Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 3 GCE

Wednesday 20 May 2026

Afternoon (Time: 1 hour 45 minutes)

Paper reference **9PH0/01**

Physics

Advanced

PAPER 1: Advanced Physics I

You must have:
Scientific calculator and ruler
Data, Formulae and Relationships Booklet (enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
  If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
  Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
  Answer the questions in the spaces provided
  – *there may be more space than you need*.

Information

- The total mark for this paper is 90.
  The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- In the question marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

Advice

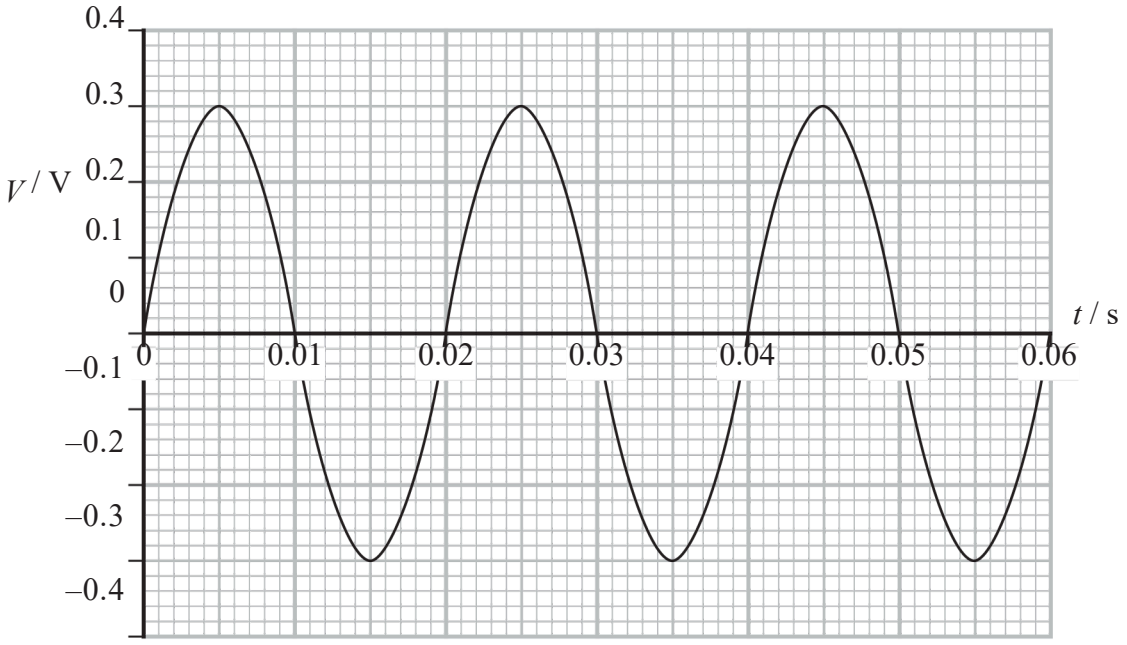
- Read each question carefully before you start to answer it.
  Try to answer every question.
  Check your answers if you have time at the end.
  You are advised to show your working in calculations including units where appropriate.

Turn over ▶

Answer ALL questions.

All multiple choice questions must be answered with a cross in the box ☒ for the correct answer from A to D. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒

1 A potential difference V varies with time t, as shown.



Which row of the table shows the values of V_{rms} and the frequency for V?

		V_{rms} / V	Frequency / Hz
☒	**A**	0.15	100
☒	**B**	0.15	50
☒	**C**	0.21	100
☒	**D**	0.21	

(Total for Question 1 = 1 mark)

2 Which of the following are the SI base units of energy?

☒ **A** kg m s^{-1}

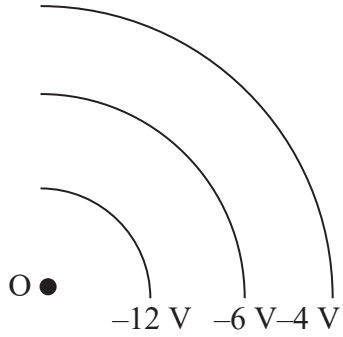
☒ **B** kg m^2 s^{-2}

☒ **C** N m

☒ **D** W s

(Total for Question 2 = 1 mark)

3 The diagram shows three equipotential lines for part of an electric field. A point labelled O is marked on the diagram.



Which row of the table shows the type and direction of the electric field?

	Type of field	Direction of field
☒ **A**	radial	towards O
☒ **A**	radial	away from O
☒ **B**	uniform	towards O
☒ **C**	uniform	away from O
☒ **D**		

(Total for Question 3 = 1 mark)

4 A down quark has a mass of 4.8 MeV / c^2.

Which of the following expressions gives the mass of a down quark in kg?

☒ **A** $\frac{4.8 \; 9 \quad 10^{16}}{1.6 \quad 10^{13}}$

☒ **B** $\frac{4.8 \; 1.6 \quad 10^{19}}{9 \quad 10^{16}}$

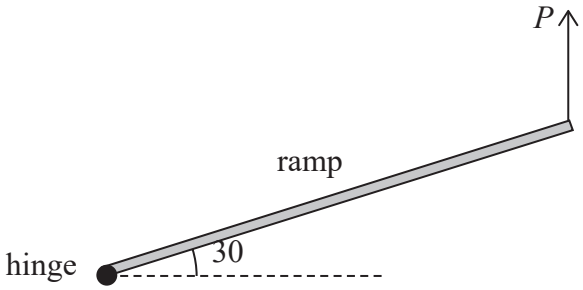
☒ **C** $\frac{4.8 \; 1.6 \quad 10^{13}}{9 \quad 10^{16}}$

☒ **D** $\frac{4.8 \; 1.6 \quad 10^{13}}{3 \quad 10^{8}}$

(Total for Question 4 = 1 mark)

5 A uniform ramp of weight W is hinged at one end. A vertical force P is applied at the other end to hold the ramp at an angle of 30° to the horizontal, as shown.

View from side



Which of the following expressions gives the value of P?

☒ **A** $P = 2W \cos 30^\circ$

☒ **B** $P = \frac{W}{2} \cos 30^\circ$

☒ **C** $P = 2^{W}$

☒ **D** $P = \frac{W}{2}$

(Total for Question 5 = 1 mark)

6 Each of the following pion decays is possible according to the law of conservation of charge.

Which of the following is **not** possible according to another conservation law?

☒ **A** $\pi^0 \rightarrow 2\gamma$

☒ **B** $\pi^0 \rightarrow e^+ + e^- + \upsilon_e$ **C**

☒ $\pi^+ \rightarrow \pi^0 + e^+ + \upsilon_e$

☒ **D** $\pi^- \rightarrow \pi^0 + e^- + -\upsilon_e$

(Total for Question 6 = 1 mark)

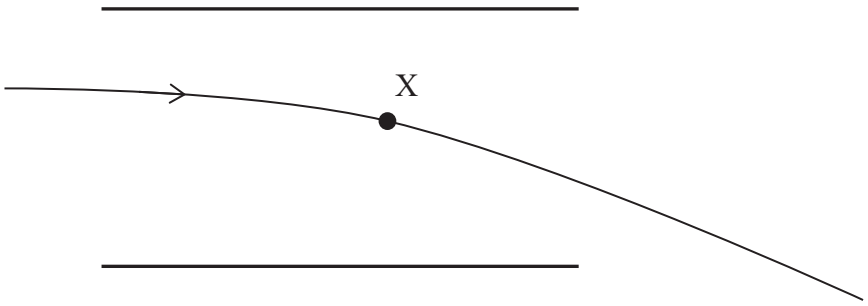
7 A filament bulb, connected to a cell, is brightly lit.
Over a period of several hours the filament bulb becomes dimmer.

Which of the following increased over this period of time?

- ☒ **A** The e.m.f. of the cell
- ☒ **B** The internal resistance of the cell
- ☒ **C** The resistance of the filament bulb
- ☒ **D** The terminal potential difference

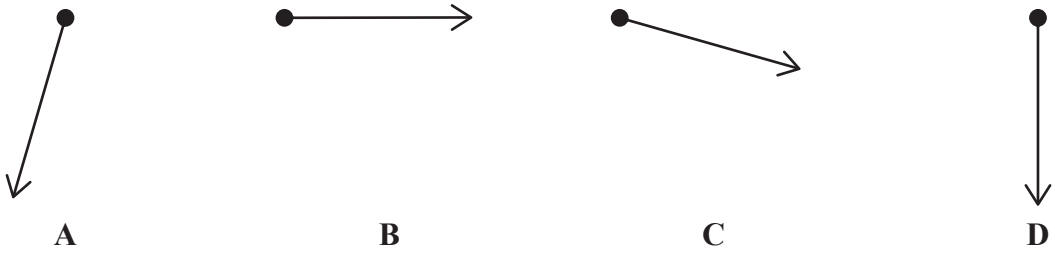
(Total for Question 7 = 1 mark)

8 An electron enters the space between two oppositely charged parallel plates.
The path of the electron is shown.



The weight of the electron is negligible.

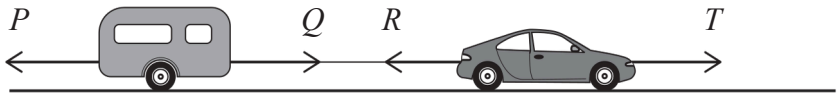
Which diagram shows the free-body force diagram for the electron at position X?



- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(Total for Question 8 = 1 mark)

9 A car uses a towrope to pull a caravan along a horizontal road at constant speed. Some of the horizontal forces acting are shown in the diagram.



P is the resistive force acting on the caravan.
Q is the tension in the towrope acting on the caravan.
R is the tension in the towrope acting on the car.
T is the driving force acting on the car.

Which of the following is a result of Newton's third law of motion?

☒ **A** $P = Q$

☒ **B** $Q = R$

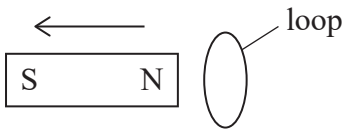
☒ **C** $R = T$

☒ **D** $P = T$

(Total for Question 9 = 1 mark)

10 A magnet is positioned near a single loop of wire. The loop is free to move.

The magnet is pulled away from the loop to the left, as shown.



The loop is observed to move as the magnet is pulled away.

Which row of the table gives the direction the loop moves and the correct reason?

	Direction of the movement of loop	Reason
☒ **A**	left	To reduce the change in the flux linkage in the loop
☒ **B**	left	To reduce the flux linkage in the loop
☒ **C**	right	To reduce the change in the flux linkage in the loop
☒ **D**	right	To reduce the flux linkage in the loop

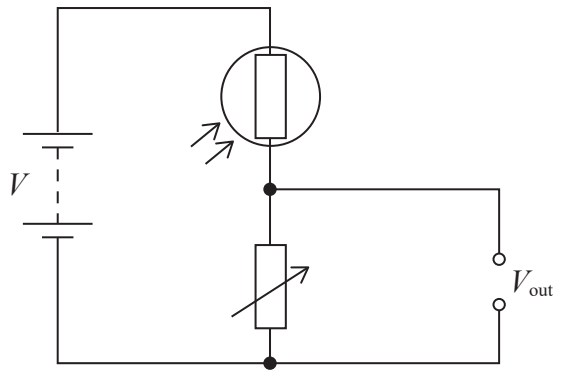
(Total for Question 10 = 1 mark)

11 A light dependent resistor (LDR) can be used as part of a sensor circuit in an alarm clock. The alarm switches on when the light level increases.

(a) Explain how the resistance of an LDR changes as the light level increases.

(2)

(b) The sensor circuit consists of an LDR connected to a variable resistor, as shown.



The output V_{out} of the sensor circuit provides an input to the alarm clock circuit.
The alarm is switched on when V_{out} increases above a minimum potential difference.

(i) Explain how the sensor circuit enables the alarm to switch on when the light level increases above a particular value.

(2)

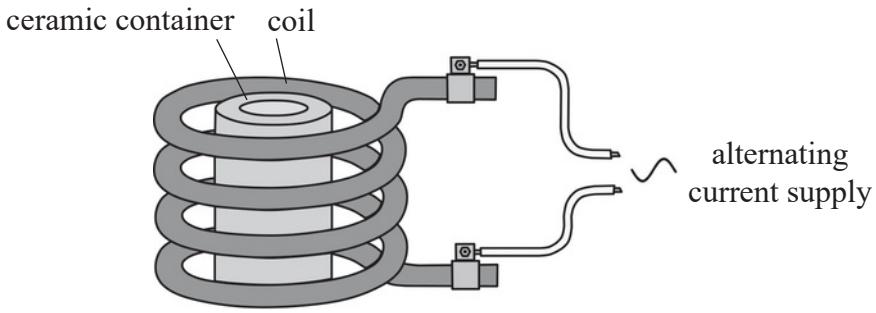
(ii) State the purpose of the variable resistor.

(1)

(Total for Question 11 = 5 marks)

12 Steel can be produced from waste metal using an induction furnace.

The induction furnace consists of a ceramic container surrounded by a coil, as shown.
The ceramic container is a poor electrical and thermal conductor.



(Source: © Sergey Merkulov/Shutterstock)

The coil is connected to an alternating current supply.

Waste metal is placed in the ceramic container.

(a) Explain why the waste metal becomes hot.

(4)

(b) In the induction furnace, the alternating current supply has a high frequency.

Explain why a high frequency is used.

(2)

(TotalforQuestion 12 = 6 marks)

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13 Concrete can deteriorate and disintegrate over time. Concrete is considered to be unsafe if the resistivity falls below 100 Ω m.

(a) A sample of concrete, in the shape of a cylinder, was tested. The resistance between the ends of the concrete cylinder was 4400 Ω.

Show that the resistivity of the concrete is greater than 100 Ω m.

diameter of cylinder = 0.12 m
length of cylinder = 0.20 m

(3)

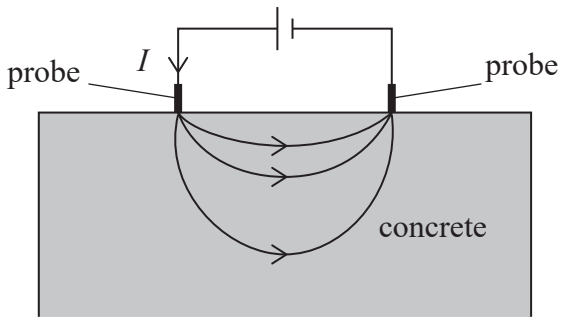
(b) As concrete deteriorates, its resistivity varies over a large range.

Explain what could produce this large range of resistivities.

(2)

(c) A resistivity meter can be used to investigate concrete.

Two probes are placed on the surface of the concrete and a current I is produced. The current can take a range of paths in the concrete, as shown.



If the potential difference between the probes is known, then the resistance can be determined.

Give **two** reasons why the equation $R = \frac{\rho l}{A}$ would **not** apply in this case.

(2)

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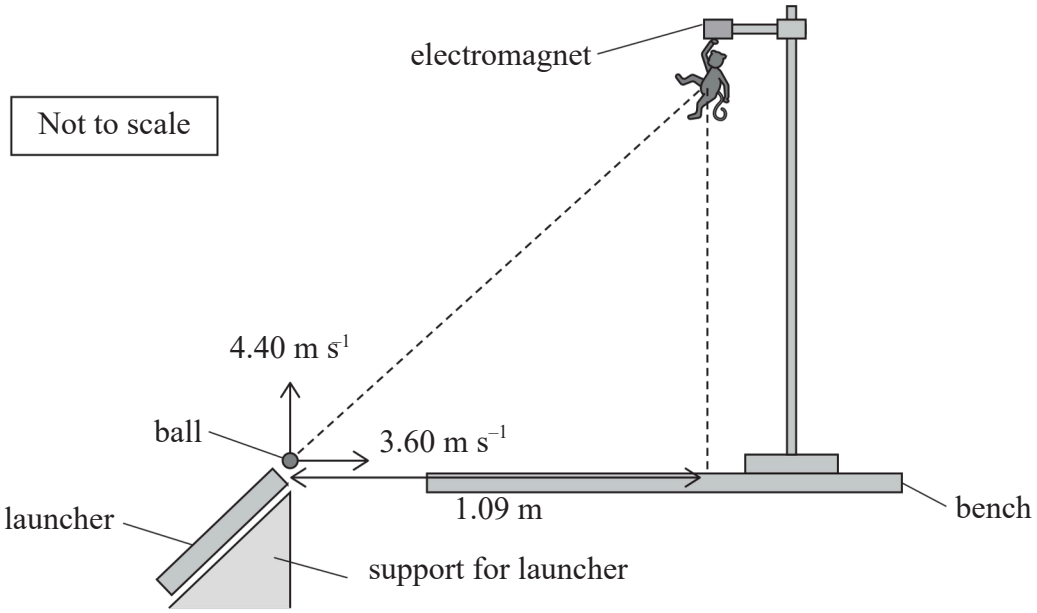
(Total for Question 13 = 7 marks)

14 A toy monkey is held by an electromagnet.
A small ball is fired from a launcher towards the toy monkey, as shown.



The ball leaves the launcher with a horizontal component of velocity 3.60 m s^{-1} and a vertical component of velocity 4.40 m s^{-1}.
The horizontal distance from the launcher to the toy monkey is 1.09 m.

(a) A short time after firing the ball from the launcher, the ball has travelled a horizontal distance of 1.09 m.

Show that the ball has now reached a height of about 0.88 m.

(3)

(b) At launch, the direction of the resultant velocity of the ball is towards the initial position of the toy monkey.

As the ball leaves the launcher, the electromagnet releases the toy monkey.

Deduce whether the toy monkey is hit by the ball.

(4)

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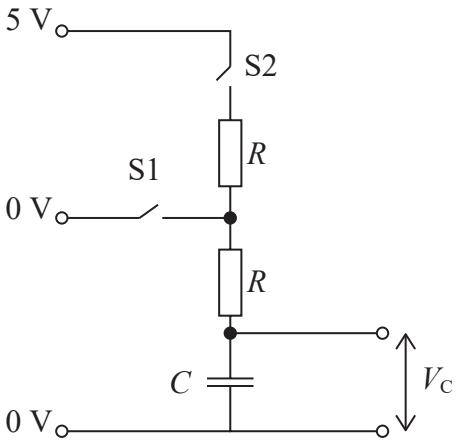
(Total for Question 14 = 7 marks)

15 A resistor-capacitor circuit provides an output potential difference V_C, as shown.

Switch S1 can be used to discharge the capacitor. Switch S2 can be used to charge the capacitor.



Switches S1 and S2 are initially open.

(a) The capacitor C is initially fully charged and $V_C = 5$ V.

(i) S1 is now closed.

Show that the time it takes V_C to decrease to a value of $\frac{5\text{V}}{e}$ is about 30 ms.

$R = 2.2\ \text{k}\Omega$
$C = 15\ \mu\text{F}$

(2)

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(ii) S1 is opened when V_C reaches a value of $\frac{5V}{e}$.

S2 is then closed.

Sketch a graph to show how V_C varies from the time switch S2 is closed.

You should add one value to each axis and show your working.

(4)

(b) A student is making the circuit. She only has 3.3 kΩ resistors available. She connects two resistors in series. She then connects the final resistor in parallel with the series combination.

Deduce whether the resistance of this combination is equal to 2.2 kΩ.

(3)

(Total for Question 15 = 9 marks)

16 The alpha particle scattering experiments were first carried out at the beginning of the last century.

*(a) These experiments led to a new model of the atom.

Describe the evidence and conclusions drawn from these experiments.

(6)

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(b) An alpha particle travelling with a speed u collides head on with a stationary gold nucleus, as shown.

Determine the recoil velocity of the gold nucleus. You should express your answer in terms of u.

The alpha particle rebounds with a speed of $0.97u$.

(3)

Recoil velocity of the gold nucleus = ...

(Total for Question 16 = 9 marks)

17 The Bohr model for the hydrogen atom was put forward in the early 20th century.

In this model, the electron orbits the proton in a circular path due to the electrostatic force between the electron and the proton.

The radius of the circular path is 5.29×10^{-11} m.

(a) Show that the velocity of the electron is about 2×10^{6} m s^{-1}.

(4)

(b) An electron in the atom has kinetic energy E_k and electric potential energy E_p.

(i) State why the electric potential energy of the electron within the electric field due to the proton is negative.

(1)

(ii) The total energy of the electron is equal to the sum of E_k and E_p.

The ionisation energy of the electron in a hydrogen atom is measured to be 2.2×10^{-18} J.

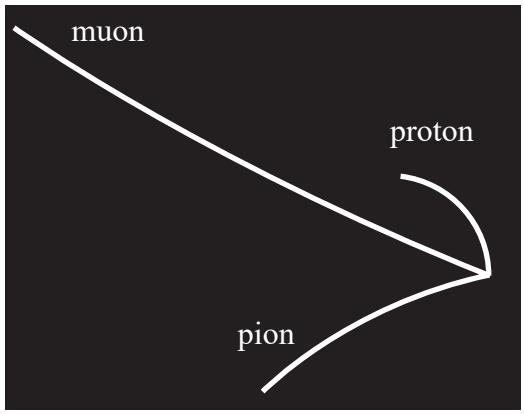
Deduce whether the total energy determined using this model agrees with this measurement.

(4)

(Total for Question 17 = 9 marks)

18 A neutrino collides with a stationary proton in a particle detector. In this collision, a muon (μ) and a pion are produced.

The tracks of the proton and the other two particles after the collision are shown in the image produced by the particle detector.



(a) A magnetic field of known flux density acts perpendicularly to the particle tracks.

(i) Identify which of the following gives the direction of the field by underlining the correct direction.

(1)

left to right into the page out of the page down the page up the page

(ii) Explain how you could determine the momentum of the moving proton from the image.

(3)

(b) Explain how the image shows that the muon must be negatively charged.

(2)

(c) Write a nuclear equation for this collision.

(2)

(d) The pion, proton and neutrino are subatomic particles.

Complete the table to give the classification of each particle and one feature of each classification. The first row has been completed for you.

(4)

Particle	Classification	Feature
pion	meson	quark and antiquark
proton		
neutrino		

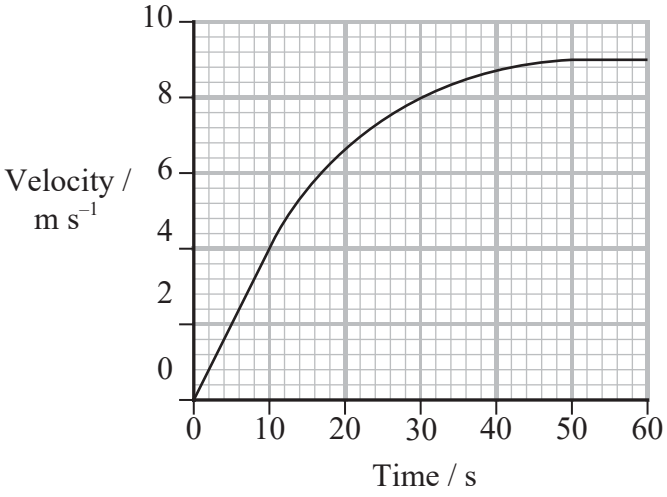
(e) Explain how the law of conservation of energy applies to this collision.
A stationary neutrino has negligible mass.

(3)

(Total for Question 18 = 15 marks)

19 A 'bike computer' is a device that can be attached to a bicycle to collect data whilst on a bicycle ride. The data can be analysed and used to display the performance of the cyclist.

The display shows the velocity for the first minute of a ride along a horizontal road.



(a) Determine the acceleration at 30 s.

(3)

Acceleration = ...

(b) Explain the variation of velocity shown in this graph in terms of the forces acting on the bicycle.

(4)

(c) The display shows that the average velocity over this period of time is 7 m s $^{-1}$.

Deduce whether the display is accurate.

(3)

(d) At the end of the minute shown on the graph, the road began to slope upwards. The cyclist continued with the same constant speed.

For every 18 m travelled, the road had risen 1 m.

As the cyclist continued up the road, the display showed an increase in power of 320 W.

Deduce whether the display was accurate.

mass of cyclist and bicycle = 65 kg

(3)

(Total for Question 19 = 13 marks)

TOTAL FOR PAPER = 90 MARKS

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