Write your name here

Surname	Other names

Pearson Edexcel GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics/Additional Science

Unit P2: Physics for Your Future

Higher Tier

Friday 17 June 2016 – Morning
Time: 1 hour

Paper Reference
5PH2H/01

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **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 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

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.

Turn over ▶

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P 4 6 5 1 3 A 0 1 2 4

PEARSON

FORMULAE

You may find the following formulae useful.

charge = current × time $Q = I \times t$

potential difference = current × resistance $V = I \times R$

electrical power = current × potential difference $P = I \times V$

energy transferred = current × potential difference × time $E = I \times V \times t$

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}} \qquad a = \frac{(v-u)}{t}$$

force = mass × acceleration $F = m \times a$

weight = mass × gravitational field strength $W = m \times g$

momentum = mass × velocity $P = m \times v$

$$\text{force} = \frac{\text{change in momentum}}{\text{time}} \qquad F = \frac{(mv-mu)}{t}$$

work done = force × distance moved in the direction of the force $E = F \times d$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{E}{t}$$

gravitational potential energy = mass × gravitational field strength × vertical height

$\text{GPE} = m \times g \times h$

kinetic energy = ½ × mass × velocity^2 $\text{KE} = ½ \times m \times v^2$

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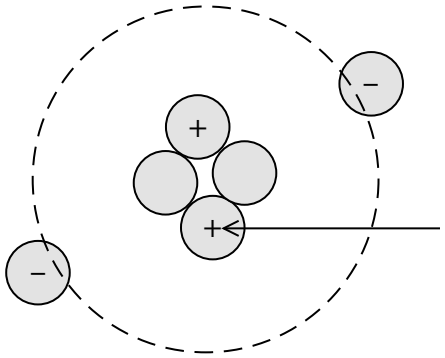
Questions begin on next page.

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Static electricity and charge

1 (a) The diagram represents an atom.



Not to scale

The arrow is pointing to a single particle.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The arrow is pointing to

(1)

☒ **A** an electron

☒ **B** a neutron

☒ **C** a nucleus

☒ **D** a proton

(b) A student has a nylon carpet in her bedroom.

She becomes positively charged as she walks across the carpet.

(i) Explain how the student becomes positively charged.

(3)

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(ii) When the student touches a metal door handle she feels an electric shock. Explain why she feels an electric shock.

(2)

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.....

(c) An electric torch is switched on for 90 s.

The current in the torch is 70 mA.

Calculate the amount of charge flowing from the torch battery during this time.

(2)

charge = ... C

(Total for Question 1 = 8 marks)

Nuclear fission and nuclear fusion

2 (a) Complete the sentence by putting a cross (☒) in the box next to your answer.

The difference between fission and fusion is that only fission

(1)

☒ **A** creates new nuclei

☒ **B** is triggered by neutrons

☒ **C** releases electrons

☒ **D** releases energy

(b) A nucleus of uranium-235, used in a fission reactor, can be represented as

$$^{235}_{92}U$$

Insert the correct numbers into this sentence:

(2)

A nucleus of uranium-235 contains ..... protons and ..... neutrons.

(c) Describe the purpose of the moderator in a nuclear fission reactor.

(2)

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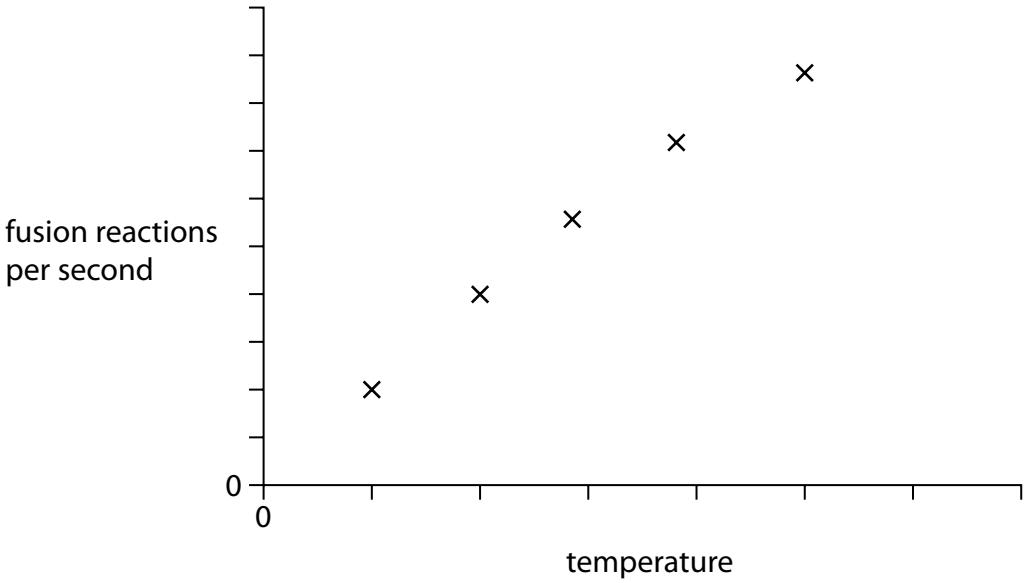
(d) Scientists have studied fusion reactors.

They have found that the number of fusion reactions per second varies with temperature.

This variation is shown on a graph.



Explain why the number of fusion reactions per second varies with temperature in this way.

(2)

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(e) In 1989, some scientists claimed to have achieved fusion at room temperature.

Suggest why their claim is no longer believed.

(1)

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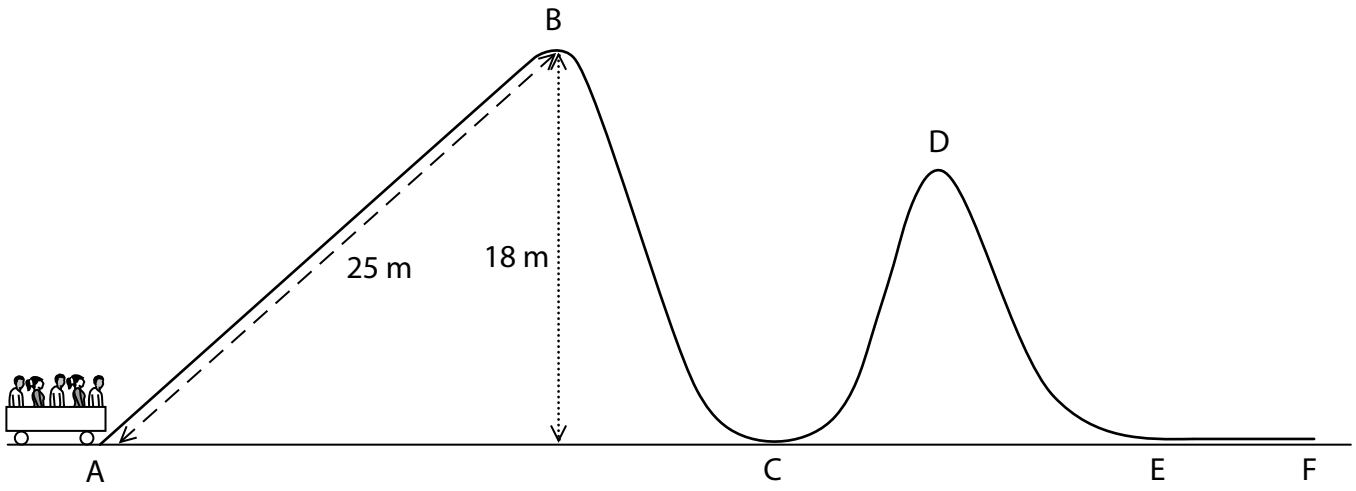
(Total for Question 2 = 8 marks)

3 The diagram shows a car and passengers at the start of a roller coaster ride at an amusement park.



(a) An electric motor pulls the car from A to B at a steady speed.

The total mass of the car and passengers is 9500 kg.

Calculate the amount of work done on the car and passengers.
[Gravitational field strength, g = 10 N/kg]

(2)

work done = ... J

(b) The car is released at B and continues down the track.

State the maximum possible kinetic energy of the car and passengers at C.

(1)

maximum KE = ... J

(c) Describe the main energy transfer that takes place between C and D.

(2)

.....

.....

.....

.....

(d) When the car and passengers reach E, they have a total momentum of 150 000 kg m/s.

The total mass of the car and passengers is 9500 kg.

Calculate the velocity of the car and passengers at E.

(3)

velocity = ... m/s

(e) Brakes are applied as the car passes E.

This brings the car to a stop at F.

Explain why it is more comfortable for the passengers if there is a large distance between E and F.

(2)

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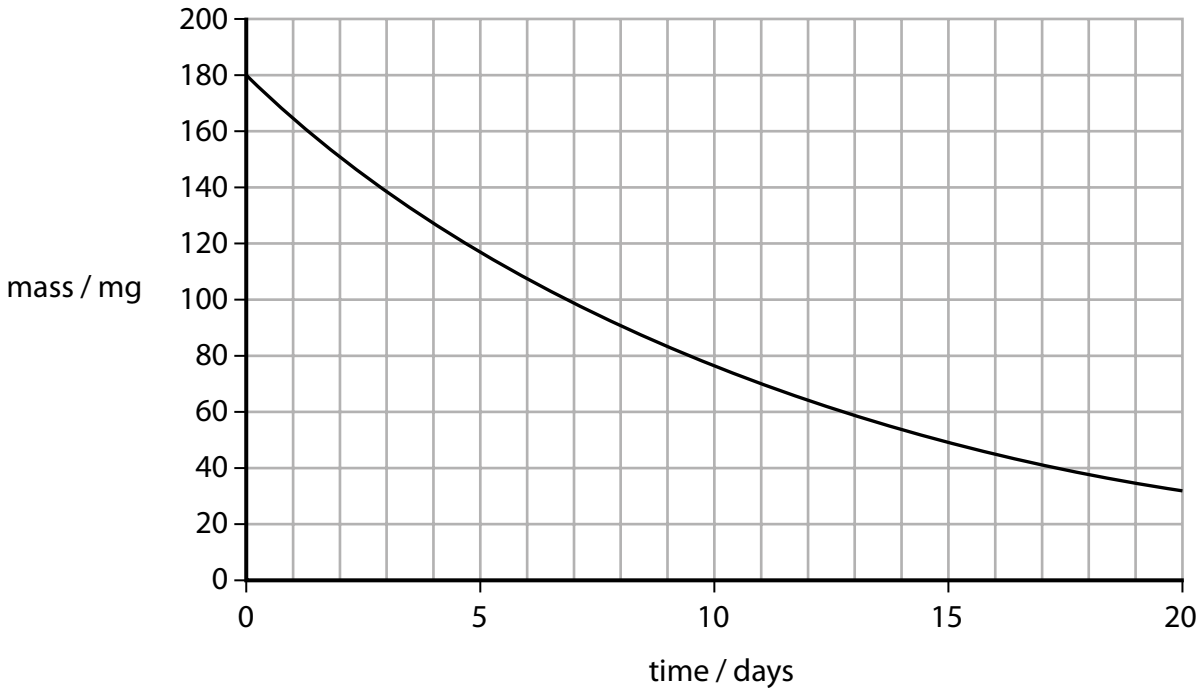
(Total for Question 3 = 10 marks)

Radioactivity and its uses

4 (a) Iodine-131 is used in hospitals.
The graph shows the decay of a sample of iodine-131.



(i) Use the graph to find the half-life of iodine-131.

(2)

half-life = ... days

(ii) Estimate the mass of iodine-131 in the sample 7 days before the start of the graph.

(1)

mass = ... mg

(iii) Iodine-131 emits beta particles and gamma rays.

A patient is only given a small dose of iodine-131 during treatment.

Hospital staff who administer this treatment to a lot of patients are potentially exposed to greater risk.

Explain the dangers to hospital staff.

(2)

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.....

.....

(iv) State one safety precaution related to the use of radioactive material.

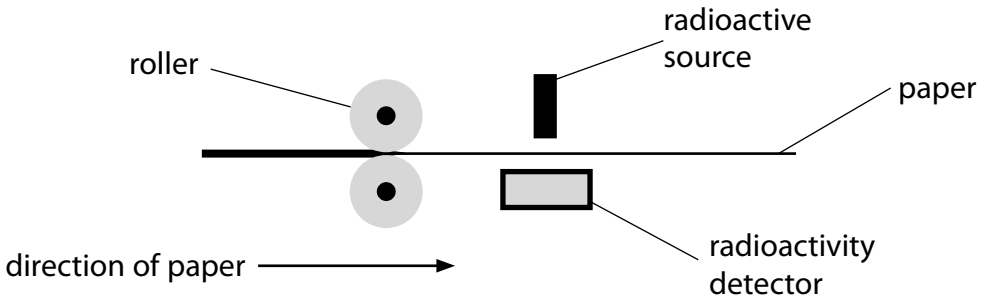
(1)

.....

(b) Radioactive sources are also used in factories that make paper.

The distance between two rollers controls the thickness of the paper.
The factories use a system to control this distance.

The system contains a radioactive source and a radioactivity detector.



(i) Which of these sources should be used?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** an alpha emitter

☒ **B** a beta emitter

☒ **C** a gamma emitter

☒ **D** an alpha and gamma emitter

(ii) Explain how this system controls the thickness of the paper.

(3)

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(Total for Question 4 = 10 marks)

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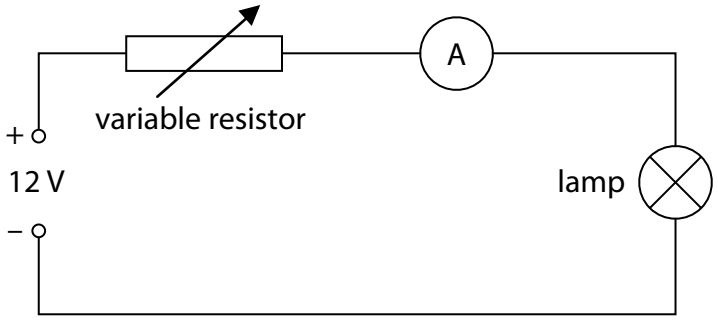
Electrical resistance

5 A student uses this circuit to investigate how the current in a filament lamp varies with the potential difference (voltage) across the lamp.



(a) Add a voltmeter to the circuit that can be used to measure the potential difference (voltage) across the lamp.

(1)

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

The 12 V electrical supply transfers

(1)

☒ **A** 12 joules per coulomb

☒ **B** 12 coulombs per joule

☒ **C** 12 joules per ohm

☒ **D** 12 volts per amp

(c) When the variable resistor is at the half-way position, the ammeter reads 0.37 A and the voltmeter reads 4.0 V.

Show that the resistance of the filament in the lamp is about 11 Ω.

(2)

(d) The student increases the resistance of the variable resistor.

Which of the following describes how the meter readings change?

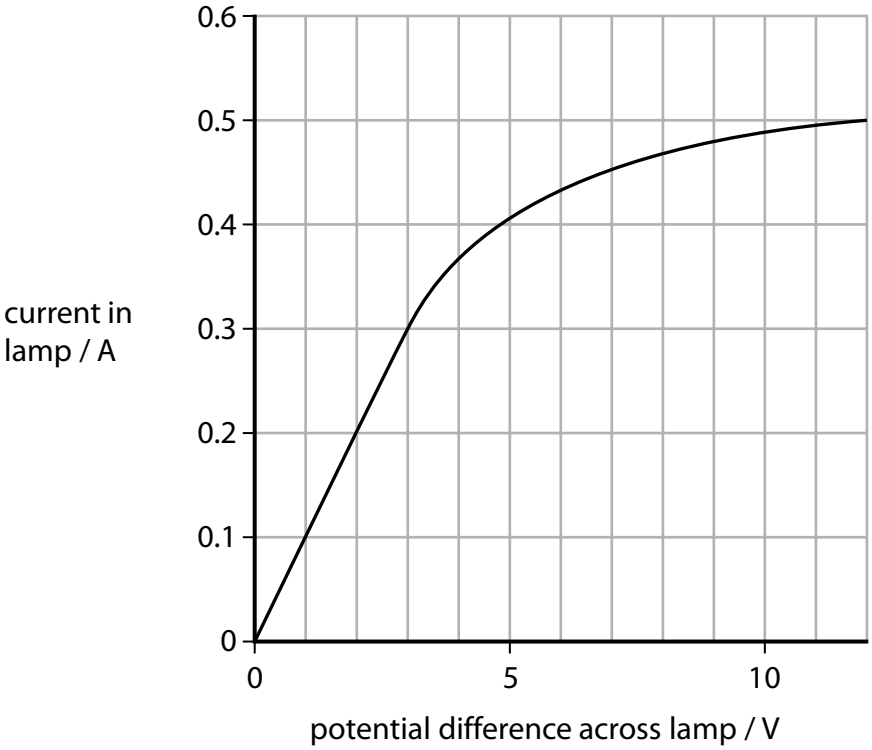
Put a cross (☒) in the box next to your answer.

(1)

	the ammeter reading	the voltmeter reading
☒ **A**	increases	increases
☒ **B**	increases	decreases
☒ **C**	decreases	decreases
☒ **D**	decreases	increases

*(e) The student takes a range of measurements for the filament lamp.

He plots this graph from his measurements.

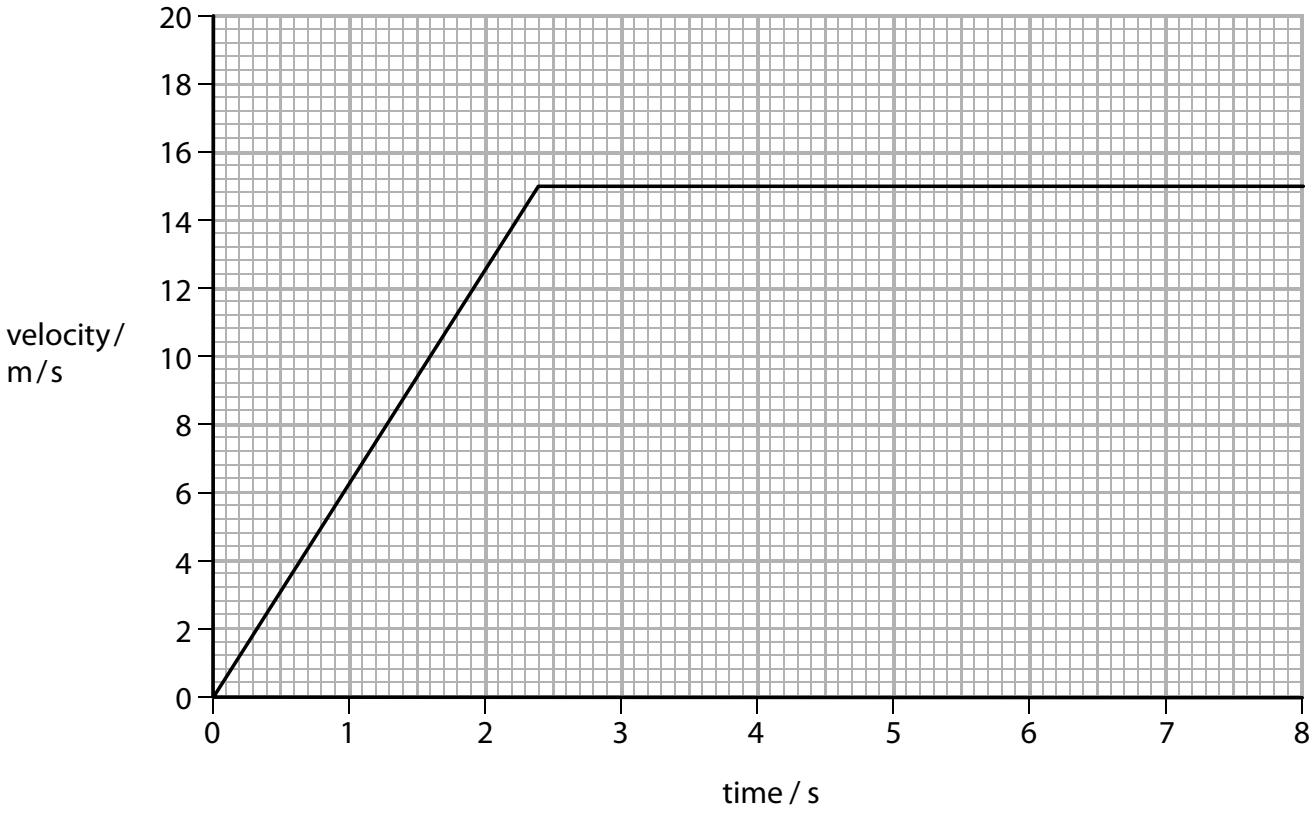


Explain how changes in the filament of the lamp account for this graph.

(6)

(Total for Question 5 = 11 marks)

6 (a) The graph represents the motion of a cyclist at the start of an Olympic race.



(i) Calculate the initial acceleration.

(2)

acceleration = ... m/s^2

(ii) Another cyclist has a smaller initial acceleration but then reaches a constant velocity of 17 m/s.
Draw her motion on the graph above.

(1)

(iii) The cyclists have to keep pedalling to maintain their constant velocity.

Give one reason why they have to keep pedalling to maintain their constant velocity.

(1)

.....

.....

(iv) One cyclist produces an average power output of 600 W during the race. She completes the race in exactly 4 minutes.

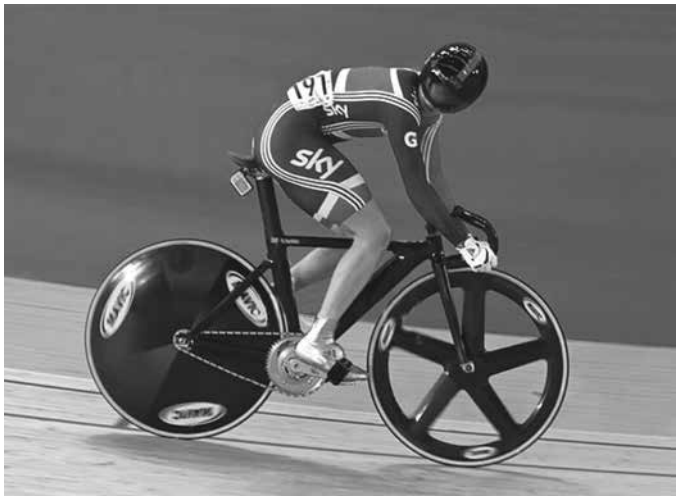
Calculate the work done by the cyclist during the race.

(3)

work done = ...J

*(b) The photographs show cyclists and the winning times for the same event in two different Olympic Games.

1920: 5 min 14 s



2012: 3 min 51 s

The designs of the cyclists' clothing and their bicycles have changed.

These changes have helped the modern cyclist to improve the winning time from 5 min 14 s to 3 min 51 s.

Describe **one** of these changes and use scientific principles to explain how this change has helped cyclists improve the winning time.

(6)

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

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