

IGCSE Physics Worksheet — Thermal Expansion

Reading Passage

All matter is made of particles that move. When a substance is heated, its particles gain kinetic energy and move faster. As they move more vigorously, the average spacing between particles increases. This causes the substance to expand. When cooled, particles lose energy and move closer together, causing contraction.

Expansion in Solids: Solids expand the least because their particles are tightly packed and can only vibrate in fixed positions. Gaps are left between railway tracks and bridges to allow for expansion on hot days.

Expansion in Liquids: Liquids expand more than solids because their particles are further apart and can move more freely. A common example is the rising level of liquid in a thermometer when heated.

Expansion in Gases: Gases expand the most. Their particles are far apart and move rapidly. When heated, gas pressure increases unless the gas is allowed to expand. This is why aerosol cans warn against heating—they may burst due to increased pressure.

Applications: Bimetallic strips in thermostats bend when heated because the two metals expand at different rates. Overhead power cables sag more in summer due to expansion. Glassware can crack if heated unevenly because different parts expand at different rates.

Heating → particles move faster → spacing increases → expansion

Solid: [●●●●●] → slightly expands

Liquid: [●●●●] → expands more

Gas: [● ● ●] → expands the most

Multiple Choice Questions

1. Thermal expansion occurs because:
 - A. Particles become heavier
 - B. Particles move faster and spread out
 - C. New particles are created
 - D. Particles change shape

2. Which state expands the most?
 - A. Solid
 - B. Liquid
 - C. Gas
 - D. Plasma
3. Railway tracks have gaps to:
 - A. Reduce friction
 - B. Allow for thermal expansion
 - C. Make construction easier
 - D. Prevent rusting
4. A bimetallic strip bends because:
 - A. Both metals expand equally
 - B. One metal expands more
 - C. The strip melts
 - D. The metals contract
5. Aerosol cans should not be heated because:
 - A. Gas contracts
 - B. Gas pressure increases
 - C. Liquid evaporates
 - D. Can becomes lighter

Structured Questions

6. Explain why solids expand less than liquids and gases.
7. Describe what happens to gas particles when heated in a sealed container.
8. Explain why a sealed glass bottle full of water may burst when heated.
9. Describe how a bimetallic strip works in a thermostat.
10. Explain why overhead power cables sag more in summer.

Teacher-Only Answer Key

MCQ Answers: 1. B 2. C 3. B 4. B 5. B

Structured Answers:

6. Solids have particles packed closely together in fixed positions, so expansion is small. Liquids and gases have more freedom of movement, so they expand more.

7. Gas particles gain kinetic energy, move faster, and collide with container walls more frequently and forcefully, increasing pressure.

8. Water expands when heated. If sealed, pressure builds up and may cause the bottle to burst.

9. A bimetallic strip has two metals that expand at different rates. When heated, one expands more, causing the strip to bend and operate a switch.

10. Metal cables expand in hot weather, becoming longer and sagging. In cold weather, they contract and become tighter.

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