UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Subsidiary Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

8546924445

PHYSICAL SCIENCE **8780/02**

Paper 2 Short Response **October/November 2012**

40 minutes

Candidates answer on the Question Paper.

Additional Materials: Data Booklet

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You may lose marks if you do not show your working or if you do not use appropriate units.

A Data Booklet is provided.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
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Total	

This document consists of **8** printed pages.

Answer **all** the questions in the spaces provided.

Relevant Data, Formulae and the Periodic Table are provided in the Data Booklet.

1 When a sphere moves through air it experiences a resistive force F. F is related to the radius of the sphere r and its velocity v by the equation

$$F = krv^2$$

where k is the constant of proportionality.

Derive the base unit of k.

base unit of k = ... [2]

2 Fig. 2.1 shows an ice skater being spun by her partner.

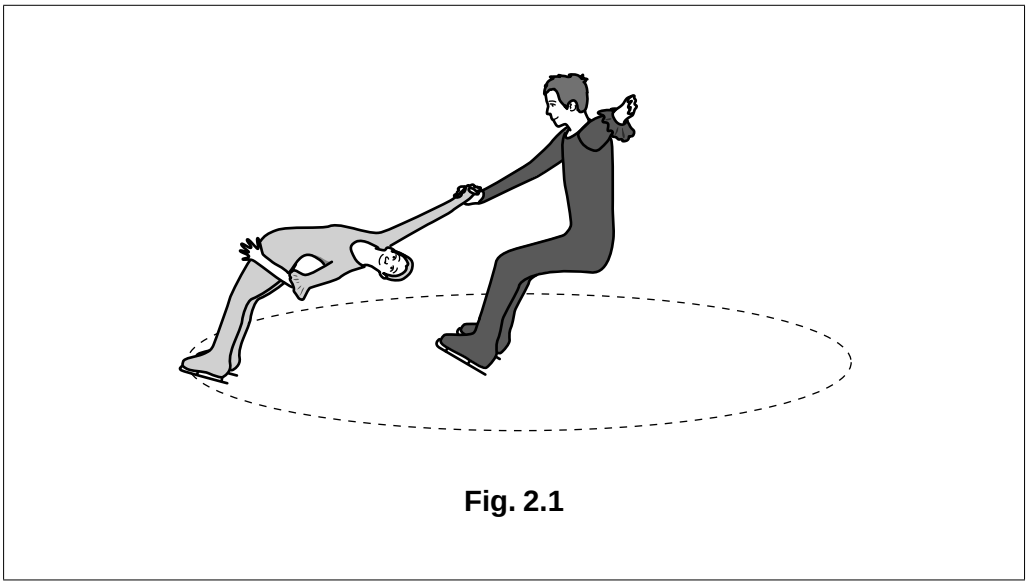


Fig. 2.1

(a) The female skater travels at a constant speed in a circular path.

Explain why there must be a resultant force acting on her.

.....

..... [1]

(b) On Fig. 2.1, draw an arrow to show this resultant force. [1]

3 There is, in general, an increase in the first ionisation energies of the elements ... Period 3.

Aluminium, however, deviates from this trend as its first ionisation energy is below that of magnesium. Explain why.

.....

.....

.....

..... [2]

4 Cobalt is in the d-block of the Periodic Table. The electron arrangement of the cobalt atom is shown below.

$$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$$

Complete the electron arrangement of the cobalt(II) ion, Co^{2+}.

$1s^2$ ..... [1]

5 **(a)** Explain, in terms of electrons, what is meant by an *oxidising agent*.

.....

..... [1]

(b) **(i)** Write an equation for the redox reaction which occurs when concentrated sulfuric acid is added to solid sodium bromide.

.....

(ii) Identify the ion or molecule that acts as a reducing agent in this reaction.

.....
[2]

6 Explain how the *torque* of a couple is calculated.

.....

.....

..... [1]

7 A wave moves along a spring.

Fig. 7.1 shows how the displacement of one particle in the spring varies with time.

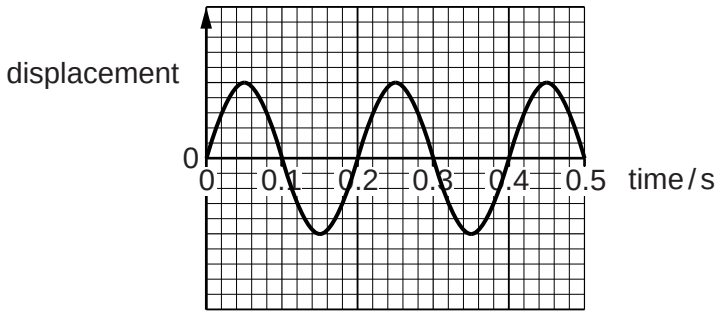


Fig. 7.1

Fig. 7.2 shows the displacement of the particles along the spring at one instant in time.

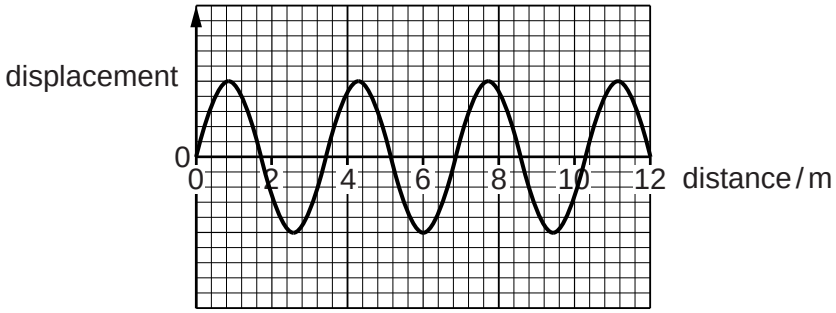


Fig. 7.2

Use the information from the graphs to calculate the speed at which the wave travels along the spring.

speed = ... $m\,s^{-1}$ [2]

8 The cracking of hydrocarbon fractions is carried out on a very large scale worldwide.

(a) Briefly explain, in terms of the molecules involved, why some hydrocarbon fractions are cracked.

.....

.....

..... [1]

(b) When one molecule of $C_{18}H_{38}$ is cracked, ethene and propene molecules are formed in a **two** to **one** ratio, along with one other molecule.

Write an equation for this reaction.

..... [2]

9 Fig. 9.1 shows the mass spectrum of the Os^+ ions in a gaseous sample of osmium.

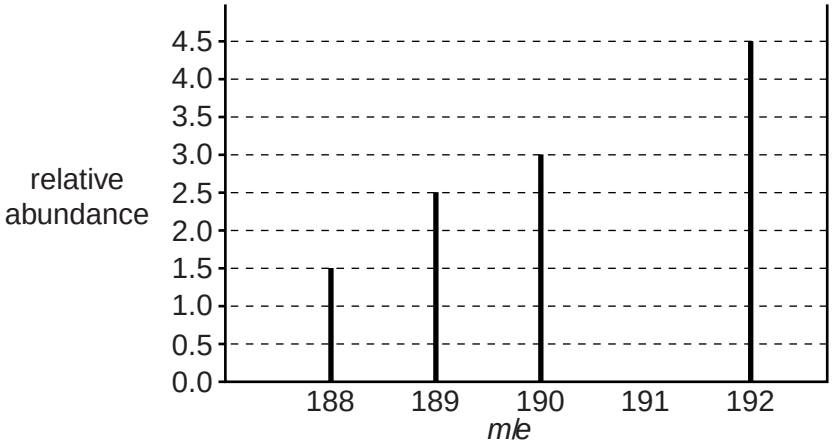


Fig. 9.1

Use information from the spectrum to calculate the relative atomic mass, A_r, of osmium. Give your answer to one decimal place.

A_r = ... [2]

10 Fig. 10.1 shows how the current *I* in a circuit component varies with potential differen

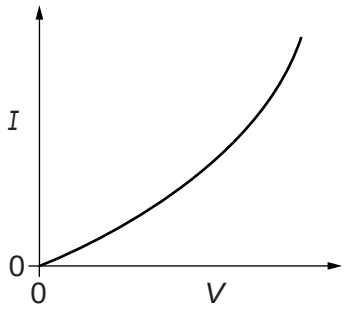


Fig. 10.1

(a) Describe how you would use the graph to find the resistance of the component at a particular potential difference.

.....

..... [1]

(b) Suggest what the component may be. Give a reason for your answer.

.....

.....

..... [1]

11 Kirchhoff's second law states that the algebraic sum of the e.m.f.s around any closed loop in a circuit is equal to the algebraic sum of the potential differences around the loop.

Explain how this law is linked to the law of conservation of energy.

.....

.....

.....

..... [2]

12 The boiling points of some hydrogen halides are shown in Table 12.1.

Table 12.1

hydrogen halide	HF	HC*l*	HBr	HI
boiling point/K	293	188	206	238

(a) Fluorine is the most electronegative element.

Suggest a reason why the boiling point of hydrogen fluoride, HF, is much higher than those of the other hydrogen halides.

.....

..... [1]

(b) There is a trend in the boiling points from hydrogen chloride, HC*l*, to hydrogen iodide, HI.

Suggest, in terms of intermolecular forces, an explanation for this trend.

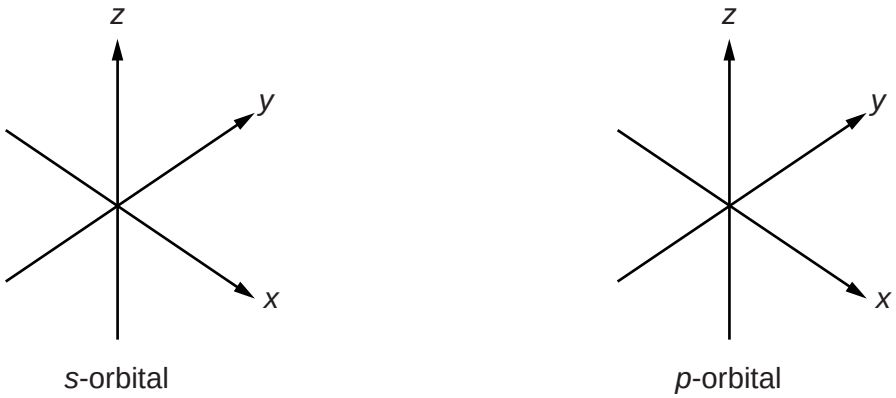
.....

.....

..... [2]

13 The six electrons in an atom of carbon are distributed between *s*- and *p*-orbitals.

On the axes in Fig. 13.1 below, sketch the shapes of **single** orbitals of each of these two types.



s-orbital *p*-orbital

[1]

Fig. 13.1

14 The Bohr model of the atom is an advance on the Rutherford model.

Describe two ways in which the Bohr model is different from the Rutherford model.

1. .....

.....

2. .....

.....

[2]

15 The decay of radioactive nuclei is both random and spontaneous.

(a) What experimental evidence shows the *random* nature of this decay?

.....

.....

..... [1]

(b) Explain what is meant by the decay being *spontaneous*.

.....

.....

..... [1]