

SECTION B

Answer **all** the questions.

- 16 Sir Humphry Davy discovered several elements including sodium, potassium, magnesium, calcium and strontium.

(a) Explain which block in the Periodic Table sodium and magnesium belong to.

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 [1]

- (b) A sample of magnesium, $A_r = 24.305$, is found to consist of three isotopes. The accurate relative isotopic masses and % abundances of two of the isotopes are shown in the table.

Isotope	Relative isotopic mass	% abundance
^{24}Mg	23.985	78.99%
^{25}Mg	24.986	10.00%

Determine the relative isotopic mass of the third isotope of magnesium in the sample.

Give your answer to **5** significant figures.

relative isotopic mass = [2]

- (c) A student adds an excess of calcium oxide to water in a test tube.
 In a separate test tube, the student adds an excess of strontium oxide to water.

(i) Write the equation for the reaction of calcium oxide with water.

State symbols are **not** required.

..... [1]

(ii) Suggest the approximate pH of the two solutions formed in the test tubes.

pH with calcium oxide

pH with strontium oxide.....

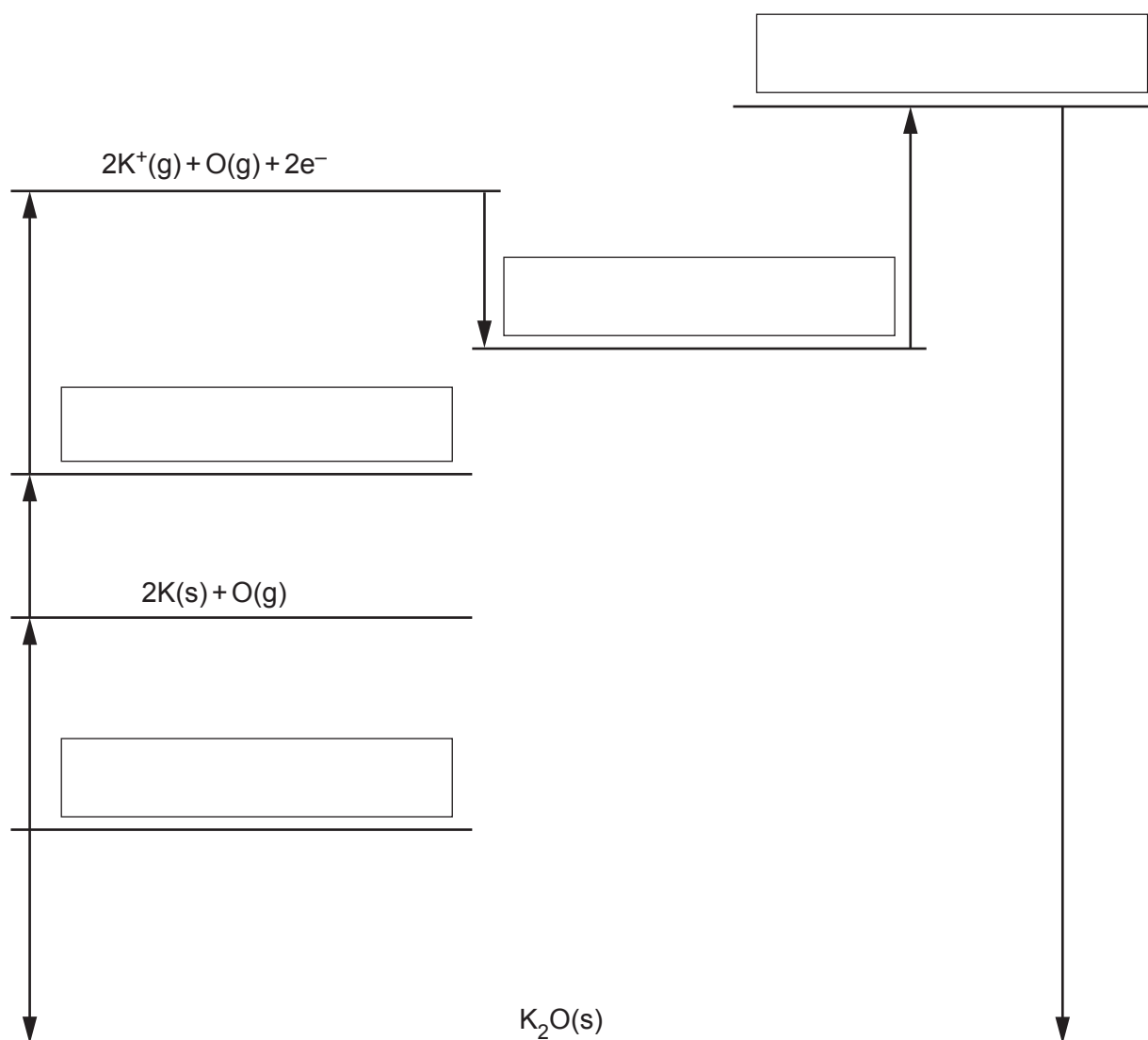
[1]

- (d) The table below shows enthalpy changes involving potassium, oxygen and potassium oxide, K_2O .

	Enthalpy change / kJ mol^{-1}
formation of potassium oxide	-363
1st electron affinity of oxygen	-141
2nd electron affinity of oxygen	+790
1st ionisation energy of potassium	+419
atomisation of oxygen	+249
atomisation of potassium	+89

- (i) The incomplete Born–Haber cycle below can be used to determine the lattice enthalpy of potassium oxide.

In the boxes, complete the species present in the cycle.
Include state symbols for the species.



- (ii) Calculate the lattice enthalpy of potassium oxide.

lattice enthalpy = kJ mol^{-1} [2]

- (e) A similar Born–Haber cycle to potassium oxide in (d) can be constructed for sodium oxide.

- (i) The first ionisation energy of sodium is more endothermic than that of potassium.

Explain why.

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..... [2]

- (ii) The lattice enthalpy of sodium oxide is more exothermic than that of potassium oxide.

Explain why.

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..... [2]