EXPERIMENT

OBJECTIVE

To study the third law of motion using two spring balances.

MATERIALS REQUIRED

(*i*) Two identical spring balance
(*ii*) Weight box
(*iii*) Thread
(*iv*) A frictionless pully
(*v*) A pan of known mass

THEORY

1. According to third law of motion to every action, there is an equal and opposite reaction.
2. When one object exerts a force (action) on another object, then the second object also exerts a force (reaction) on the first.
3. These two forces are always equal in magnitude but in opposite direction.
4. The forces always exist in pairs.
5. The two opposing forces are known as action and reaction forces.
6. The forces of action and reaction always act on two different bodies.

PROCEDURE

1. Find the range and the least count of the two spring balances.
2. Ensure that the two spring balances are identical.
3. Check the spring balances measure the force?
4. Hold the two spring balances vertically and ensure that their pointers are at zero mark.

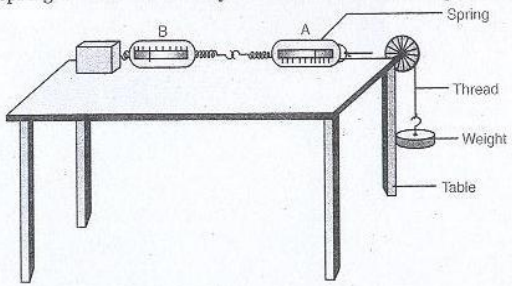

Fig. 9.1. *The experimental set up.*

5. Arrange both spring balances A and B, a pully and a pan with the help of thread.
6. The balance B must be attached to a rigid support.
7. Now identify the action and reaction forces. The force which spring balance A exerts on B is action (reading on the scale of spring balance B). The reading on the scale of balance A shows the reaction that spring balance B exerts on A.

8. Put some mass M on the hanger (say 150 g). The total mass attached to the thread is now $(M + m)$. Observe the readings of both the balances.
9. Repeat the same activity as above for at least four more masses on the pan. Tabulate your observations.

OBSERVATION AND CALCULATIONS

(*i*) Range of the two spring balances = ... N or ..... g.
(*ii*) Least count of the spring balance = ... N or ..... g.
(*iii*) Acceleration due to gravity (g) at your place = ... m s^{-2}.
(*iv*) Mass of the pan (given) m = ... g = ... kg.
(*v*) Weight of the pan $w = m$ (in kg) $\times g$ = ... N.

Sl. No.	*Mass on the pan, M*	*Total mass attached to spring balance A (M + m)*		*Total Weight attached to the balance A (M + m) × g*	*Reading on the scale*						$F_A \sim F_B$
					spring balance A			*spring balance B*			
					F_A			F_B			
	(g)	*(g)*	*(kg)*	*(N)*	*(g)*	*(kg)*	*(N)*	*(g)*	*(kg)*	*(N)*	*(N)*
1.	0										
2.											
3.											
4.											

PRECAUTIONS

(*i*) The spring balances, pointer should are at zero mark.
(*ii*) The reading of the two spring balances should be noted only when their position come to rest.
(*iii*) Spring balances should be identical.
(*iv*) The thread used should be inextensible.

VIVA-VOCE

Q. 1. Do action and reaction act on the same body or on different bodies ?
Ans. Action and reaction act on different bodies.

Q. 2. State Newton's third law of motion.
Ans. Newton's third law of motion states that action and reaction are equal and opposite and they act on different bodies.

Q. 3. Define action and reaction forces.
Ans. The force exerted by the first body on the second body is called action and the force exerted by the second body on the first body is called reaction.

Q. 4. Is action and reaction act on same body ?

Ans. No.

Q. 5. Do action and reaction forces act simultaneously ?

Ans. Yes.

Q. 6. Is action and reaction forces are equal ?

Ans. Yes.

Q. 7. Is action and reaction forces are balanced ?

Ans. No, because they act on two different bodies. In case when, they act on two different bodies forming a single system, they become balanced.

Q. 8. Give examples in the support of the third law of motion.

Ans. (*i*) Gun and bullet.

(*ii*) Man jumps from the boat to the river bank.

(*iii*) Flight of jet planes.

Q. 9. Which scientist gave the famous three laws of motion ?

Ans. Issac Newton.

Q. 10. Define one newton force.

Ans. One newton force is that force which produces an acceleration of 1 m/s² in a body of mass 1 kg.

Q. 11. Define the term force.

Ans. The external push or pull, which changes the state of rest or uniform motion or the direction of motion of a body is called force.

Q. 12. Is force a vector quantity ?

Ans. Yes.

Q. 13. What do you mean by the term interaction in physics ?

Ans. When one object changes the state of motion of another object by the application of a force, we can say the first object has interacted with the second object.

MULTIPLE CHOICE QUESTIONS

1. The action and reaction forces referred to in Newton's third law.
   (*a*) Must act on the same object
   (*b*) May act on the different objects
   (*c*) Must act on different objects
   (*d*) Need not be equal in magnitude but must have the same direction
2. Identify A in the given Fig. 9.2.
   (*a*) Action (*b*) Reaction
   (*c*) Motion (*d*) Acceleration

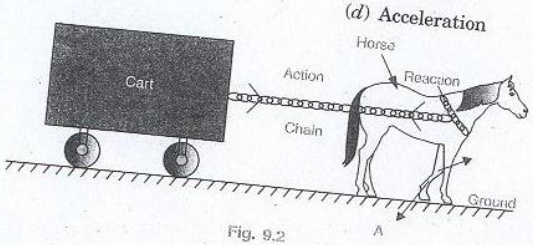

Fig. 9.2

3. Out of these which one is not an example of Newton's third law of motion :
   (*a*) Motion of an aeroplane (*b*) Walking of man
   (*c*) Flight of jet (*d*) Catching the ball by a cricketer
4. If action and reaction were to act on the same body :
   (*a*) the resultant would be zero (*b*) the body would not move at all
   (*c*) both (*a*) and (*b*) are correct (*d*) neither (*a*) nor (*b*) is correct
5. When we kick a stone, we get hurt. Due to which one of the following properties of the stone does it happen ?
   (*a*) Inertia (*b*) Velocity
   (*c*) Reaction (*d*) Momentum
6. A man is standing in a boat in still water. If he tries to walk towards the shore, the boat will :
   (*a*) move away from the shore (*b*) remain stationary
   (*c*) sink (*d*) move towards the shore
7. A fisherman is stranded in a lake because the motor of his motor-boat has failed. What should he do come to the shore ? He should start :
   (*a*) throwing the fish he has collected, away from the shore
   (*b*) throwing the fish he has collected, towards the shore
   (*c*) walking in his boat towards the shore
   (*d*) crying for help
8. During a planned manoeuvre in a space flight, a free-floating astronaut *A* pushes another free-floating astronaut *B*, the mass of *A* being greater than that of *B*. Then, the magnitude of the force exerted by the astronaut *A* on astronaut *B* is
   (*a*) equal to zero
   (*b*) equal to the force exerted by *B* on *A*
   (*c*) greater than the force exerted by *B* on *A*
   (*d*) less than the force exerted by *B* on *A*
9. In the above question during the push :
   (*a*) the acceleration of *A* is greater than that of *B*
   (*b*) the acceleration of *A* is less than that of *B*
   (*c*) neither is acclerated
   (*d*) their accelerations are equal in magnitude but opposite in direction
10. It is difficult to walk on ice because of :
    (*a*) more inertia (*b*) more friction
    (*c*) absence of friction (*d*) absence of inertia
11. Two balls at the same temperature collide. What is conserved ?
    (*a*) Momentum (*b*) Velocity
    (*c*) Temperature (*d*) Kinetic energy

12. A rocket or a jet engien works on the principle of :
(*a*) conservation of energy (*b*) conservation of momentum
(*c*) conservation of mass (*d*) Newton's second law of motion

13. Force of action and reaction on object are :
(*a*) equal (*b*) opposite
(*c*) balanced (*d*) equal and opposite

14. Consider two spring balances hooked as shown in Fig. 9.3. We pull them in opposite directions.

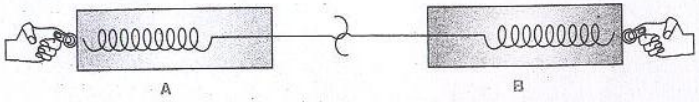

Fig. 9.3.

If the reading shown by *A* is 1.5 N, the reading shown by *B* will be
(*a*) 1.5 N (*b*) 2.5 N
(*c*) 3.0 N (*d*) zero

15. A loded gun has a bullet inside it. When the gun's trigger is pressed, the power inside cartrige, it is the example of a
(*a*) First law of motion (*b*) Second law of motion
(*c*) Third law of motion (*d*) Zeroth law of thermodynamics

Answers

1. (*c*)	**2.** (*a*)	**3.** (*d*)	**4.** (*c*)	**5.** (*c*)	**6.** (*d*)
7. (*a*)	**8.** (*b*)	**9.** (*b*)	**10.** (*c*)	**11.** (*a*)	**12.** (*b*)
13. (*d*)	**14.** (*a*)	**15.** (*c*)			

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EXPERIMENT 10

OBJECTIVE

To determine the percentage of water imbided by raisins.

MATERIALS REQUIRED

(*i*) Weight box (*ii*) Physical balance
(*iii*) Raisins (5–10 g) with intact stalk (*iv*) 250 ml beaker
(*v*) Water (*vi*) petridish
(*vii*) Filter paper.

THEORY

1. *The process of selective transmission of a liquid in preference to another or a solvent in preference to the solute through* **semipermeable membrane** *is termed* **Osmosis.**
2. The pressure which is just sufficient to stop the flow of solvent (water) from weaker solution to concentrated solution through semipermeable membrane is termed **Osmotic pressure.**
3. Raisins are actually dehydrated grapes of various varieties.
4. The swelling up of raisins, when soaked in water, takes place due to the phenomenon called **Osmosis.**
5. *The process of selective transmission of a liquid in preference to another or a solvent in preference to the solute through* **semipermeable membrane** *is termed* **Osmosis.**
6. The pressure which is just sufficient to *stop the flow* of solvent (water) from weaker solution to concentrated solution through semipermeable membrane is termed **Osmotic pressure.**
7. Semipermeable membrane allows passage of solvent (water) molecules only from hypotonic (dilute) solution to the hypertonic (concentrated) solution.
8. The gain (inflow) of water (solvent) by the cell or a body through semipermeable membrane is called as **endosmosis.**
9. The loss or out flow of water from a cell or a body through semipermeable membrane is called as **exosmosis.**

PROCEDURE

1. Weigh the dry raisins.
2. Place them in 100 ml water in a beaker (or petridish).
3. Allow the raisins to get soaked for 24 hours.
4. Take out the swollen raisins and *gently dry them with the help of filter paper.*
5. Weigh the swollen raisins using physical balance and find out the increase in weight and percentage of water absorbed.

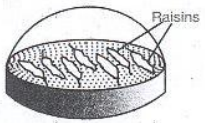

Fig. 10.1. *Raisins in water (initial stage).*

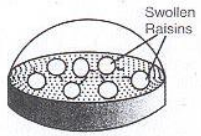

Fig. 10.2. *Raisins in water (after 24 hours).*

OBSERVATION

1. Weight of raisins taken (x_1) = ... gm.
2. Weight of swollen raisins (x_2) = ... gm.

CALCULATIONS

1. Amount of water absorbed by raisins or increase in weight of raisin = $x_2 - x_1$ gm
   = ... gm

2. Percentage of water absorbed = $\frac{\text{Increase in weight of raisins}}{\text{Weight of raisins taken}} \times 100$
   = ... %

INFERENCE

Percentage of water absorbed by raisins is = ... %.

PRECAUTIONS

1. Raisins should be clean, dry and with intact stalks.
2. Raisins should be completely immersed into water.
3. Raisins should be soaked in water for sufficient time (overnight).
4. Before weighing, gently dry the raisins with the help of filter paper.

NOTE FOR THE TEACHER

- In this study, adsorption is the process of formation of a layer of a liquid on a solid.
- In place of raisins, dry gram seeds may also be used.
- The mechanism by which the water enters the raisins or seeds is also called imbibition.

VIVA-VOCE

Q. 1. What is osmosis ?

Ans. Movement of water from hypotonic solution to hypertonic solution through semipermeable membrane is called osmosis.

Q. 2. What is endosmosis ?

Ans. The movement of water in the cell or body through a semipermeable membrane is called endosmosis.

Q. 3. How does water enter into the raisins ?

Ans. By endosmosis.

Q. 4. What is isotonic solution ?

Ans. The solution whose concentration is same as compared to internal concentration.

Q. 5. What is hypotonic solution ?

Ans. A solution which has less concentration compared to internal solution is known as hypotonic solution.

Q. 6. Define hypertonic solution.

Ans. The solution which has a greater concentration than that of internal solution is called hypertonic solution.

Q. 7. What will happen if grapes dipped into concentrated solution of sugar for sometime ? Why does it happen ?

Ans. The grapes shrink. Because solution in grapes is dilute than sugar solution outside. The skin of grapes acts as semipermeable membrane. So, *water from grapes flows into concentrate* sugar solution and grapes shrink.

Q. 8. What is exosmosis ?

Ans. The outward movement of water from a cell or a body through a semipermeable membrane.

Q. 9. What is plasmolysis ?

Ans. Excessive loss of water from a cell when kept in hypertonic solution is called plasmolysis.

Q. 10. Name two important aspects in which plants use osmosis process.

Ans. (*i*) Plant root hairs absorbs water from the soil by osmosis.

(*ii*) Movement of water/solution from cell to cell in the body of plants takes place by osmosis.

Q. 11. Define imbibition.

Ans. The process of absorption of water by a substance through a permeable surface (no condition of SPM) is called imbibition.

Q. 12. Turgidity represents a condition in the cell when it is fully stretched. Why does a cell not burst after attaining turgidity ?

Ans. The development of osmotic pressure within the cell prevents the further entry of water into the cell, thus preventing its bursting.

Q. 13. How is osmosis different from diffusion ?

Ans. (*i*) In osmosis, a semipermeable membrane is present in between the two solutions; while in diffusion, there is no semipermeable membrane.

(*ii*) In osmosis, solvent particles move; while in diffusion, solute particles move.

MULTIPLE CHOICE QUESTIONS

Choose the correct alternative :

1. Osmosis is the :
   (*a*) Process of selective transmission of a solvent in preference to another
   (*b*) Process of selective transmission of a solvent (water) in preference to the solute through semipermeable membrane
   (*c*) Both of above
   (*d*) None of above
2. Water enters into the raisins by the process of :
   (*a*) Osmosis (*b*) Endosmosis
   (*c*) Exosmosis (*d*) None of the above

3. Endosmosis is defined as :
   (*a*) The inflow of water by the cell
   (*b*) The inflow of water through a permeable membrane
   (*c*) The inflow of water through a semipermeable membrane
   (*d*) None of the above
4. What is exosmosis ?
   (*a*) Outflow of water from the cell
   (*b*) Outflow of water from the cell through a permeable membrane
   (*c*) Outflow of water from the cell through a semipermeable membrane
   (*d*) None of above
5. Percentage of water absorbed by raisins is calculated by a formula :
   (*a*) $\frac{\text{Increase in wt. of raisins}}{\text{Weight of water taken}} \times 100$ (*b*) $\frac{\text{Increase in wt. of raisins}}{\text{Weight of raisins taken}} \times 100$
   (*c*) $\frac{\text{Increase in wt. of raisins}}{\text{Weight of water absorbed}} \times 100$ (*d*) None of these.
6. Which is not correct regarding the absorption of water by raisins ?
   (*a*) Weighing must be accurate (*b*) Petridish must have sufficient water
   (*c*) Raisins must be without stalk
   (*d*) Raisins must be wiped off gently before weighing
7. In determining the percentage of water absorbed by raisins, which is necessary :
   (*a*) Raisins should be clean and completely immersed into water
   (*b*) Raisins should be soaked in water for sufficient time (overnight)
   (*c*) Before weighing, gently dry the raisins with the help of filter paper
   (*d*) All of the above
8. What will happen if grapes dipped into concentrated solution of sugar for sometime ?
   (*a*) The grapes swell (*b*) The grapes shrink
   (*c*) No change in grapes (*d*) Swell in the beginning then shrink
9. A student dissolved 1 g of sugar in 100 ml of distilled water in beaker *A*. She dissolved 100 g of sugar in 100 ml of distilled water in beaker *B*. Then she dropped a few raisins of equal weight in each beaker. After overnight she found the raisins in *A* swollen and those in *B* shrunken. The inference drawn is that :
   (*a*) Sugar concentration of raisins is lower than that of solution A and higher than that of solution B
   (*b*) Sugar concentration of raisins is higher than that of solution A and lower than that of solution B
   (*c*) In B the cell membrane of raisins was damaged resulting in leaching
   (*d*) In A the permeability to water of the cell membrane of raisins was enhanced

10. What are the important aspects in which plants use osmosis process ?
    (*a*) Plant root hairs absorb water from the soil by osmosis
    (*b*) Movement of water/solution from cell to cell in the body of plants takes place by osmosis
    (*c*) Both (*d*) None of these
11. The grapes shrink when dipped into conc. sugar solution because :
    (*a*) Solution in grapes is dilute than sugar solution outside
    (*b*) Solution in grapes in conc. than sugar solution outside
    (*c*) Concentration of solution in grapes and sugar solution is same
    (*d*) Concentration of solution in grapes and sugar is different
12. The grapes shrink when dipped in concentrated sugar solution, then peeling of the grapes act as :
    (*a*) Semipermeable membrane (*b*) Permeable membrane
    (*c*) Non-permeable (*d*) None of these
13. A student dissolved 1 g of sugar in 100 ml of distilled water in a beaker *A*. He dissolved 10 g of sugar in 1000 ml of distilled water in beaker *B*. Then he dropped a few raisins, in each. After overnight he found the raisins :
    (*a*) swollen in A and shrunken in B (*b*) shrunken in A and swollen in B
    (*c*) swollen in both (*d*) shrunken in both
14. The pressure which is just sufficient to stop the flow of solvent (water) from weaker solution to concentrated solution through semipermeable membrane is termed as :
    (*a*) Atmospheric pressure (*b*) Osmotic pressure
    (*c*) Vapour pressure (*d*) Exopressure
15. Which balance will you use to weigh the raisins ?
    (*a*) Chemical balance (*b*) Physical balance
    (*c*) Spring balance (*d*) Electronic balance
16. A student soaked 10 g of raisins in 100 ml of distilled water in two beakers *A* and *B* each. She maintained beaker *A* at 30°C and beaker *B* at 60°C. After two hours, the percentage of water absorbed will be :
    (*a*) the same in both *A* and *B* (*b*) more in *A* than in *B*
    (*c*) more in *B* than in *A* (*d*) exactly twice as much in *B* as in *A*
17. If the wt. of raisins taken 7 gm and weight of swollen raisins x gm then the amount of water absorbed by raisins will be :
    (*a*) $(7 - x)$ gm (*b*) $(x - 7)$ gm
    (*c*) $(2x - 7)$ gm (*d*) None of these
18. In the determination of percentage of water absorbed by raisins, for 5 gm raisins the amount of water required is nearly
    (*a*) 5 ml (*b*) 100 ml
    (*c*) 10 ml (*d*) any amount can be taken

19. The grapes shrink when dipped in concentrated sugar solution for sometime. It is because of :
    (*a*) Water from sugar solution flows into grapes and grapes shrink
    (*b*) Now flow of water from sugar solution into grapes
    (*c*) Water from grapes flows into concentrated sugar solution and grapes shrink
    (*d*) None of above
20. Student *A*, *B* and *C* were given five raisins each of equal weight. The raisins were soaked in distilled water at room temperature. *A* removed the raisins after 10 minutes, *B* after overnight and *C* after 60 minutes. If P_A, P_B and P_C denote percentage absorption of water obtained by students *A*, *B* and *C* respectively, then :
    (*a*) $P_A > P_B > P_C$ (*b*) $P_A < P_B < P_C$
    (*c*) $P_A < P_B > P_C$ (*d*) $P_A = P_B = P_C$
21. What are the two types of osmosis ?
    (*a*) Osmosis and reosmosis (*b*) Osmosis and endosmosis
    (*c*) Osmosis and exosmosis (*d*) Endosmosis and exosmosis
22. In the determination of % of water absorbed by raisins, raisins should be soaked in water for :
    (*a*) 2–5 hr (*b*) 24 hr
    (*c*) 5–10 hr (*d*) $\frac{1}{2}$ hr
23. To demonstrate the absorption of water raisins should be immersed into water :
    (*a*) Completely (*b*) Partially
    (*c*) Both (*d*) None of the above
24. To determine the % of water absorbed the raisins, before weighing are dried by :
    (*a*) clothes (*b*) filter paper
    (*c*) air (*d*) sunlight

Answers

1. (*b*)	**2.** (*b*)	**3.** (*c*)	**4.** (*c*)	**5.** (*b*)	**6.** (*c*)
7. (*d*)	**8.** (*b*)	**9.** (*b*)	**10.** (*c*)	**11.** (*a*)	**12.** (*a*)
13. (*c*)	**14.** (*b*)	**15.** (*b*)	**16.** (*c*)	**17.** (*b*)	**18.** (*b*)
19. (*c*)	**20.** (*c*)	**21.** (*d*)	**22.** (*b*)	**23.** (*a*)	**24.** (*b*).

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