}{m}\right)}$$

Let l be the length of spring and Δl be the elongation when loaded with mg .

$$\text{Then } k = \frac{mg}{\Delta l/2} = 2K$$

$$\therefore f' = \frac{1}{2\pi} \sqrt{\left(\frac{k'}{m}\right)} = \frac{1}{2\pi} \sqrt{\left(\frac{2k}{m}\right)}$$

$$\text{Now } \frac{f}{f'} = \sqrt{\left(\frac{k}{2k}\right)} = \frac{1}{\sqrt{2}}$$

Q57. A child builds a tower from three blocks. The blocks are uniform cubes of side 2 cm. The blocks are initially all lying on the same horizontal surface and each block has a mass of 0.1 kg. The work done by the child is

- (a) 4 J
- (b) 0.04J
- (c) 6J
- (d) 0.06J

Sol. (d)

Q58. A particle of mass m moves from rest under the action of a constant force F which acts for two seconds. The maximum power attained is

- (a) 2 kw
- (b) 5 w
- (c) 200 w
- (d) 1 kw

Sol. (d)

Q59. Consider the following two statements:

- I. Linear momentum of a system of particles is zero.
- II. Kinetic energy of a system of particles is zero.

Then

- (a) I implies II but II does not imply I.
- (b) I does not imply II implies I.
- (c) I implies II and II implies I.
- (d) I does not imply II and II does not imply I.

Sol. (b)

If $\vec{L} = 0 \Rightarrow K.E \text{ may or may not be zero.}$

If $K.E. = 0, \vec{L} = 0$

Q60. A body of mass m moving with velocity v makes a head on elastic collision with another body of mass $2m$ which is initially at rest. The loss of kinetic energy of the colliding body (mass m) is

- (a) $1/2$ of its initial kinetic energy
- (b) $1/9$ of its initial kinetic energy
- (c) $8/9$ of its initial kinetic energy
- (d) $1/4$ of its initial kinetic energy

Sol. (c)

Fraction of energy transferred = $\frac{4 \times 2}{(1+2)^2} = \frac{8}{9}$