18 The ionic equation for the redox reaction between acidified manganate(VII) ions and iodide ions is shown.

$$2MnO_4^-(aq) + 16H^+(aq) + 10I^-(aq) \rightarrow 2Mn^{2+}(aq) + 5I_2(aq) + 8H_2O(l)$$

Which row shows the changes in oxidation number for manganese and for iodine during this reaction?

	manganese		iodine	
	from	to	from	to
A	–2	+4	–1	0
B	–2	+4	–10	+5
C	+7	+2	–1	0
D	+7	+2	–10	+5

19 What is the oxidation number of chromium in the $Cr_2O_7^{2-}$ ion?

A –2 **B** –1 **C** +6 **D** +12

18 Zinc reacts with dilute hydrochloric acid.

Which statement about the particles in the reaction is correct?

A Increasing the concentration of dilute hydrochloric acid increases the collision rate but has **no** effect on the activation energy.

B Increasing the concentration of dilute hydrochloric acid increases the collision rate and the activation energy.

C Increasing the temperature of the reaction increases the activation energy.

D Increasing the temperature of the reaction causes all collisions to lead to a reaction.

22 The equation shows the reaction between copper and concentrated nitric acid.

$$Cu(s) + 4HNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2NO_2(g) + 2H_2O(l)$$

Which element is reduced in this reaction?

A oxygen

B nitrogen

C copper

D hydrogen

2 Iron is extracted from iron ore in a blast furnace.

(a) The iron compound in the main iron ore used in the blast furnace is iron(III) oxide.

(i) State the name of the main iron ore used in the blast furnace.

..... [1]

(ii) State how the main source of heat is provided in the blast furnace.

..... [1]

(iii) Name the gaseous reducing agent in the blast furnace.

..... [1]

(iv) Write a symbol equation for the reduction of iron(III) oxide by the gaseous reducing agent in **(a)(iii)**.

..... [2]

(v) The main impurity in iron ore is silicon(IV) oxide.

Write **two** symbol equations to show the role of limestone in removing silicon(IV) oxide from iron ore.

1 .....

2 .....
[2]

(b) Table 2.1 shows four different isotopes of iron, **A**, **B**, **C** and **D**.

Table 2.1

A	**B**	**C**	**D**
^{54}Fe	^{56}Fe	^{57}Fe	^{58}Fe

Explain why **A**, **B**, **C** and **D** are isotopes of iron.

.....

..... [2]

(c) Iron can form two different ions, Fe^{2+} and Fe^{3+}.

(i) Complete Table 2.2 to show the number of protons, neutrons and electrons in the two iron ions shown.

Table 2.2

	$^{54}Fe^{2+}$	$^{58}Fe^{3+}$
protons		
neutrons		
electrons		

[3]

(ii) Describe a test for aqueous Fe^{2+} ions.

test .....

observations .....

.....

[2]

(d) An oxidising agent converts Fe^{2+} ions to Fe^{3+} ions.

(i) Define the term oxidising agent.

.....

..... [2]

(ii) Explain why the conversion of Fe^{2+} ions to Fe^{3+} ions is described as oxidation.

..... [1]

(iii) The oxidising agent for the conversion of Fe^{2+} ions to Fe^{3+} ions is aqueous potassium manganate(VII).

State **one** condition needed for the oxidation to take place.

..... [1]

(e) Iodide ions, I^-, reduce Fe^{3+} ions to Fe^{2+} ions in aqueous solution.

Suggest the identity of the other product formed in this reaction.

..... [1]

[Total: 19]

17 Which equations show the underlined species acting as a reducing agent?

1 $\underline{Fe_2O_3} + 3CO \rightarrow 2Fe + 3CO_2$

2 $\underline{Fe} + CuSO_4 \rightarrow FeSO_4 + Cu$

3 $\underline{5Fe^{2+}} + MnO_4^- + 8H^+ \rightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$

4 $\underline{Fe(OH)_2} + H_2SO_4 \rightarrow FeSO_4 + 2H_2O$

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

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18 The equation represents a redox reaction.

$$2Al + Fe_2O_3 \rightarrow 2Fe + Al_2O_3$$

What is the change in the oxidation number of iron in this reaction?

A from +2 to +3

B from +2 to 0

C from +3 to +2

D from +3 to 0

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21 Mercury(II) oxide, HgO, decomposes when heated.

The equation is shown.

$$2HgO \rightarrow 2Hg + O_2$$

Why is this a reduction reaction?

A The products weigh less than the reactants.

B There are fewer reactants than products.

C There is a gain of oxygen.

D There is a loss of oxygen.