Blast-off : Periodic Table Mark Scheme

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Table Completion

Name of Substance	Chemical Formula	Element or Compound?
Water	H_2O	Compound
Nitrogen	N_2	Element
Carbon Dioxide	CO_2	Compound
Ammonia	NH_3	Compound
Sulfur Dioxide	SO_2	Compound
Hydrogen	H_2	Element
Hydrogen Chloride	HCl	Compound
Oxygen	O_2	Element

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Atomic Structure Table

Element	Atomic No	Mass No	No of Protons	No of Electrons	No of Neutrons
Hydrogen	1	1	1	1	0
Oxygen	8	16	8	8	8
Sodium	11	23	11	11	12
Potassium	19	39	19	19	20
Calcium	20	40	20	20	20
Sulfur	16	32	16	16	16
Phosphorus	15	31	15	15	16

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What Elements Do Compounds Contain?

Compound	Element 1	Element 2	Bonus Element
Aluminium Oxide	Aluminium	Oxygen	-
Copper Chloride	Copper	Chlorine	-
Magnesium Carbonate	Magnesium	Carbon	Oxygen
Sodium Chloride	Sodium	Chlorine	-
Sodium Hydroxide	Sodium	Oxygen	Hydrogen
Iron Sulfide	Iron	Sulfur	-
Copper Carbonate	Copper	Carbon	Oxygen
Hydrochloric Acid	Hydrogen	Chlorine	-
Magnesium Chloride	Magnesium	Chlorine	-
Copper Sulfate	Copper	Sulfur	Oxygen

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Compounds Table

Symbol	Name	Elements
$CaCO_3$	Calcium Carbonate	Calcium, Carbon, Oxygen
O_2	Oxygen Molecule	Oxygen
H_2O	Water	Hydrogen, Oxygen
CO_2	Carbon Dioxide	Carbon, Oxygen
HCl	Hydrogen Chloride	Hydrogen, Chlorine

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Mass Calculations

- **Iron Sulfide:**
  5.0 g+9.0 g=14.0 g5.0
- **Oxygen:**
  11.0 g−8.0 g=3.0

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Particle Diagrams

1. **Mixture of Two Different Molecular Forms:**
   Answer: D
2. **Physical Change Only:**
   Answer: C
3. **One Pure Substance:**
   Answer: B

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4. **Only One Compound Composed of X and Z:**
   Answer: C
5. **Mixture of X and Z Only:**
   Answer: B

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6. **Sample Containing CO(g):**
   Answer: A
7. **Molecules of One Compound in Gaseous Phase:**
   Answer: D

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8. **Mixtures of Diatomic Elements:**
   Answer: A and c

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Correcting Mistakes in Student Answers

1. **Air is not a compound; it is a mixture of gases.**
2. **The symbol for carbon is C, not Ca (which is calcium).**
3. **Carbon dioxide is a compound, not an element.**

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Match and Draw

Symbol	Name
Fe	Iron
Au	Gold
Ag	Silver
C	Carbon
K	Potassium
Ca	Calcium

True or False?

1. Water is an element. **False** (Water is a compound.)
2. Carbon dioxide is a compound. **True**
3. A compound can only contain 2 elements chemically combined. **False** (It can contain more.)
4. There are about 120 elements that can be found on the periodic table. **True**
5. All the elements were found at the same time. **False** (They were discovered over time.)

Model Drawing

- **Carbon Dioxide:** A central carbon atom with double bonds to two oxygen atoms.
- **Sulphur Dioxide:** A central sulphur atom with double bonds to two oxygen atoms in a bent structure.

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Word Search

- **Elements (green):** Carbon, Nitrogen, Oxygen, Potassium.
- **Compounds (blue):** Carbon dioxide, Carbon monoxide, Sulphur dioxide, Water.

What Are We?

Label	Name
A	compound
B	mixture
C	element
D	Element – diatomic element

Name the Elements

1. **Carbon dioxide:** Carbon, Oxygen.
2. **Sodium iodide:** Sodium, Iodine.
3. **Calcium carbonate:** Calcium, Carbon, Oxygen.

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How Many?

Name of Compound	No. of Atoms
CO_2	1 C, 2 O
H_2SO_4	2 H, 1 S, 4 O
CO	1 C, 1 O

Name of Compound	No. of Atoms
$CaCO_3$	1 Ca, 1 C, 3 O

Match and Draw

Compound	Symbol
Carbon dioxide	CO_2
Hydrochloric acid	HCl
Copper carbonate	$CuCO_3$
Magnesium oxide	MgO
Sulphuric acid	H_2SO_4
Sodium iodide	NaI

What Am I?

1. **Oxygen** (Element carried by red blood cells).
2. **Carbon dioxide** (Compound exhaled by the body).
3. **Magnesium** (Burns brightly).
4. **Air** (Mixture of gases).

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Definitions of Diffusion

- **Correct definition:** Movement of particles from an area of high concentration to an area of low concentration, until equilibrium.

Separation Techniques

Picture	Technique
1	Chromatography
2	Distillation
3	Evaporation
4	Filtration

Purity Characteristic

- **Answer:** Melting or boiling point.

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Separating Mixtures

Technique	Description
Filtration	Separates insoluble substances in a solvent from soluble ones.
Evaporation	Obtains pure salt from a salt solution.
Distillation	Separates and collects a solvent from a solution.
Fractional Distillation	Separates miscible liquids with different boiling points.
Chromatography	Separates substances based on their solubility in a solvent.

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1(a)(i)

Molly thought that magnesium would react more vigorously with hydrochloric acid because:

- Hydrochloric acid is stronger than vinegar (a weak acid).

- The table might indicate that hydrochloric acid reacts faster with metals than vinegar.

1(a)(ii)

Molly could observe the following to determine which reaction was more vigorous:

- The rate of bubbling (hydrogen gas produced).
- The temperature increase in the test tube.
- The time taken for the magnesium to completely dissolve.

1(b)(i)

Word equation: Magnesium + Hydrochloric acid → Magnesium chloride + Hydrogen.

1(b)(ii)

The reaction stopped because:

- All the magnesium was used up.
- Or the acid was completely neutralized.

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2(a)

- Diagram A: **Distillation.**
- Diagram B: **Filtration.**
- Diagram C: **Crystallization.**

2(b)(i)

Debbie would use **B** (Filtration) to separate the sand from salt water.

2(b)(ii)

Debbie would use **A** (Distillation) to separate pure water from salt water.

2(c)

Magnesium chloride is:

- **A compound.**
- **A salt.**

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3(d)(i)

Predicted temperature: Close to the temperature of the cooling water (e.g., 15°C).

Explanation: The condenser cools the water vapor back into liquid form by removing heat.

3(d)(ii)

Two changes in water vapor:

1. It cools down.
2. It condenses into liquid water.

3(e)

The condenser in **Apparatus A** is better because:

- It allows for efficient cooling of the vapor.
- It prevents loss of vapor by condensing it completely.

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4(a)(i)

A mixture of gases: **D**.

4(a)(ii)

A single compound: **C**.

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4(b)(i)

The diagram shows that a chemical reaction took place because:

- The substances combined to form a new product with different properties.

4(b)(ii)

Substance Q: Oxygen.

Substance R: Carbon dioxide.

4(b)(iii)

The diagram shows conservation of mass because:

- The number of atoms of each element is the same before and after the reaction.

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5(a)

Order of reactivity:

1. **Zinc (most reactive)**
2. **Copper**
3. **Lead**
4. **Silver (least reactive)**

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(b)

Metal that reacted: Zinc.

Explanation: Zinc reacts with dilute hydrochloric acid to produce hydrogen gas, while other metals in the series might not.

(c)

Prediction correctness: The prediction is incorrect.

Explanation: Zinc will react with silver nitrate in a displacement reaction because zinc is more reactive than silver.

(d)

Gold placement in reactivity series: Gold should be placed at the bottom of the series.

Explanation: Gold is very unreactive and does not easily form compounds with other elements.

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6(a)(i)

Type of substance (paint): A mixture.

6(a)(ii)

Type of substance (titanium dioxide): A compound.

6(a)(iii)

Reason particles sank: The particles are denser than the liquid, causing them to settle at the bottom.

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7(a)(i)

Mixture of two elements: Diagram A.

7(a)(ii)

Mixture of two compounds: Diagram D.
7(a)(iii)
Mixture of an element and a compound: Diagram C.
7(b)
Difference between a compound and a mixture:

- A compound has chemically combined elements with fixed proportions.
- A mixture has physically combined substances that can be separated.

7(c)(i)
Name and formula (diagram B):
Name: Oxygen gas.
Formula: O_2.
7(c)(ii)
Name and formula (diagram D):
Name: Water.
Formula: H_2O.

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8(a)
Properties suggesting jovium is a metal:

- It has a high melting point.
- It is a good conductor of heat and electricity.

8(b)(i)
Method of separation: Filtration.
8(b)(ii)
Labels for results:

- A: Filter paper.
- B: Filtrate.

8(c)
What happened to the liquid: It evaporated, leaving blue crystals in the dish.