

Worksheet 01: Matter Classification and Particle Models

Trimester school assessment - IB-style practice with SL and HL questions | Time: 50 minutes | Total: 40 marks

Name:	Class:	Date:	Total: 40 marks
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Focus: Classifying matter as elements, compounds, homogeneous mixtures and heterogeneous mixtures, using particle models and command terms.

Instructions: Answer all questions. Show working where relevant. HL questions are marked with [HL]. For extended responses, use clear scientific language and link particle-level explanations to observable properties.

Section A - Multiple choice (8 marks)

Choose the best answer, A, B, C or D. Each question is worth 1 mark.

1. Which sample must contain only one type of atom?

- A. sodium chloride
- B. carbon dioxide
- C. copper metal
- D. air

2. Which statement best describes a compound?

- A. Particles are mixed in any ratio.
- B. Different elements are chemically bonded in a fixed ratio.
- C. One element is dissolved in another.
- D. Different elements can be separated by filtration.

3. Which is a homogeneous mixture?

- A. salt solution
- B. sand and iron filings
- C. water and oil
- D. granite with visible crystals

4. A student writes Co and CO in a table. Which statement is correct?

- A. Both represent cobalt.
- B. Both represent compounds.
- C. Co is an element and CO is a compound.
- D. Co is a compound and CO is an element.

5. Which statement about mixtures is correct?

- A. They always have fixed melting points.
- B. Their components are not chemically bonded to each other.
- C. They must contain only elements.
- D. They always have a uniform composition.

6. Which physical method would most directly separate iron filings from sulfur powder?

- A. distillation
- B. chromatography
- C. magnetism
- D. crystallization

7. A particle diagram shows identical pairs of bonded atoms. The sample is best classified as

- A. a mixture of elements
- B. a compound
- C. a heterogeneous mixture
- D. an alloy

8. [HL] Which statement best identifies a limitation of a simple particle model of matter?

- A. It cannot be used to classify elements.
- B. It may not show the real size, forces or motion of particles accurately.
- C. It proves that all mixtures are homogeneous.
- D. It shows exact electron arrangements in every atom.

Section B - Short answer (12 marks)

9. Distinguish between an element and a compound using the ideas of atom type and bonding. (4)

10. A beaker contains water, dissolved sugar and undissolved sand. Classify the overall sample and explain how each part of the sample supports your classification. (4)

11. The formula for glucose is $C_6H_{12}O_6$. State the elements present and the number of atoms of each element in one molecule. (3)

[HL] 12. Explain why a mixture may appear homogeneous at the macroscopic scale but still be described by a particle model containing different types of particles. (1)

Section C - Data response / case study (10 marks)

13. Four unknown samples are described below.

Sample	Observation and particle-level description
P	Shiny solid made from only one type of atom; cannot be decomposed chemically.
Q	Clear liquid with particles of salt evenly distributed between water molecules.
R	White crystals formed by sodium and chlorine in a fixed 1:1 ratio.
S	Two visible layers form after shaking oil with water.

(a) Classify P, Q, R and S as element, compound, homogeneous mixture or heterogeneous mixture. (4)

(b) State one physical method that could be used to separate a component from Q. (1)

(c) Explain why R is not a mixture even though it contains two elements. (2)

(d) [HL] Suggest why the classification of S depends on the scale at which it is observed. (3)

Section D - Extended response (10 marks)

14. A student claims: "All matter can be understood simply by naming whether it is an element, compound or mixture." Evaluate this claim using examples from chemistry and the particle model. Include one limitation of the model in your answer. (10)

Answer Key and Marking Guidance - Worksheet 01

General marking guidance: Award marks for chemically correct answers expressed in equivalent wording. Do not award a mark twice for the same idea. For calculations, allow error carried forward if the method is correct. HL marking points may be used as extension credit where appropriate.

Section A: 1 C; 2 B; 3 A; 4 C; 5 B; 6 C; 7 B; 8 B

Section B: 9. Element: pure substance with one type of atom and cannot be chemically decomposed (2); compound: two or more elements chemically bonded in a fixed ratio (2). 10. Heterogeneous mixture overall because undissolved sand is not uniformly distributed (1); water and sugar form a homogeneous solution (1); sand remains a separate solid phase (1); components are not chemically bonded and can be separated physically (1). 11. Carbon, hydrogen and oxygen (1); C = 6 (1), H = 12 and O = 6 (1). 12. Macroscopic uniformity can occur when different particles are evenly distributed; the particle model still shows more than one particle type (1).

Section C: 13(a) P element, Q homogeneous mixture/solution, R compound, S heterogeneous mixture (4). (b) Evaporation, crystallization or distillation depending on the desired component (1). (c) R has sodium and chlorine chemically bonded in a fixed ratio and has properties different from its elements (2). (d) On a large scale the layers are clearly non-uniform (1); at a very small sampled region one phase may appear uniform (1); classification should specify the scale and observation method (1).

Section D: Award up to 10 marks. Strong answers should classify matter correctly with examples (2), explain that classification is useful for predicting separation methods and composition (2), link to particle model ideas such as atom type, bonding, fixed ratio and particle distribution (3), evaluate the claim by showing that classification alone does not explain forces, motion, energy or reactivity (2), and give a clear limitation of models such as not showing true scale or exact interactions (1).