Cambridge International **AS Level**

Cambridge International Examinations
Cambridge International Advanced Subsidiary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6698098294

PHYSICAL SCIENCE **8780/02**

Paper 2 Short Response **October/November 2015**

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, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
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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This document consists of **10** printed pages and **2** blank pages.

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

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

1 A small ball is released from rest at the top of a cylinder of oil. Fig. 1.1 shows the ball falling through the oil.

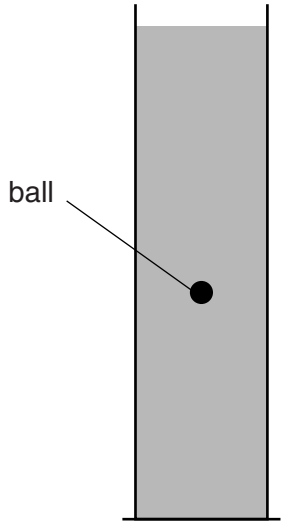

Fig. 1.1

The ball initially accelerates. The acceleration gradually decreases until the ball falls with a constant velocity.

Explain why the acceleration decreases and why the ball reaches a constant velocity.

.....

.....

.....

.....[2]

2 A compound contains 28.4% of sodium, 32.1% of chromium and 39.5% of oxygen, by mass.

Calculate the empirical formula of this compound.
Show your working.

empirical formula = ... [2]

3 Define the coulomb.

.....

.....

.....[1]

4 A student sets up the circuit shown in Fig. 4.1.

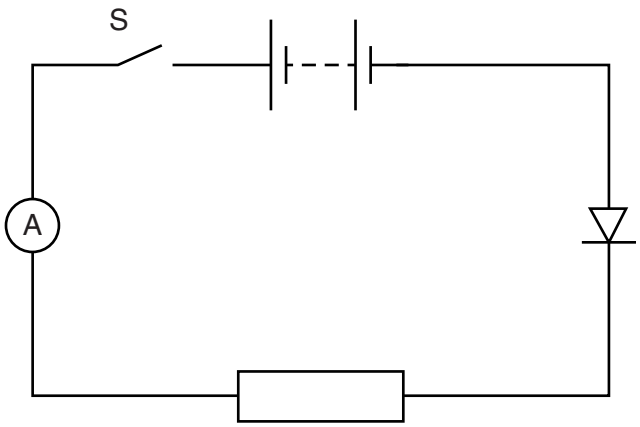

Fig. 4.1

Explain why, when switch S is closed, the reading on the ammeter remains zero.

.....

.....

.....[2]

5 **(a)** **(i)** Draw the shape of a PCl_5 molecule.

[1]

(ii) Name the shape of a PCl_5 molecule.

.....[1]

(b) Draw the shape of a PCl_4^+ ion.

[1]

6 The circuit diagram in Fig. 6.1 shows a thermistor being used to measure the temperature of the water in a beaker.

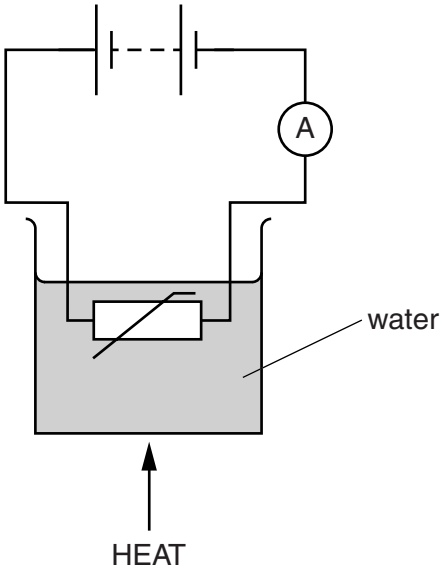

Fig. 6.1

The graph in Fig. 6.2 shows the calibration curve for the thermistor.

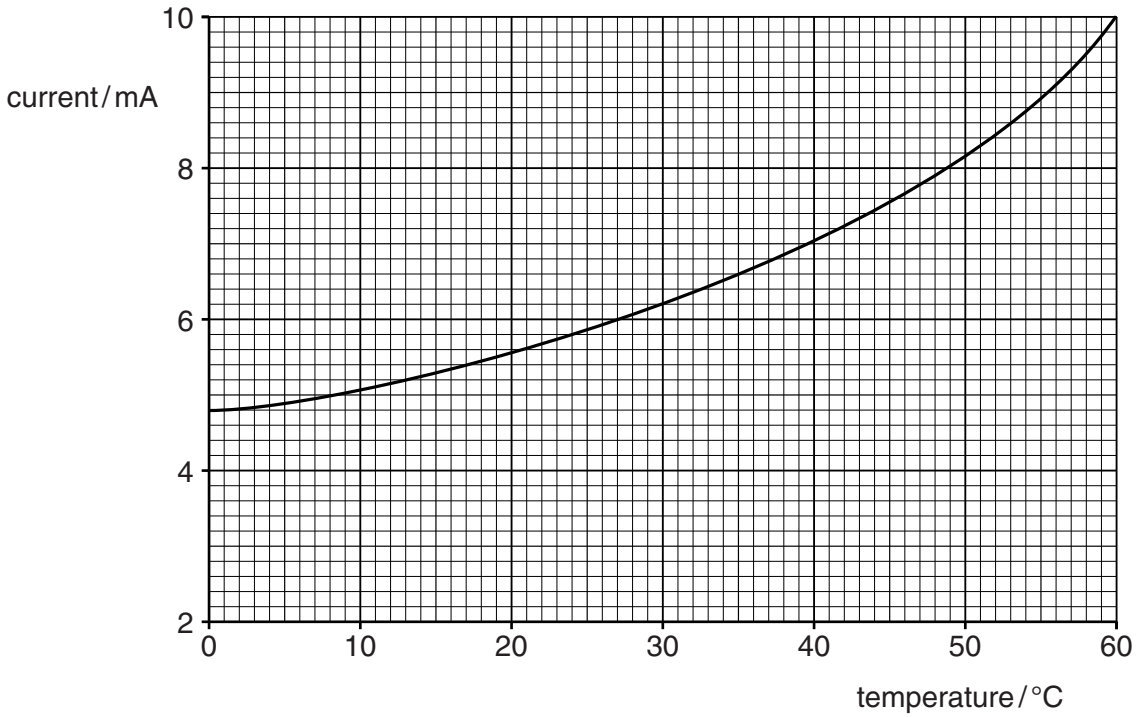

Fig. 6.2

Fig. 6.3 shows the reading on the ammeter at temperature *T*.

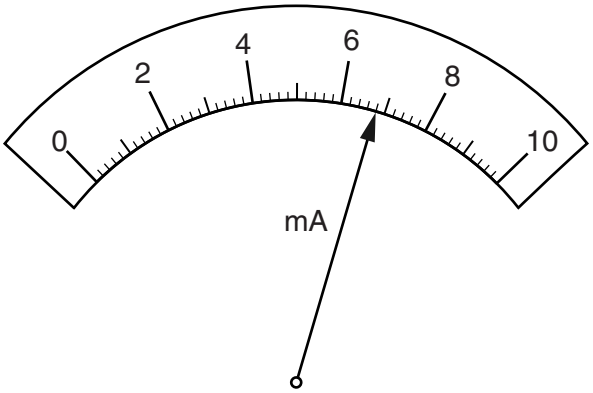

Fig. 6.3

Determine temperature *T*.
Show your working.

T = ...°C [2]

7 The table shows the electron arrangements and first ionisation energy values of some Period 3 elements.

element	electron arrangement	first ionisation energy / kJ mol^{-1}
sodium	$1s^2 2s^2 2p^6 3s^1$	494
magnesium	$1s^2 2s^2 2p^6 3s^2$	736
aluminium	$1s^2 2s^2 2p^6 3s^2 3p^1$	577

(a) Explain why the first ionisation energy of magnesium is higher than that of sodium.

.....

.....[1]

(b) Explain why the first ionisation energy of aluminium is lower than that of magnesium.

.....

.....

.....[2]

8 Fig. 8.1 shows a beam of weight 200 N, freely pivoted at end **A**. The beam is supported by a rope attached to end **B** of the beam. The tension in the rope is 140 N. The angle of the rope with the beam is 35°.

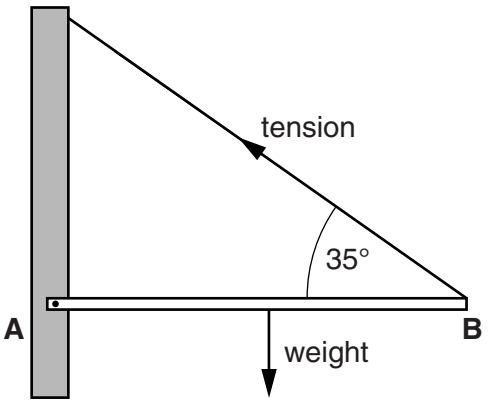

Fig. 8.1

Fig. 8.2 shows a vector representation of the weight of the beam drawn to scale.

On Fig. 8.2, complete a suitable vector diagram to determine the magnitude of the reaction force at **A** and the direction of the reaction force relative to the beam.

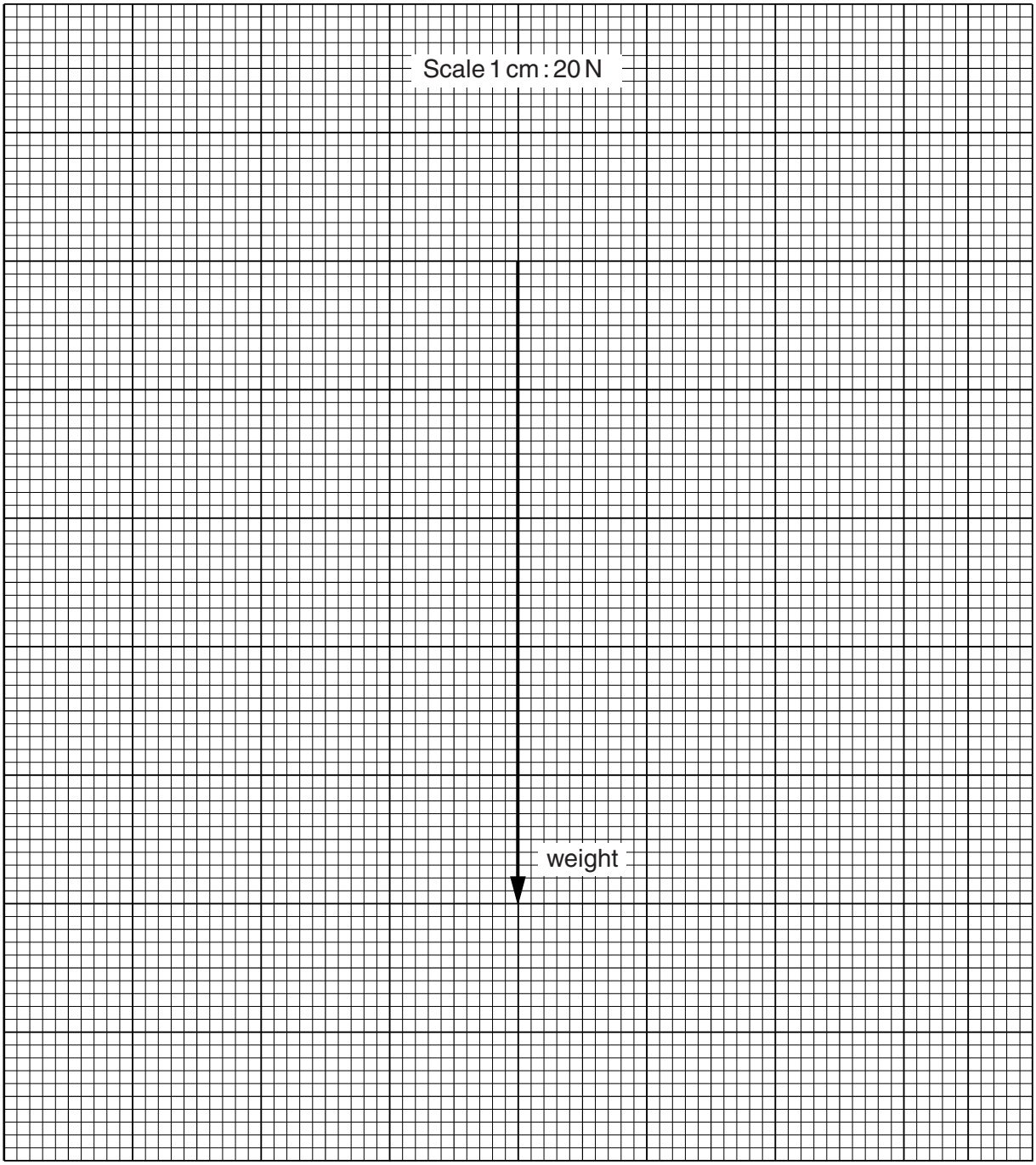

Fig. 8.2

magnitude of the reaction = ... N

direction of reaction = ... ° to the beam.

[4]

9 There are three structural isomers with the molecular formula C_5H_{12}.

One of these is pentane, which has the structural formula $CH_3CH_2CH_2CH_2CH_3$.

(a) State what is meant by the term *structural isomers*.

.....

.....[1]

(b) Draw a structural formula for each of the two remaining structural isomers of C_5H_{12}.

isomer 1 isomer 2

[2]

10 Fig. 10.1 shows a potential divider circuit.

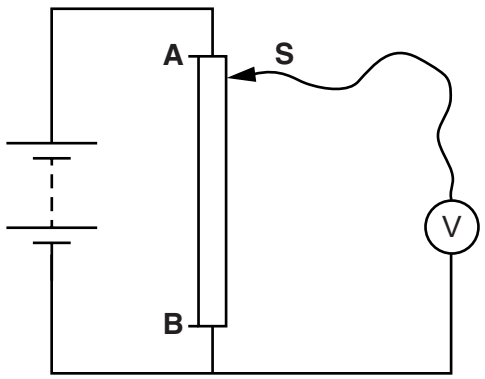

Fig. 10.1

State and explain what happens to the reading on the voltmeter as the sliding connector **S** is moved from point **A** to point **B**.

.....

.....

.....

.....[2]

11 Crude oil fractions containing large hydrocarbon molecules are used to make alkenes.

(a) (i) Name the process by which alkenes are made from large hydrocarbon molecules.

.....[1]

(ii) Using the named process in **(a)(i)**, $C_{17}H_{36}$ is converted into equal amounts of butene and propene, together with one other product.

Write an equation for this reaction.

.....[1]

(b) One important use of alkenes is their conversion into poly(alkenes) by addition polymerisation.

Write a balanced equation using **displayed** formulae to show the formation of poly(but-1-ene) from but-1-ene.

[2]

12 The equation below shows part of the uranium-238 decay chain. The particles emitted at each stage are indicated above the arrows.

$$^{238}_{92}U \xrightarrow{\mathbf{Q}} {}^{234}_{90}Th \xrightarrow{\beta} {}^{.....}_{.....}Pa$$

(a) Identify the particle **Q** emitted in the decay of uranium (U) to thorium (Th).

.....[1]

(b) State the nucleon number and the proton number of the protactinium nuclide (Pa) formed by the decay of thorium.

nucleon number .....

proton number .....
[1]

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