Surname	Centre Number	Candidate Number
First name(s)		2

GCE AS

B420U10-1

S23-B420U10-1

eduqas Part of WJEC

WEDNESDAY, 17 MAY 2023 – MORNING

PHYSICS – AS component 1
Motion, Energy and Matter

1 hour 30 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**9**	
2.	**13**	
3.	**10**	
4.	**11**	
5.	**11**	
6.	**12**	
7.	**9**	
Total	**75**	

B420U101 01

ADDITIONAL MATERIALS

In addition to this paper, you will require a calculator and a **Data Booklet**.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The total number of marks available for this paper is 75.

The number of marks is given in brackets at the end of each question or part-question.

You are reminded to show all working. Credit is given for correct working even when the final answer is incorrect.

The assessment of the quality of extended response (QER) will take place in **2(a)**.

JUN23B420U10101

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Answer **all** questions.

1. (a) (i) State the difference between a vector and a scalar quantity. [1]

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(ii) The following quantities are either vectors or scalars. **Complete the table** by putting each into the correct column. The first quantity has already been done for you. [2]

force kinetic energy wavelength momentum

density temperature weight

Vector	Scalar
Force	....
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(b) (i) Two people push a car, one with a force of 60 N North and the other with a force of 80 N East. Calculate the resultant of these two forces acting on the car. [4]

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(ii) If the car moves at a constant velocity, state the magnitude and direction of the resistive force acting against the car. [2]

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B420U101 03

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2. (a) Copper is a crystalline material. Describe its structure and explain, on a molecular and macroscopic level, what happens to a copper wire when it breaks. [6 QER]

(b) A copper wire 2.0 m long of diameter 1.28 mm reaches its elastic limit when a load of 56 N is added.

(i) Calculate the stress at its elastic limit. [2]

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(ii) The wire has a Young modulus of 1.3×10^{11} Pa. Calculate the extension at its elastic limit. [2]

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(c) The usual unit for Young modulus is the Pascal (Pa). Express this in terms of SI base units. [3]

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B420U101 05

13

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3. (a) State the principle of moments. [2]

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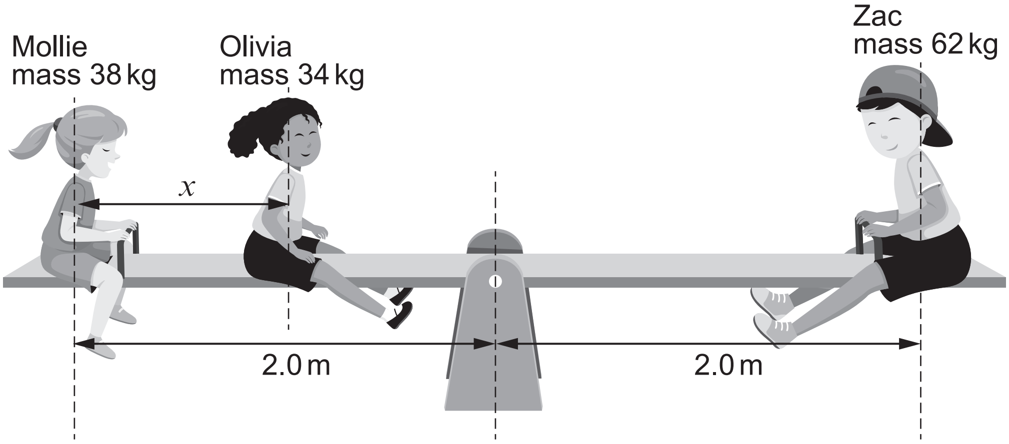
(b) (i) Zac, of mass 62 kg, and Mollie, of mass 38 kg, each sit 2.0 m from the pivot of a see-saw as shown in the diagram. Olivia, who has a mass of 34 kg, sits a distance, x, away **from Mollie**. Albert states that equilibrium is obtained when x is approximately 60 cm and that Zac will go upwards if Olivia moves further away from Mollie. Determine to what extent Albert's statements are correct. [5]



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(ii) The see-saw has a mass of 40 kg. Calculate the force of the pivot on the see-saw when all three children are sitting on it. [3]

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B420U101 07

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4. A ball bearing has a diameter of $20 \pm 1\,\text{mm}$ and a mass of $32.6 \pm 0.1\,\text{g}$.

(a) Determine its volume along with the **percentage** uncertainty. [3]

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(b) (i) Determine the density of the ball bearing along with its **absolute** uncertainty. Quote your answer to an appropriate number of significant figures. [6]

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(ii) Identify the main uncertainty in the experiment **and** explain how you could reduce this. [2]

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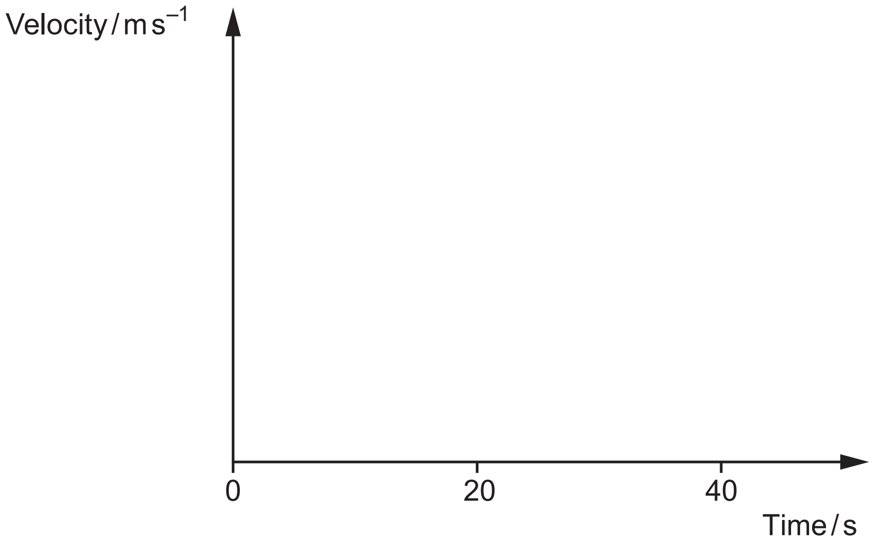
5. A train travels at a constant velocity of $8.0\,m\,s^{-1}$ for 20 s while passing through a station. Once clear of the station it then accelerates constantly up to a velocity of $40\,m\,s^{-1}$ over a further 20 s.

(a) (i) Sketch a velocity-time graph to describe its motion. [1]



(ii) Determine the change in velocity between 20 and 40 seconds. [1]

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(iii) **Use the graph** to determine the total distance travelled over this 40 s period. [3]

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(iv) Calculate the mean velocity of the train during the 40 seconds. [1]

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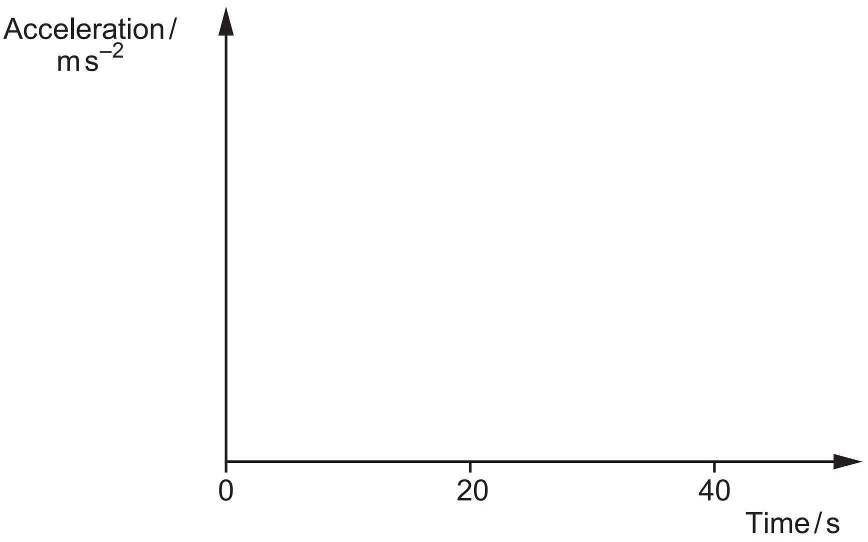
(b) (i) Sketch an acceleration-time graph for the train during the 40 seconds journey. Space for calculations if required. [3]



(ii) Evaluate whether or not your graph is in agreement with your answer to part (a)(ii). [2]

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6. The table shows some information about first generation subatomic particles.

Particle	Symbol	Quark combination	Charge / e	Baryon number	Lepton number
proton	p	uud	+1	+1	0
delta	Δ^{++}	....	....	....	....
electron	e^-	....	....	....	....
pion	π^+	....	....	....	....
neutrino	ν_e	....	....	....	....

(a) **Complete the table.** [4]

(b) (i) The following reaction shows the beta decay of a beryllium nucleus. Using conservation laws, identify particle X. [3]

$$^{10}_{4}\text{Be} \rightarrow {}^{10}_{5}\text{B} + e^- + \text{X}$$

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(ii) State which force is responsible for this decay. Explain your answer. [2]

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(c) Many fundamental particles have been discovered in the Large Hadron Collider at CERN.

(i) Explain what is meant by the term hadron. [1]

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(ii) Given the significance of CERN to the scientific community consider whether every country in the world should be contributing to its funding. Explain your answer. [2]

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7. Hot stars such as Vega are considered to be black bodies.

(a) Explain what is meant by a black body. [1]

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(b) The black body graph of spectral intensity against wavelength for Vega is shown in **Figure (a)**. A magnified section, showing the finer detail of the spectrum is also given in **Figure (b)**.

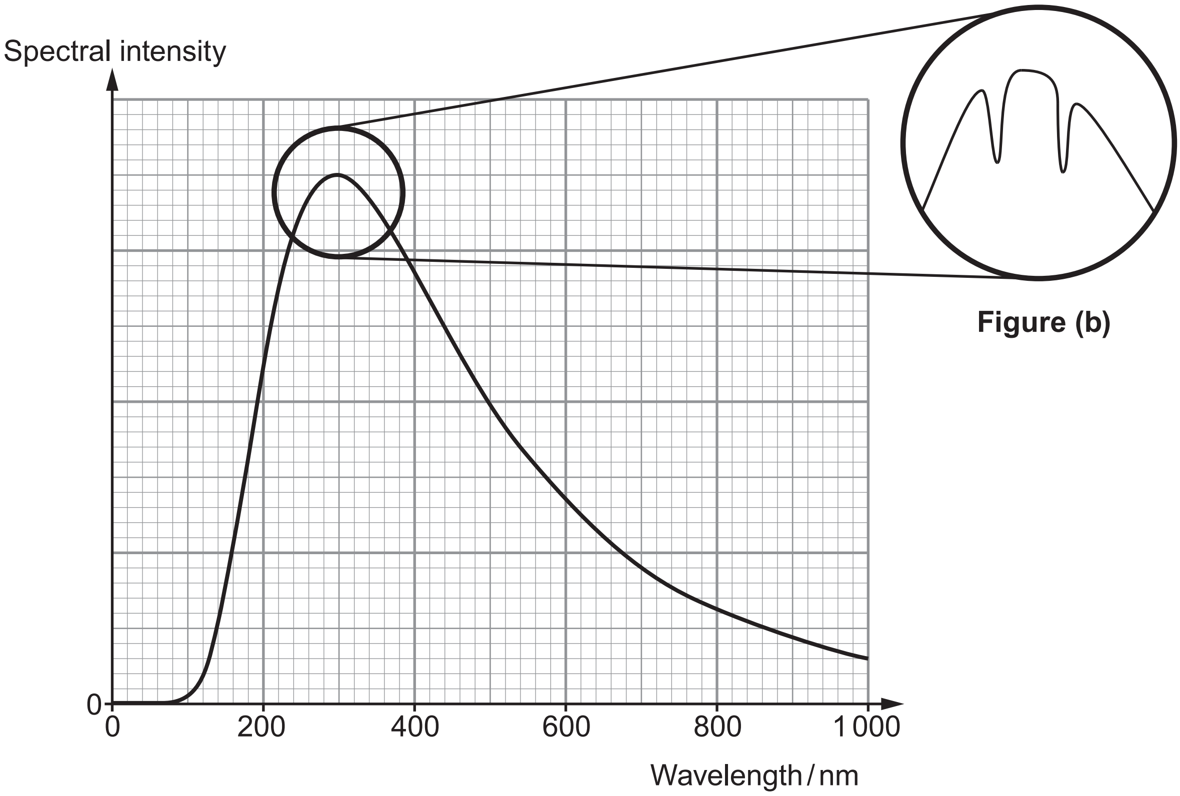

Figure (b)

Figure (a)

(i) Determine the temperature of the star. [2]

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(ii) Describe the colour of the star. [1]

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(c) (i) The dips in intensity in the spectrum (see **Figure (b)**), can be used to determine the elements making up the outer region of Vega. Explain how these dips arise. [3]

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(ii) Use **Figure (a)** to determine the energy of a photon of light emitted by Vega at the peak of the curve. [2]

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END OF PAPER

Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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