OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL GCSE

PHYSICS

Paper 2

Monday 15 November 2021 07:00 GMT Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a pencil and a ruler
- a scientific calculator
- the Physics Equations Sheet (enclosed).

Instructions
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you worked out your answer.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

Information
- The maximum mark for this paper is 90.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.

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

0 1 **Figure 1** represents an atom of the element bromine (Br).

Figure 1

$^{81}_{35}Br$

0 1 . 1 How many protons are there in the nucleus of the bromine atom shown in **Figure 1**?
[1 mark]

Tick (✓) **one** box.

35 ☐

46 ☐

81 ☐

116 ☐

0 1 . 2 How many electrons surround the nucleus of the bromine atom shown in **Figure 1**?
[1 mark]

Tick (✓) **one** box.

35 ☐

46 ☐

81 ☐

116 ☐

Do not write outside the box

0 1 . 3 There are different isotopes of bromine.

Isotopes of bromine contain different numbers of which type of particle?

[1 mark]

Tick (✓) **one** box.

Electrons ☐

Neutrons ☐

Protons ☐

0 1 . 4 Complete the following sentences.

Choose answers from the box.

[2 marks]

electron	**neutron**	**proton**

The two particles with the greatest mass in the atom are the

_____ and the _____ .

The two charged particles in the atom are the _____

and the _____ .

Question 1 continues on the next page

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0 1 . 5 **Figure 2** gives some information about bromine.

Figure 2

Bromine	
Melting point =	−7.2 °C
Boiling point =	59 °C

In which state of matter is bromine at 20 °C?

[3 marks]

Tick (✓) **one** box.

Solid ☐ Liquid ☐ Gas ☐

Explain your answer.

Use information from **Figure 2**.

_____

_____

_____

_____

8

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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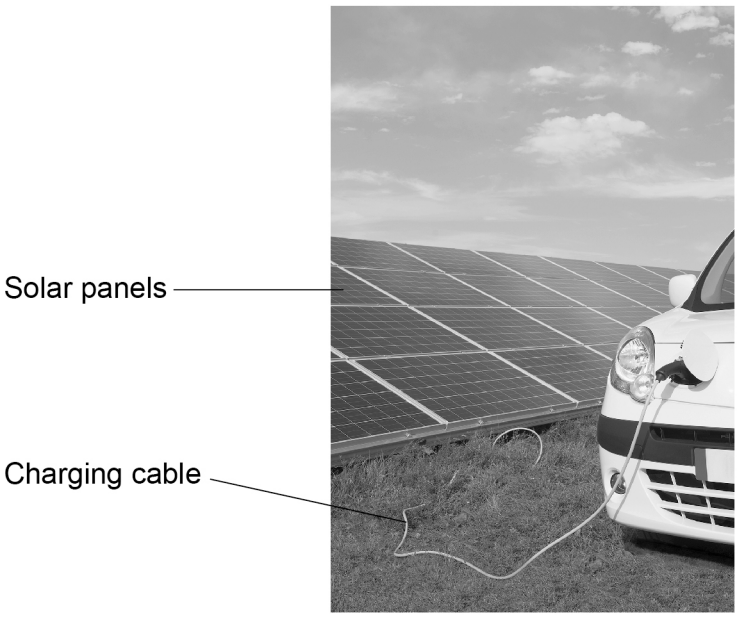
0 2 **Figure 3** shows solar panels being used to charge the battery in an electric car.

Figure 3



0 2 . 1 The solar panels in **Figure 3** provide an average power of 4.0 kW.

Calculate the energy transferred to the battery in 1.5 hours.

Give your answer in kW h.

Use the Physics Equations Sheet.

[2 marks]

Energy transferred = _____ kW h

Do not write outside the box

0 2 . 2 The solar panels in **Figure 3** cost $14 400.

The car can also be charged by connecting it to the mains electricity supply.

It takes 24 kW h of electricity to charge the battery from zero charge to full charge.

cost of 1 kW h of mains electricity = $0.15

Calculate the minimum number of charges needed to match the cost of the solar panels.

[3 marks]

Minimum number of charges = _____

Question 2 continues on the next page

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0 2 . 3 **Figure 4** gives some information about two different cars.

Figure 4

Car **A** – An electric car that is charged by solar panels
Car **B** – A car with an engine that burns biofuel

Compare the environmental benefits of car **A** and car **B**.

[4 marks]

9

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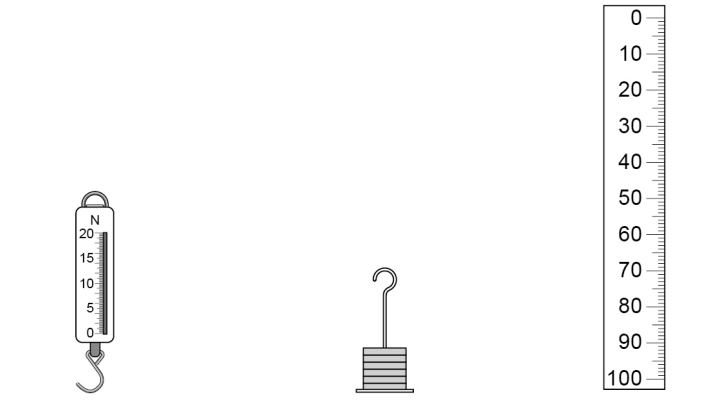
0 3 **Figure 5** shows some equipment, including a newtonmeter.

The newtonmeter contains a spring.

Figure 5



Newtonmeter Slotted masses Metre rule

0 3 . 1 The spring constant of the spring is given by the gradient of a force-extension graph for the spring.

Describe an experiment to find the spring constant of the spring using the equipment in **Figure 5**.

[4 marks]

Question 3 continues on the next page

A student measured the mass and weight of a metal block five times.

The student used the measurements to calculate the gravitational field strength, *g*.

Table 1 shows the results.

Table 1

Reading	1	2	3	4	5	**Mean**
***g* in N/kg**	10.1	9.3	10.2	10.0	10.1	**X**

0 3 . 2 Give the range of the values for *g* in **Table 1**.

[1 mark]

Range = _____ to _____ N/kg

0 3 . 3 The student made a random error.

Explain how the data in **Table 1** shows that the student made a random error.

[2 marks]

_____

_____

_____

_____

0 3 . 4 Calculate value **X** in **Table 1**.

[2 marks]

_____

_____

_____

X = _____ N/kg

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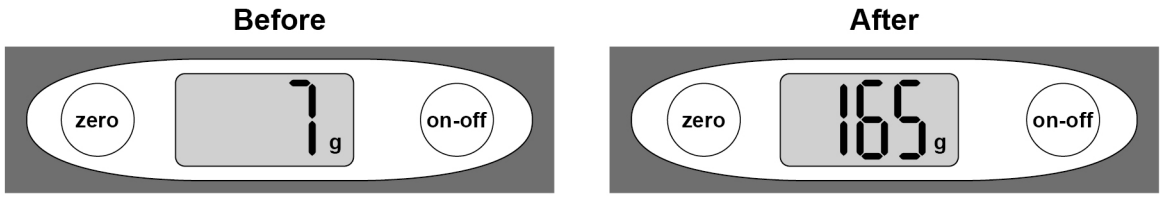
A student used a top pan balance to determine the weight of a mobile phone.

Figure 6 shows the readings on a top pan balance before and after placing the phone on it.

Figure 6



0 3 . 5 What should the student have done to the top pan balance in **Figure 6** before placing the mobile phone on it?

[1 mark]

0 3 . 6 Determine the weight of the mobile phone.

gravitational field strength = 9.8 N/kg

Use the Physics Equations Sheet.

Give your answer to 2 significant figures.

[4 marks]

Weight (2 significant figures) = _____ N

14

Turn over ►

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0 4 **Figure 7** shows a wireless microphone.

Figure 7

The microphone detects sound waves and emits electromagnetic waves.

0 4 . 1 Describe **two** differences and **two** similarities between the properties of sound waves and electromagnetic waves.

[4 marks]

Differences

1 _____

_____

2 _____

_____

Similarities

1 _____

_____

2 _____

_____

Do not write outside the box

0 4 . 2 The microphone emits radio waves with a frequency of 750 MHz.

speed of radio waves = 300 000 000 m/s

Calculate the wavelength of the radio waves.

Use the Physics Equations Sheet.

Give the unit.

[4 marks]

Wavelength = _____ Unit _____

0 4 . 3 The microphone can detect frequencies of sound up to 24 000 Hz.

What is the difference between 24 000 Hz and the highest frequency that a human can hear?

[1 mark]

Difference in frequency = _____ Hz

0 4 . 4 Sound waves that have a frequency above the range of human hearing are called ultrasound waves.

Give **two** uses of ultrasound waves.

[2 marks]

1 _____

2 _____

11

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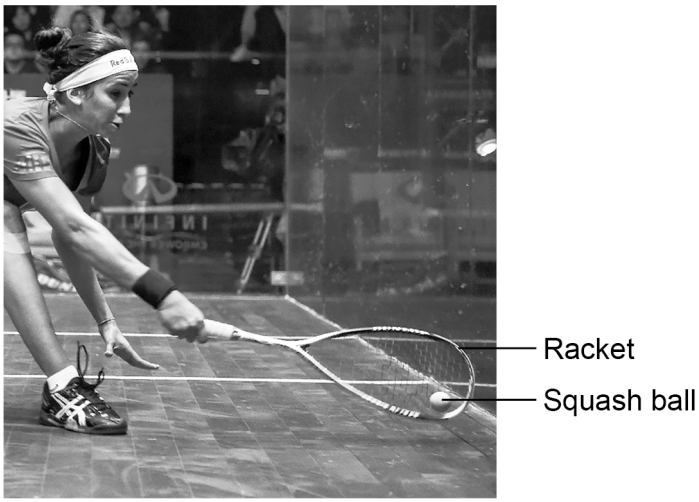
0 5 **Figure 8** shows a person playing a game of squash.

Figure 8



The player hits the squash ball with the racket.

0 5 . 1 When the ball is in contact with the racket there is a pair of forces between the ball and the racket.

Which of the following statements about the size of the forces is true?

[1 mark]

Tick (✓) **one** box.

The force on the ball is less than the force on the racket. ☐

The force on the ball is the same size as the force on the racket. ☐

The force on the ball is greater than the force on the racket. ☐

Do not write outside the box

0 5 . 2 The racket contains strings that stretch when the racket hits the ball.

The strings behave like springs.

Calculate the elastic potential energy stored in a string when the extension of the string is 2.5 mm.

spring constant = 4.0×10^5 N/m

Use the Physics Equations Sheet.

[3 marks]

Elastic potential energy = _____ J

Question 5 continues on the next page

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Figure 9 shows how the velocity of the ball changes when it is hit by the racket.

Figure 9

0 5 . 3 Describe **two** differences between the velocity of the ball before it was hit and the velocity of the ball after it was hit.

[2 marks]

1 _____

_____

2 _____

_____

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0 5 . 4 When the ball was in contact with the racket, the average resultant force acting on the ball was 15 N.

mass of ball = 0.025 kg

Calculate the time that the ball was in contact with the racket.

Use information from **Figure 9**.

Use the Physics Equations Sheet.

[4 marks]

Time = _____ s

0 5 . 5 The ball compresses when hit by the racket.

Describe how the energy stores of the ball change as it compresses.

[3 marks]

13

0 6 A student investigated how the light intensity incident on a light-dependent resistor (LDR) affects the current in the LDR.

Figure 10 is a circuit diagram for some of the equipment the student used.

Figure 10

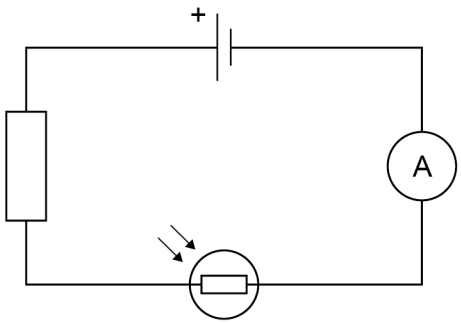

Table 2 shows the results.

Table 2

Light intensity in W/m^2	Current in milliamps
0	5
100	25
200	40
300	53
400	63
500	71
600	79
700	85
800	91

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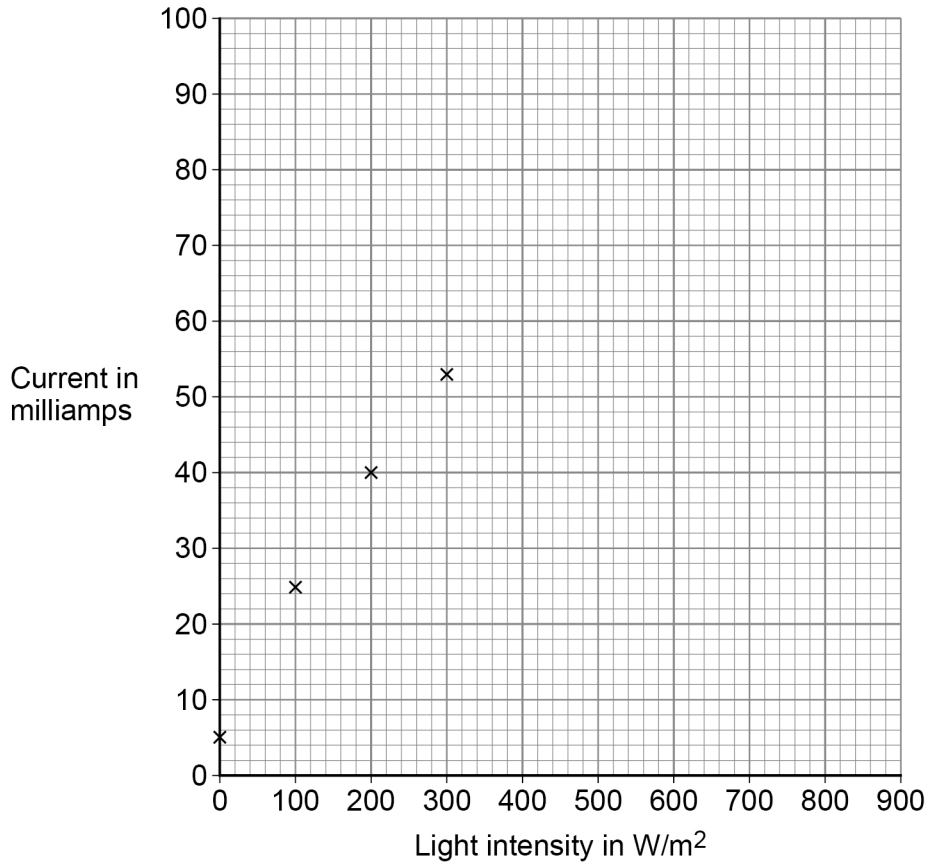
0 6 . 1 Plot the data from **Table 2** on **Figure 11**.

Draw a line of best fit.

The first four points have been plotted for you.

[3 marks]

Figure 11



0 6 . 2 Explain the shape of the line of best fit on **Figure 11**.

[3 marks]

Question 6 continues on the next page

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0 6 . 3 Explain why a fixed resistor was included in the circuit.

[2 marks]

8

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0 7 The Andromeda galaxy is the nearest large galaxy to the Milky Way.

0 7 . 1 Suggest how many stars there are in the Andromeda galaxy.

[1 mark]

0 7 . 2 The light emitted by the Andromeda galaxy does **not** display a red shift when observed from Earth.

Suggest why the light does **not** display a red shift.

[1 mark]

0 7 . 3 Explain how the observed red shift of light from distant galaxies supports the Big Bang theory.

[4 marks]

Question 7 continues on the next page

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0 7 . 4 Which of the following is the best estimate of the age of the universe, according to the Big Bang theory?

[1 mark]

Tick (✓) **one** box.

13.7×10^6 years ☐

14.9×10^6 years ☐

13.7×10^9 years ☐

14.9×10^9 years ☐

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According to the Big Bang theory, the universe has changed between its origin and today.

0 7 . 5 When the universe was approximately 380 thousand years old, electromagnetic radiation filled the universe.

This electromagnetic radiation is detected as CMBR.

What do the letters CMBR stand for?

[1 mark]

0 7 . 6 When the universe was 200 million years old, stars began to form.

Explain the process of stars forming and then energy being released.

[4 marks]

12

Turn over for the next question

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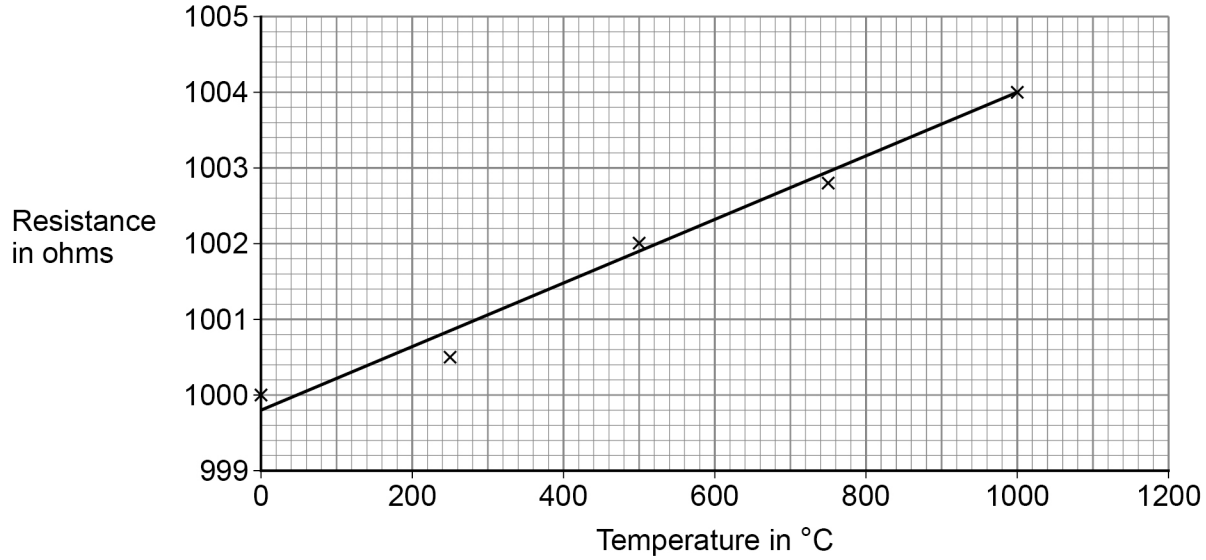
0 8 The metal nichrome is used to make fixed resistors for electrical circuits.

A scientist investigated how the resistance of a 1.0 m length of nichrome wire varied with temperature.

Figure 12 shows the results.

Figure 12



0 8 . 1 Explain why nichrome is a suitable metal for making fixed resistors.

[3 marks]

Do not write outside the box

0 8 . 2 The scientist also tested different lengths of nichrome wire with the same diameter as the wire used in **Figure 12**.

Determine the resistance of a piece of nichrome wire with a length of 0.25 m when the temperature of the wire is 340 °C.

[3 marks]

Resistance = _____ Ω

0 8 . 3 The scientist also tested a piece of tungsten wire.

Tungsten wire can be used as the filament in a filament lamp.

Explain how the resistance of a piece of tungsten wire varies with temperature.

[3 marks]

Question 8 continues on the next page

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0 8 . 4 The scientist connected the piece of tungsten wire to a cell. The wire was kept at a constant temperature.

There was a constant current in the wire for 4.0 minutes.

A charge of 1200 C transferred 15 kJ of energy to the wire.

Calculate the resistance of the wire.

[6 marks]

Resistance = _____ Ω

15

END OF QUESTIONS

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