

1 What is the electronic configuration for the particle  ${}_{13}^{27}\text{Al}^{+}$ ?

- A**  $1s^2 2s^2 2p^6 3s^1 3p^1$   
**B**  $1s^2 2s^2 2p^6 3s^2$   
**C**  $1s^2 2s^2 2p^6 3s^2 3p^2$   
**D**  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7 4s^1$

2 The data in the table gives the 5th to the 10th ionisation energies of three elements from Period 3 of the Periodic Table.

| element | ionisation energy / $\text{kJ mol}^{-1}$ |        |        |        |        |        |
|---------|------------------------------------------|--------|--------|--------|--------|--------|
|         | 5th                                      | 6th    | 7th    | 8th    | 9th    | 10th   |
| X       | 6274                                     | 21 269 | 25 398 | 29 855 | 35 868 | 40 960 |
| Y       | 7012                                     | 8 496  | 27 107 | 31 671 | 36 579 | 43 140 |
| Z       | 6542                                     | 9 362  | 11 018 | 33 606 | 38 601 | 43 963 |

What are the correct identities of these three elements?

|          | element X | element Y | element Z |
|----------|-----------|-----------|-----------|
| <b>A</b> | Na        | Mg        | Al        |
| <b>B</b> | Mg        | Al        | Si        |
| <b>C</b> | P         | S         | Cl        |
| <b>D</b> | S         | Cl        | Ar        |

1 What is the electrons in boxes notation for the  $\text{Fe}^{3+}$  ion?

- A** [Ar] 

|                      |            |  |  |  |                      |
|----------------------|------------|--|--|--|----------------------|
| 3d                   |            |  |  |  | 4s                   |
| $\uparrow\downarrow$ | $\uparrow$ |  |  |  | $\uparrow\downarrow$ |
- B** [Ar] 

|            |            |            |  |  |                      |
|------------|------------|------------|--|--|----------------------|
| 3d         |            |            |  |  | 4s                   |
| $\uparrow$ | $\uparrow$ | $\uparrow$ |  |  | $\uparrow\downarrow$ |
- C** [Ar] 

|                      |            |            |            |  |    |
|----------------------|------------|------------|------------|--|----|
| 3d                   |            |            |            |  | 4s |
| $\uparrow\downarrow$ | $\uparrow$ | $\uparrow$ | $\uparrow$ |  |    |
- D** [Ar] 

|            |            |            |            |            |    |
|------------|------------|------------|------------|------------|----|
| 3d         |            |            |            |            | 4s |
| $\uparrow$ | $\uparrow$ | $\uparrow$ | $\uparrow$ | $\uparrow$ |    |

2 Which equation has an energy change that is equal to the first ionisation energy of bromine?

- A  $\text{Br(g)} \rightarrow \text{Br}^{\text{+}}(\text{g}) + \text{e}^{-}$   
B  $\text{Br(g)} \rightarrow \text{Br}^{-}(\text{g}) - \text{e}^{-}$   
C  $\frac{1}{2} \text{Br}_2(\text{g}) \rightarrow \text{Br}^{\text{+}}(\text{g}) + \text{e}^{-}$   
D  $\frac{1}{2} \text{Br}_2(\text{g}) \rightarrow \text{Br}^{-}(\text{g}) - \text{e}^{-}$

4 Which statement is correct?

- A The relative atomic mass of a  $^{35}\text{Cl}$  atom is 35.5.  
B The relative molecular mass of  $\text{O}_2$  is 16.0.  
C The relative formula mass of  $\text{CaCO}_3$  is 100.1.  
D The relative isotopic mass of a  $^{24}\text{Mg}$  atom is 24.3.

7 X and Y are different elements in Period 3.

Atoms of X and Y each have only one completely filled orbital in their highest occupied energy sub-shell.

Y has a greater first ionisation energy than X.

Which row shows the structure and bonding in X and Y?

|   | X                | Y                |
|---|------------------|------------------|
| A | giant metallic   | giant metallic   |
| B | giant metallic   | simple molecular |
| C | giant covalent   | simple molecular |
| D | simple molecular | simple molecular |

1 Helium forms an ion  $^3_2\text{He}^{+}$ .

Three statements about this ion are listed.

- 1 It contains two protons.  
2 It contains three neutrons.  
3 It contains one electron.

Which statements are correct?

- A 1, 2 and 3      B 1 and 3 only      C 2 and 3 only      D 2 only

**2** The table shows the first five ionisation energies of element X.

| element | ionisation energy / kJ mol <sup>-1</sup> |      |      |        |        |
|---------|------------------------------------------|------|------|--------|--------|
|         | 1st                                      | 2nd  | 3rd  | 4th    | 5th    |
| X       | 736                                      | 1450 | 7740 | 10 500 | 13 600 |

Element X is in Period 3 of the Periodic Table.

What is element X?

- A** sodium
- B** magnesium
- C** silicon
- D** argon

**3** Methanethiol, CH<sub>3</sub>SH, burns as shown.



A sample of 10 cm<sup>3</sup> of methanethiol gas was reacted with 60 cm<sup>3</sup> of oxygen. Both samples were measured at room conditions.

What would be the final volume of the resultant mixture of gases measured at room temperature?

- A** 20 cm<sup>3</sup>      **B** 30 cm<sup>3</sup>      **C** 50 cm<sup>3</sup>      **D** 70 cm<sup>3</sup>