Collins

AQA

GCSE

PHYSICS

F

SET A – Paper 1 Foundation Tier

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Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a ruler
- a calculator.
- the Physics Equation Sheet (found at the end of the paper).

Instructions

- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- There are 100 marks available on this paper.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions 03.1, 08.2 and 11.4 you need to make sure that your answer:
  – is clear, logical, sensibly structured
  – fully meets the requirements of the question
  – shows that each separate point or step supports the overall answer.

Advice

- In all calculations, show clearly how you work out your answer.

Name: ....

01.1 A plastic ruler becomes **positively charged** when rubbed with a cloth.

Explain why.

....

....

.... **[2 marks]**

01.2 Name the type of charge produced on the **cloth**.

.... **[1 mark]**

01.3 The surface of a small metal ball has been given positive charge.

This is shown in **Figure 1.1**

Figure 1.1

Draw **at least four** electric field lines on the diagram to show the electric field created by the charge.

[2 marks]

01.4 Describe what would happen to a tiny negatively charged particle of dust in the air near to the charged metal ball.

Explain why this would happen.

....

.... **[2 marks]**

02 Coconut oil, used in cooking, changes from a solid to a liquid when it is heated.

02.1 Describe **two** changes to the arrangement and movement of the particles when coconut oil changes from a solid to a liquid.

1. ....

....

2. ....

.... **[2 marks]**

02.2 The specific latent heat of fusion of coconut oil is 250 000 J/kg

Calculate the thermal energy needed to change 0.40 kg of coconut oil from solid to liquid.

Use the following equation.

thermal energy for a change of state = mass × specific latent heat

Give the correct unit with your answer.

....

....

Thermal energy = ...

Unit: ....

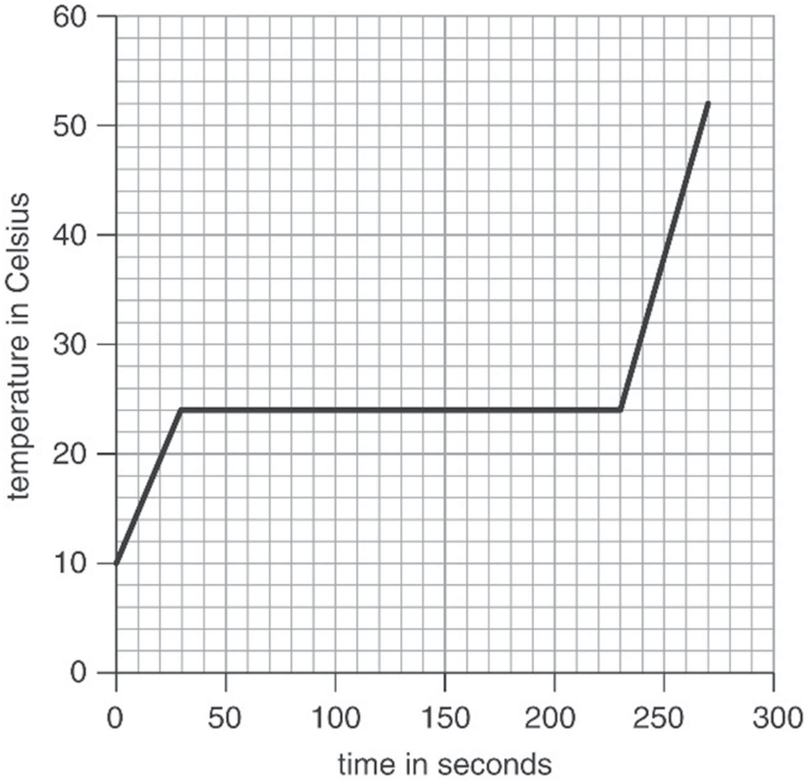
[3 marks]

Question 2 continues on the next page

02.3 A sample of coconut oil is heated at a constant rate.

The graph in **Figure 2.1** shows how the temperature of the oil changes as time passes.

Figure 2.1



Use **Figure 2.1** to determine the melting point of coconut oil.

Melting point = ... °C

[1 mark]

02.4 Use **Figure 2.1** to determine the time taken for the coconut oil to melt completely.

....

Time taken = ... s

[1 mark]

03 A student learns that the density of a material can be found from the following equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

The student is asked to determine the density of a rectangular metal block from a school laboratory materials kit.

03.1 Describe a method that the student could follow to determine the density of the block.

Include the measuring instruments that should be used.

[4 marks]

Question 3 continues on the next page

03.2 The materials kit contains three rectangular blocks, each made of a different metal.

The blocks are labelled **A**, **B** and **C**.

All three blocks have the same length, width and height.

The mass of each block is shown in **Table 3.1**

The density of the metals used in the materials kit is shown in **Table 3.2**

Table 3.1

Block	A	B	C
Mass in g	157	143	178

Table 3.2

Metal	zinc	steel	nickel
Density in g/cm³	7.1	7.8	8.9

Identify the metal in each of the three blocks.

Choose from **zinc**, **steel** and **nickel**.

A ....

B ....

C .... **[3 marks]**

04 There are 37 known isotopes of iodine.

04.1 Explain what is meant by the term **isotope**.

....

.... **[2 marks]**

04.2 The symbol for a nucleus of one of the isotopes of iodine is:

$$^{127}_{53}I$$

Give the numbers of protons, neutrons and electrons in an atom of this isotope.

Protons: ....

Electrons: ....

Neutrons: .... **[3 marks]**

04.3 Another isotope of iodine is iodine-131

Iodine-131 undergoes radioactive decay.

Describe what is meant by **radioactive decay**.

....

.... **[2 marks]**

04.4 Iodine-131 decays by emitting a beta particle.

Explain what is meant by **emitting a beta particle.**

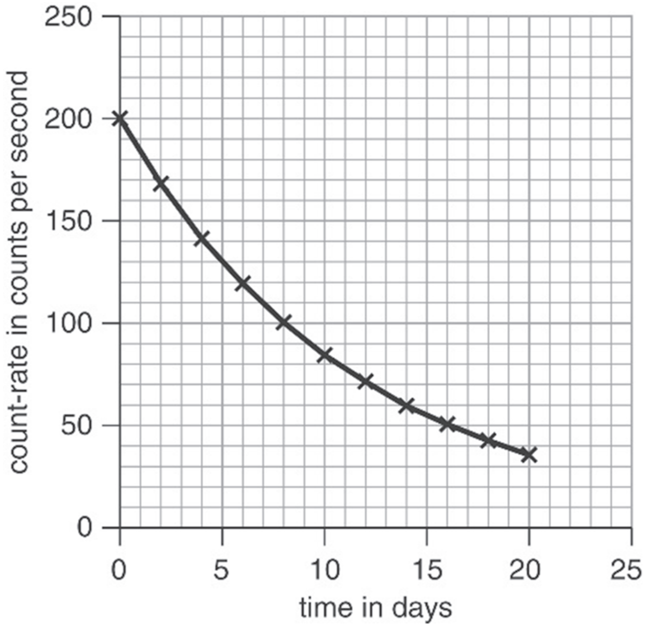
....

.... **[2 marks]**

Question 4 continues on the next page

04.5 **Figure 4.1** shows the recorded count-rate from a sample of iodine-131 over 20 days.

Figure 4.1



Use the graph to determine an accurate value for the half-life of iodine-131

Show how you obtain your answer.

....

....

Half-life = ... days **[3 marks]**

05.1 **Table 5.1** shows the typical power rating of some household electrical appliances.

Table 5.1

Appliance	hair dryer	laptop	iron	printer	electric kettle
Power in W	1800	60	1000	25	2000

What do the **three** highest power appliances have in common?

....

[1 mark]

05.2 Write down the equation that links energy transferred, power and time.

.... **[1 mark]**

05.3 An LED TV has a normal operating power rating of 50 W

Calculate the energy transferred by the TV if it is used continuously for 5 hours.

....

....

Energy transferred = ... J **[3 marks]**

05.4 The TV is used for 5 hours every day for one week.

Calculate the energy transferred by the TV in this week.

....

Energy transferred = ... J **[1 mark]**

Turn over >

06 A system is an object or a group of objects.

06.1 Draw a line from each system to its store of energy.

System	Store of energy
A stretched spring	Elastic potential energy
A football that has just been kicked	Thermal energy
	Chemical energy
	Kinetic energy

[2 marks]

06.2 A child rides her bicycle at 6.0 m/s

The mass of the child and her bicycle is 50 kg

Calculate the store of kinetic energy of the cyclist and her bicycle.

Use the following equation.

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{speed})^2$$

....

Store of kinetic energy = ... J **[2 marks]**

06.3 Write down the equation that links gravitational potential energy, mass, gravitational field strength and height.

.... **[1 mark]**

06.4 The child now rides her bicycle to the top of a small hill and stops.

The height of the hill is 10 m

Gravitational field strength = 9.8 N/kg

Calculate the increase in the store of gravitational potential energy of the child and her bicycle.

....

Increase in gravitational potential energy store = ... J **[2 marks]**

06.5 The child now freewheels down the hill on her bicycle.

At the bottom of the hill she reaches a speed of 8.0 m/s

Calculate the store of kinetic energy of the child and her bicycle at the bottom of the hill.

....

Store of kinetic energy = ... J **[2 marks]**

06.6 Calculate the amount of energy that is dissipated as she freewheeled from the top to the bottom of the hill.

....

Energy dissipated = ... J **[1 mark]**

Turn over >

07 A metal block is heated to 100°C

The hot metal block is then put into a beaker of water at room temperature.

07.1 The temperature of the water increases by 10°C

The mass of water in the beaker is 0.10 kg

The specific heat capacity of water is 4200 J/kg °C

Calculate the **increase** in thermal energy of the **water**.

Use the correct equation from the Physics Equation Sheet.

....

....

Increase in thermal energy of water = ... J **[2 marks]**

07.2 The temperature of the metal block decreases by 70°C

The mass of the block is 0.10 kg

The specific heat capacity of the block is 500 J/kg °C

Calculate the **decrease** in thermal energy of the **metal block**.

Use the correct equation from the Physics Equation Sheet.

....

....

Decrease in thermal energy of metal block = ... J **[2 marks]**

07.3 Suggest **one** reason why the **increase** in thermal energy of the water is less than the **decrease** in thermal energy of the block.

....

.... **[1 mark]**

08 The resistance of a particular type of wire depends on its length and its thickness.

A student decides to investigate how the resistance of a wire depends on its length.

08.1 Identify the **independent variable**, the **dependent variable** and the **control variable** in this investigation.

Independent variable: ....

Dependent variable: ....

Control variable: .... **[3 marks]**

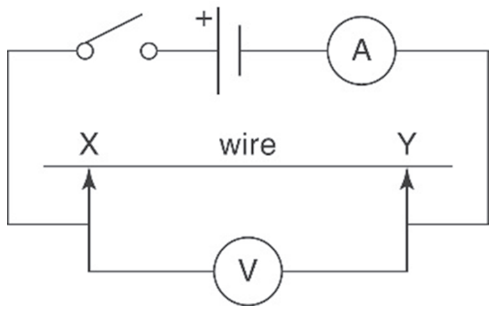
08.2 **Figure 8.1** shows a circuit that can be used to determine the resistance of a length of wire.

The wire under test is connected between crocodile clips **X** and **Y**.

Describe how the student could use this circuit in their investigation.

Include any additional apparatus that you think the student may need.

Figure 8.1



....

....

....

....

....

....

....

....

....

[4 marks]

Question 8 continues on the next page

08.3 The student decides to take repeat measurements for each length of wire.

What type of error does the repeat of measurements help to reduce?

Tick **one** box.

Zero error ☐

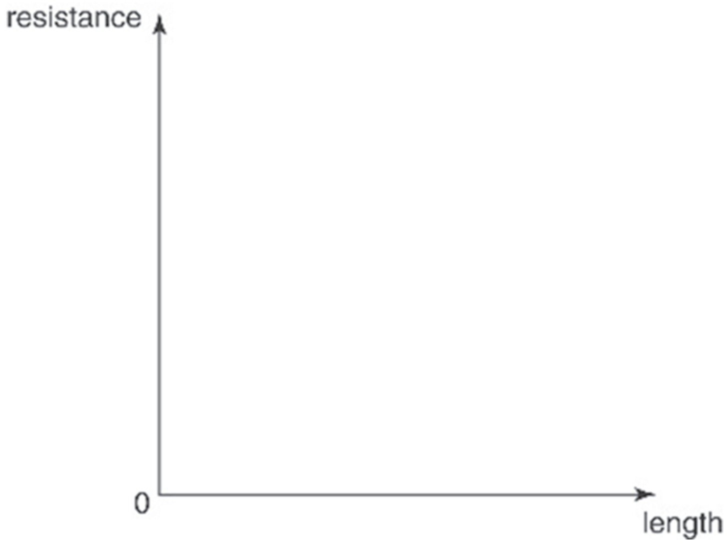
Systematic error ☐

Random error ☐ **[1 mark]**

08.4 The resistance of the student's wire is directly proportional to its length.

Sketch a graph on the axes in **Figure 8.2** to show how the resistance of the wire depends on its length.

Figure 8.2



[1 mark]

08.5 The resistance of a 1.00 m length of wire is 11 Ω

The resistance of the wire is directly proportional to its length.

Calculate the length of a piece of this wire that would have a resistance of 2.2 Ω

....

....

Length = ... m **[2 marks]**

09 In the particle model of matter, particles are sometimes shown as small circles.

09.1 Draw particles in the box to show the particle model of a **gas**.

[1 mark]

09.2 Describe the motion of the gas particles.

....

.... **[2 marks]**

09.3 Give the term that is used to describe the total kinetic energy and potential energy of all of the particles in a gas?

.... **[1 mark]**

09.4 Which **two** of the following statements correctly describe the behaviour of a gas heated at a constant volume?

Tick **two** boxes.

Increasing the temperature increases the speed of the gas particles. ☐

Increasing the temperature decreases the average kinetic energy of the gas particles. ☐

Increasing the temperature decreases the gas pressure. ☐

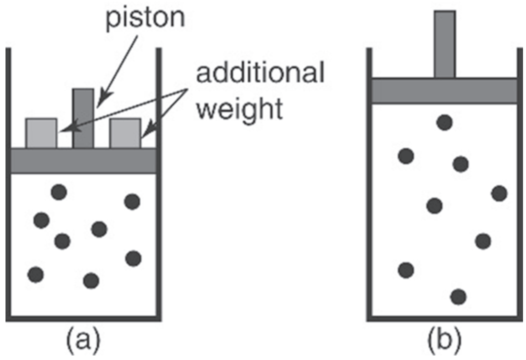
Increasing the temperature increases the gas pressure. ☐ **[2 marks]**

Question 9 continues on the next page

09.5 **Figure 9.1(a)** shows a gas-filled cylinder.

It is sealed by a moveable piston.

Figure 9.1



The pressure of the gas is 200 000 Pa

The volume occupied by the gas is initially 2000 cm^3

The temperature of the gas is 20°C

When the additional weights are slowly removed, the piston moves upwards and comes to a stop (**Figure 9.1(b)**).

The new volume of the gas is 2500 cm^3

The temperature of the gas is still 20°C

Calculate the new pressure of the gas.

Use the correct equation from the Physics Equation Sheet.

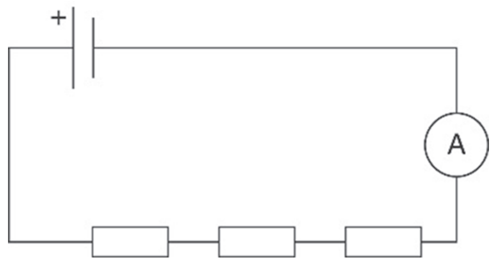
....

....

New pressure = ... Pa **[3 marks]**

10 The circuit diagram in **Figure 10.1** has three **identical** resistors.

Figure 10.1



10.1 Which **two** statements about the circuit are correct?

Tick **two** boxes.

The potential difference across each resistor has the same value. ☐

The resistors are connected in parallel. ☐

The current through each resistor has a different value. ☐

The resistors are connected in series. ☐ **[2 marks]**

10.2 Each of the resistors in the circuit has a resistance of 5.0 Ω

Calculate the total resistance of the three resistors in the circuit.

....

Total resistance = ... Ω **[1 mark]**

10.3 Write down the equation that links potential difference, current and resistance.

.... **[1 mark]**

10.4 The cell in the circuit of **Figure 10.1** supplies a potential difference of 1.5 V

Calculate the size of the electric current in the circuit.

....

Current = ... A **[3 marks]**

Question 10 continues on the next page

10.5 Write down the equation that links charge, current and time.

.... **[1 mark]**

10.6 Calculate the charge that flows around the circuit in 5 minutes.

....

....

Charge = ... C **[3 marks]**

10.7 Each of the resistors in the circuit can be described as an ohmic conductor.

Explain what is meant by an **ohmic conductor**.

....

.... **[1 mark]**

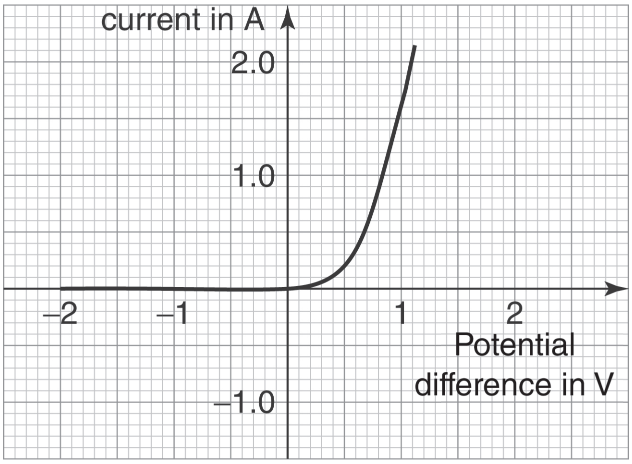
10.8 A diode is an electrical component that is **not** an ohmic conductor.

Draw the circuit symbol for a diode in the box below.

[1 mark]

10.9 **Figure 10.2** shows how the current through a diode changes with the potential difference across it.

Figure 10.2



Write down **two** things that the graph shows about how a diode works.

1. ....

2. .... **[2 marks]**

Turn over >

11.1 The main sources of energy used in UK power stations are listed in this box.

natural gas	wood	uranium	coal
solar	wind	hydroelectric	oil

Complete the following sentences.

Choose words from the box.

.... is an example of a biofuel.

.... is an example of a fossil fuel. **[2 marks]**

11.2 A power station transfers energy from an input energy source to generate electricity as output energy.

Write down the equation for calculating the **efficiency** of an energy transfer process.

....

.... **[1 mark]**

11.3 A gas power station generates electrical power at 720 MW

Natural gas supplies energy to the power station at a rate of 1200 MW

Calculate the efficiency of the power station.

....

....

Efficiency = ... **[2 marks]**

11.4 Wind turbines and coal-fuelled power stations are both used to generate electricity in the UK.

Compare the advantages and disadvantages of wind turbines and coal-fuelled power stations for generating electricity in the UK.

Include comparisons of their **reliability** and **environmental effects**.

[6 marks]

END OF QUESTIONS

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Physics Equation Sheet

Equation Number	Word Equation	Symbol Equation
1	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2\,a\,s$
2	elastic potential energy = 0.5 × spring constant × (extension)^2	$E_e = \frac{1}{2}\,ke^2$
3	change in thermal energy = mass × specific heat capacity × temperature change	$\Delta E = m\,c\,\Delta\theta$
4	period = $\frac{1}{\text{frequency}}$	
5	magnification = $\frac{\text{image height}}{\text{object height}}$	
6	thermal energy for a change of state = mass × specific latent heat	$E = m\,L$
7	potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_p I_p = V_s I_s$
8	For gases: pressure × volume = constant	pV = constant