

Materials Around Us — Case Study Worksheet Set A

Name: _____ Class & Section: _____ Date: _____

Case Study 1: The School Uniform

Riya's school uniform includes a cotton shirt, a woollen sweater for winter, and a pair of leather shoes. Her mother explained that cotton is soft and comfortable to wear in summer because it absorbs sweat, wool keeps the body warm in winter as it traps air, and leather is tough and durable, which is why it is used for shoes that face daily wear on the ground.

1. Why is cotton chosen for the summer school shirt?
2. Which property of wool makes it suitable for winter wear?
3. Why is leather, and not cloth, used for making shoes?

Case Study 2: The Kitchen Experiment

During a science activity, Arjun's teacher gave him four containers of water. In the first, she added a spoon of salt; in the second, a spoon of sand; in the third, a spoon of sugar; and in the fourth, a spoon of chalk powder. Arjun stirred each container and observed that some substances disappeared completely while others settled at the bottom, even after stirring for a long time.

1. Which substances dissolved completely in water, and what do we call such substances?
2. Which substances did not dissolve, and what property do they show?
3. How could Arjun confirm that a substance is soluble without seeing it disappear immediately?

Case Study 3: Objects that Float and Sink

During an outdoor activity, students dropped different objects into a bucket of water: an iron key, a wooden block, a plastic bottle cap, a stone, and a rubber ball. They observed that some objects immediately went to the bottom, while others stayed on the surface of the water throughout the activity.

1. Name the objects from the activity that floated on water.
2. Name the objects that sank, and explain why they sank.
3. If a heavy iron ship can float on the ocean, what does this tell us about how floating actually works?

Case Study 4: Choosing Material for an Umbrella

A shopkeeper is designing a new umbrella. He is choosing between cotton cloth, plastic-coated nylon cloth, and paper for the umbrella canopy, and between a wooden stick and a steel rod for the handle and frame.

1. Which material should the shopkeeper choose for the umbrella canopy, and why?
2. Why would paper be an unsuitable choice for the umbrella canopy?
3. Between a wooden stick and a steel rod, which is more suitable for the umbrella's frame, and why?

Case Study 5: The Mixing Liquids Activity

In a science lab activity, students poured water and mustard oil into the same beaker and stirred them. They noticed that no matter how much they stirred, the oil kept forming a separate layer above the water. In another beaker, they mixed water with a few drops of blue ink and observed that the ink spread evenly and coloured the entire water.

1. What does the behaviour of oil and water tell us about the two liquids?
2. What does the mixing of ink and water show about their nature?
3. Why do you think oil always forms a layer above water rather than below it?

Answer Key — Case Study Worksheet Set A

Case Study 1: The School Uniform

1. Cotton is a soft, breathable material that absorbs sweat and keeps the body comfortable in hot weather.
2. Wool traps air within its fibres, which helps keep the body warm, making it ideal for winter clothing.
3. Leather is a tough, hard-wearing, and durable material that can withstand friction and rough use, unlike soft cloth.

Case Study 2: The Kitchen Experiment

1. Salt and sugar dissolved completely in water; such substances are called soluble substances.
2. Sand and chalk powder did not dissolve and settled at the bottom, showing that they are insoluble in water.
3. He could stir the mixture for a longer time and check whether the water remains clear with no particles settling or floating, confirming complete dissolving.

Case Study 3: Objects that Float and Sink

1. The wooden block, the plastic bottle cap, and the rubber ball floated on the water.
2. The iron key and the stone sank because they are denser (heavier for their size) than water.
3. It shows that floating depends not just on weight but on the overall design and density of the object; a ship's hollow, wide shape displaces enough water to let it float despite being made of iron.

Case Study 4: Choosing Material for an Umbrella

1. He should choose plastic-coated nylon cloth because it is waterproof and does not let rainwater pass through, unlike cotton or paper, which absorb water.
2. Paper easily gets wet, becomes soft, and tears when it comes in contact with water, making it unsuitable for an umbrella.
3. A steel rod is more suitable because it is stronger, harder, and more durable than wood, and can be bent into a frame without breaking easily.

Case Study 5: The Mixing Liquids Activity

1. It tells us that oil and water are immiscible liquids because they do not mix and instead form two separate layers.
2. It shows that ink and water are miscible liquids because they mix completely and spread evenly to form a single coloured liquid.
3. Oil is lighter (less dense) than water, so it stays on top, while the denser water settles below.

Materials Around Us — Case Study Worksheet Set B

Name: _____ Class & Section: _____ Date: _____

Case Study 1: The Furniture Maker

A carpenter is making a study table. He has the choice of using plywood, glass, or thin cardboard for the tabletop, and either plastic or metal for the legs. He wants the table to be strong, long-lasting, and able to bear the weight of books and a study lamp every day.

1. Why would the carpenter avoid using thin cardboard for the tabletop?
2. Between plywood and glass, which is generally safer and more practical for a study tabletop, and why?
3. Why might the carpenter prefer metal legs over plastic legs for heavy daily use?

Case Study 2: The Rainy Day Problem

On a rainy day, Meena noticed that her cotton school bag became heavy and damp after walking through the rain, while her friend's plastic-coated bag remained completely dry inside. Both bags looked similar in size and design.

1. Why did Meena's cotton bag become damp in the rain?
2. Why did the plastic-coated bag stay dry?
3. What change would you suggest to make Meena's cotton bag more suitable for the rainy season?

Case Study 3: Sorting the Classroom Objects

As a class activity, the teacher asked students to sort ten classroom objects — chalk, a steel scale, a glass tumbler, a rubber eraser, a wooden duster, a plastic pen, cotton thread, a mirror, sandpaper, and a paper sheet — into groups based on hardness, transparency, and lustre.

1. Name two objects from the list that would be grouped as 'hard materials'.
2. Name two objects that would be grouped as 'transparent or translucent'.
3. Which objects from the list would you group together as 'lustrous materials', and why?

Case Study 4: The Water Purification Activity

In a village, muddy river water was collected in a large drum. When left undisturbed, the mud particles slowly settled at the bottom, leaving clearer water on top. When a spoon of salt was added to a small sample of the same clear water and stirred, it disappeared completely without leaving any particles behind.

1. Why did the mud particles settle at the bottom of the drum instead of dissolving?
2. What does the disappearance of salt in the clear water tell us about salt?

3. Based on this activity, suggest one way villagers could get cleaner water for daily household use before drinking it.

Case Study 5: Comparing Two Toy Balls

Kabir has two balls of the same size — one made of rubber and the other made of glass. When he drops both balls from the same height onto the floor, the rubber ball bounces back up, but the glass ball breaks into pieces on hitting the ground.

1. Why does the rubber ball bounce back after hitting the floor?
2. Why does the glass ball break instead of bouncing?
3. Based on this observation, which material — rubber or glass — would be more suitable for making a children's play ball, and why?

Answer Key — Case Study Worksheet Set B

Case Study 1: The Furniture Maker

1. Cardboard is a soft, weak material that bends and gets damaged easily under weight and moisture, making it unsuitable for a tabletop.
2. Plywood is generally safer and more practical because it is strong, hard-wearing, and does not break like glass, which can shatter under pressure.
3. Metal is harder and more durable than plastic, so metal legs can bear more weight and last longer without bending or breaking.

Case Study 2: The Rainy Day Problem

1. Cotton absorbs water easily, so rainwater soaked into the bag, making it damp and heavy.
2. The plastic coating is waterproof, so it did not allow rainwater to pass through and kept the inside dry.
3. A waterproof cover or a plastic coating could be added over the cotton bag to prevent rainwater from soaking through.

Case Study 3: Sorting the Classroom Objects

1. The steel scale and the glass tumbler would be grouped as hard materials since both resist being scratched or dented easily.
2. The glass tumbler is transparent, and a thin paper sheet can be considered translucent, as light passes through them.
3. The steel scale and the mirror would be grouped as lustrous materials because both have shiny, reflective surfaces.

Case Study 4: The Water Purification Activity

1. Mud is insoluble in water and denser than water, so its particles settle down instead of dissolving into the water.
2. It tells us that salt is soluble in water, as it dissolves completely and does not leave visible particles behind.
3. They could let the water settle to remove mud and then filter or boil it further to make it cleaner and safer for use.

Case Study 5: Comparing Two Toy Balls

1. Rubber is an elastic material, so it can be pressed out of shape on impact and quickly spring back to its original shape, causing it to bounce.
2. Glass is a hard but brittle material; it does not bend or stretch on impact and shatters under the sudden force instead.
3. Rubber would be more suitable because it is elastic, does not break easily, and is safe for children to play with.

Materials Around Us — Case Study Worksheet Set C

Name: _____ Class & Section: _____ Date: _____

Case Study 1: The Science Fair Model

For a science fair, Ayesha built a small model boat using a thin sheet of thermocol (a type of foam), while her friend Sam built a similar-sized boat using a thin sheet of iron. When both boats were placed on water in a tub, Ayesha's boat floated easily, but Sam's iron boat sank immediately.

1. Why did Ayesha's thermocol boat float on water?
2. Why did Sam's iron boat sink, even though real iron ships float on the sea?
3. What change could Sam make to his iron boat design so that it floats like a real ship?

Case Study 2: The Paint and Varnish Activity

A carpenter noticed that an untreated wooden chair kept in the garden absorbed rainwater and slowly started to rot, while a similar chair coated with varnish remained dry and undamaged even after months outdoors.

1. Why did the untreated wooden chair absorb rainwater?
2. How did the varnish coating protect the second chair?
3. Suggest one more way, apart from varnish, to protect outdoor wooden furniture from water damage.

Case Study 3: The Mixed-Up Labels

In the science lab, four unlabelled containers held white powders: one was salt, one was chalk powder, one was sugar, and one was fine sand. A student was asked to identify each powder using only water and stirring, without tasting any of them.

1. How can the student use water to separate the soluble powders from the insoluble ones?
2. The student notices that chalk powder settles slowly, while sand settles quickly. What might this suggest about the two materials?
3. Since both salt and sugar dissolve completely, suggest one other property (not taste) the student could use to try to tell them apart.

Case Study 4: The Broken Toy Investigation

Little Aryan's favourite toy car had wheels made of hard plastic. After being dropped on a hard floor, one plastic wheel cracked, while a rubber ball he was also playing with survived being dropped many times without any damage.

1. Why did the hard plastic wheel crack instead of bouncing back after the fall?
2. Why did the rubber ball remain undamaged after being dropped repeatedly?

3. If Aryan's parents want to buy a more durable toy car, which material would you suggest for the wheels, and why?

Case Study 5: The Classroom Window Debate

While designing a new classroom, an architect must choose materials for the windows. She is comparing three options: plain transparent glass, frosted (translucent) glass for the washroom, and a solid wooden panel for a storeroom that needs no light at all.

1. Why would the architect choose plain transparent glass for the classroom windows?
2. Why is frosted (translucent) glass a better choice for the washroom than plain transparent glass?
3. Why is a solid wooden panel suitable for the storeroom instead of any glass?

Answer Key — Case Study Worksheet Set C

Case Study 1: The Science Fair Model

1. Thermocol is a very light material that is much less dense than water, so it easily floats on the surface.
2. A flat sheet of iron is denser than water and sinks, but a properly shaped hollow iron ship displaces enough water to float despite being made of iron.
3. He could shape the iron sheet into a hollow, wide structure (like a real ship's hull) instead of a flat sheet, so it displaces more water and stays afloat.

Case Study 2: The Paint and Varnish Activity

1. Untreated wood has tiny pores that can soak up water, so the chair absorbed rainwater and became damp.
2. The varnish formed a waterproof layer over the wood, preventing rainwater from soaking into the wooden surface.
3. Painting the wood with waterproof paint, or covering it with a plastic sheet during rains, could also protect it from water damage.

Case Study 3: The Mixed-Up Labels

1. By adding each powder to water and stirring, the powders that dissolve completely (salt and sugar) can be separated from those that remain visible or settle down (chalk powder and sand).
2. It suggests that sand particles are heavier or denser than chalk powder particles, causing them to settle faster in water.
3. The student could compare their appearance closely, such as crystal shape and texture, or check other properties like how they behave when heated, since taste testing unknown lab substances is not safe.

Case Study 4: The Broken Toy Investigation

1. Hard plastic is stiff and not very elastic, so instead of bending and springing back like rubber, it cracks under a sudden sharp force.
2. Rubber is an elastic material that can absorb the impact by changing shape briefly and then springing back to normal, protecting it from damage.
3. A slightly flexible or rubber-coated wheel would be better, as it can absorb shocks from falls without cracking, unlike rigid hard plastic.

Case Study 5: The Classroom Window Debate

1. Transparent glass allows maximum sunlight to pass through clearly, keeping the classroom well-lit while still letting students see outside.
2. Frosted glass allows light to enter while blurring the view, which provides both brightness and privacy, unlike plain glass, which would let others see inside clearly.
3. The storeroom needs no light and requires security and strength, so an opaque, sturdy wooden panel blocks light and view completely while also being durable.