26 Which row identifies a transition element?

	melting point	density at r.t.p.
A	high	high
B	high	low
C	low	high
D	low	low

23 Some properties of elements are listed.

1 They have good electrical conductivity.

2 They have high melting points.

3 They are malleable.

4 They have ions with variable oxidation numbers.

Which properties are correct for **both** iron and lithium?

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

24 Which element is a transition element?

	melting point in °C	density at r.t.p. in g / cm^3	colour of oxide at r.t.p.
A	98	1.0	white
B	328	11.3	yellow
C	651	1.7	white
D	1907	7.2	green

5 Manganese is the element with atomic number 25 in the Periodic Table.
Calcium is the element with atomic number 20 in the Periodic Table.

(a) Complete Table 5.1 to show the number of protons, neutrons and electrons in the ^{55}Mn atom and the $^{42}Ca^{2+}$ ion.

Table 5.1

	^{55}Mn	$^{42}Ca^{2+}$
protons		
neutrons		
electrons		

[3]

(b) Manganese forms several oxides. The formulae of some of these oxides are shown.

MnO
Mn_2O_3
Mn_3O_4
MnO_2
Mn_2O_7

(i) Suggest why manganese is expected to form coloured oxides.

..... [1]

(ii) State which other property of manganese is shown by the formation of several oxides.

..... [1]

(iii) State the formula of manganese(II) oxide.

..... [1]

(c) Mn_3O_4 is found in an ore of manganese. Manganese metal can be extracted from Mn_3O_4 using aluminium as the reducing agent.

(i) Define the term reducing agent.

.....

..... [2]

(ii) Complete the symbol equation by inserting the formula of the missing product and balancing the equation.

$$\text{.....}Mn_3O_4 + \text{.....}Al \rightarrow \text{.....} + \text{.....}Mn$$

[2]

(d) MnO_2 reacts with dilute hydrochloric acid as shown in the equation.

$$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$$

(i) Calculate the volume of chlorine gas formed, in cm^3, at r.t.p. when excess MnO_2 reacts with 50.0 cm^3 of 0.200 mol / dm^3 HCl.

Use the following steps.

- Calculate the number of moles of HCl used.

..... mol

- Determine the number of moles of Cl_2 formed.

..... mol

- Calculate the volume of Cl_2 formed.

..... cm^3
[3]

(ii) Describe a test for chlorine gas.

test .....

observations .....
[1]

(iii) Explain, in terms of collision theory, why decreasing the temperature decreases the rate of this reaction.

.....

.....

.....

.....

.....

..... [3]

[Total: 17]