

# Periodic Table [D]

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1. The Periodic Table was originally developed as a list of atoms arranged in terms of their mass and chemical reactivity. We now think of it as a list of elements.
  - a. What order are the elements listed? **[2]**
  
  - b. State the name and symbol of the element in Period 5, Group 4: **[2]**
  
  - c. Elements can be classified as metals or non-metals.
    - i. State two properties of metals: **[2]**
  
    - ii. An element was combusted in oxygen and the product of the reaction dissolved in water to form a solution with pH 3. What type of element was it?  
**[1]**
  
  - d. Explain why, in terms of the arrangement of electrons, two elements in the same Group undergo similar chemical reactions: **[2]**
  
  - e. State the name and symbol of an element that you would expect to have very small atoms and be chemically inert: **[2]**

2. Group 1 metals all highly reactive.

a. Sodium reacts violently with water to produce an alkaline solution.

i. Write a balanced equation, including state symbols, for the reaction of sodium with water: **[3]**

ii. State three observations you would make during this reaction: **[3]**

iii. Would you expect rubidium to react more or less violently than sodium? **[1]**

b. Potassium is so reactive that it tarnishes when exposed to air within seconds.

i. Write a balanced equation for the formation of potassium oxide: **[2]**

ii. State and explain the colour universal indicator would turn if added to a solution of potassium oxide in water: **[2]**

3. The Group 7 elements (the Halogens) are a series of reactive non-metals.
- a. The halogens each have distinctive physical properties. State the difference between bromine and iodine in terms of:
- State at room temperature and pressure: **[2]**
  - Colour: **[2]**
- b. Hydrogen chloride is a colourless gas that dissolves in water.
- Write a balanced equation, with state symbols, for the formation of hydrogen chloride: **[3]**
  - State the colour change you would observe during the reaction in part i: **[2]**
  - Explain why hydrogen chloride dissolved in water turns blue litmus paper red but hydrogen chloride dissolved in methylbenzene does not: **[4]**
- c. Fluorine is a yellow gas at room temperature and pressure.
- State whether it is more or less reactive than iodine: **[1]**

- d. You are provided with bottles of the following solutions. Explain how, using the word *oxidise*, you could show that iodine is less reactive than bromine: **[5]**

KCl(aq), KBr(aq), KI(aq)

Cl<sub>2</sub>(aq), Br<sub>2</sub>(aq), I<sub>2</sub>(aq)

4. Oxygen is a reactive gas at room temperature and pressure.

- a. It can be produced by the decomposition of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>):

i. Write a balanced equation for this reaction: **[2]**

ii. State a suitable catalyst for this reaction: **[1]**

- b. State the percentage of oxygen in air at atmospheric pressure: **[1]**

- c. Other elements can combust in oxygen.
- i. Write a balanced equation for the combustion of sulphur: **[2]**
  - ii. This reaction occurs as a side-reaction in various industrial processes. Explain how it contributes towards acid rain: **[2]**
- d. Write a balanced equation for the combustion of hydrogen: **[2]**
- e. Carbon also combusts in plentiful oxygen to form carbon dioxide.
- i. State two uses for carbon dioxide: **[2]**
  - ii. Describe one other way, including a balanced equation, to produce carbon dioxide: **[3]**
  - iii. Describe the test for carbon dioxide: **[2]**

# Periodic Table [S]

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1. The Periodic Table was originally developed as a list of atoms arranged in terms of their mass and chemical reactivity. We now think of it as a list of elements.

a. What order are the elements listed? [2]

**increasing... [1] ... atomic number [1]**

b. State the name and symbol of the element in Period 5, Group 4: [2]

**Sn [1], tin [1]**

c. Elements can be classified as metals or non-metals.

i. State two properties of metals: [2]

**conduct electricity, malleable, ductile, alkaline/basic oxide, dense**

**[1] each, maximum [2]**

ii. An element was combusted in oxygen and the product of the reaction

dissolved in water to form a solution with pH 3. What type of element was it?

**[1]**

**non-metal [1]**

d. Explain why, in terms of the arrangement of electrons, two elements in the same Group undergo similar chemical reactions: [2]

**chemical reactions depend on outer-shell electrons [1]**

**two elements in the same group have the same number of outer-shell electrons [1]**

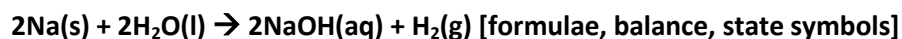
e. State the name and symbol of an element that you would expect to have very small atoms and be chemically inert: [2]

**He [1], helium [1] (allow Ne, neon although clearly He is smaller)**

2. Group 1 metals all highly reactive.

a. Sodium reacts violently with water to produce an alkaline solution.

- i. Write a balanced equation, including state symbols, for the reaction of sodium with water: **[3]**



- ii. State three observations you would make during this reaction: **[3]**

**fizzing, Na floats, Na moves around, Na disappears, heat given off**

**[1] each, maximum [3]**

- iii. Would you expect rubidium to react more or less violently than sodium? **[1]**

**more violently [1]**

b. Potassium is so reactive that it tarnishes when exposed to air within seconds.

- i. Write a balanced equation for the formation of potassium oxide: **[2]**



- ii. State and explain the colour universal indicator would turn if added to a solution of potassium oxide in water: **[2]**

**purple/blue [1], because solution is alkaline [1]**

3. The Group 7 elements (the Halogens) are a series of reactive non-metals.
- a. The halogens each have distinctive physical properties. State the difference between bromine and iodine in terms of:
- State at room temperature and pressure: **[2]**  
**bromine is liquid [1], iodine is solid [1]**
  - Colour: **[2]**  
**bromine is red/brown [1], iodine is grey (NOT purple) [1]**
- b. Hydrogen chloride is a colourless gas that dissolves in water.
- Write a balanced equation, with state symbols, for the formation of hydrogen chloride: **[3]**  
 **$\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$  [formulae, balance, state symbols]**
  - State the colour change you would observe during the reaction in part i: **[2]**  
**green [1] to colourless [1]**
  - Explain why hydrogen chloride dissolved in water turns blue litmus paper red but hydrogen chloride dissolved in methylbenzene does not: **[4]**  
**HCl dissociates to give  $\text{H}^+$  in water [1]**  
**so it is acidic and turns blue litmus to red [1]**  
**HCl does not dissociate in methylbenzene so there's no  $\text{H}^+$  [1]**  
**so it is not acidic and blue litmus remains the same colour [1]**
- c. Fluorine is a yellow gas at room temperature and pressure.
- State whether it is more or less reactive than iodine: **[1]**  
**more reactive [1]**



- d. You are provided with bottles of the following solutions. Explain how, using the word *oxidise*, you could show that iodine is less reactive than bromine: [5]

KCl(aq), KBr(aq), KI(aq)

Cl<sub>2</sub>(aq), Br<sub>2</sub>(aq), I<sub>2</sub>(aq)

**add Br<sub>2</sub>(aq) to KI(aq) [1]**

**the colour changes from orange [1] to brown (NOT purple) [1]**

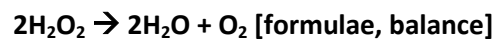
**this shows that iodine has been oxidised by bromine [1]**

**so iodine must be less reactive than bromine [1]**

4. Oxygen is a reactive gas at room temperature and pressure.

- a. It can be produced by the decomposition of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>):

- i. Write a balanced equation for this reaction: [2]



- ii. State a suitable catalyst for this reaction: [1]

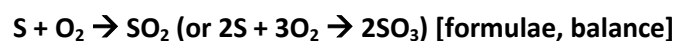
**iron oxide, manganese oxide, copper oxide [1 for any]**

- b. State the percentage of oxygen in air at atmospheric pressure: [1]

**21%**

c. Other elements can combust in oxygen.

i. Write a balanced equation for the combustion of sulphur: **[2]**



ii. This reaction occurs as a side-reaction in various industrial processes. Explain how it contributes towards acid rain: **[2]**

**$SO_2$  (or  $SO_3$ ) dissolves in rainwater [1]**

**to form an acidic solution [1]**

d. Write a balanced equation for the combustion of hydrogen: **[2]**



e. Carbon also combusts in plentiful oxygen to form carbon dioxide.

i. State two uses for carbon dioxide: **[2]**

**carbonated drinks [1]**

**fire extinguishers [1]**

ii. Describe one other way, including a balanced equation, to produce carbon dioxide: **[3]**

**heat a metal carbonate [1] OR add an acid to a metal carbonate [1]**

**collect the gas that forms [1]**

**under water [1] OR by displacement of water [1]**

iii. Describe the test for carbon dioxide: **[2]**

**Bubble through limewater [1], which goes cloudy [1]**