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H

Monday 30 January 2012 – Afternoon

GCSE GATEWAY SCIENCE
PHYSICS B

B651/02 Unit 1 Modules P1 P2 P3 (Higher Tier)

B620880112

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour

B651102

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- A list of physics equations is printed on page two.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

EQUATIONS

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

fuel energy input = waste energy output + electrical energy output

power = voltage × current

energy supplied = power × time

energy (kilowatt hours) = power (kW) × time (h)

wave speed = frequency × wavelength

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

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

force = mass × acceleration

work done = force × distance

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{kinetic energy} = \frac{1}{2}mv^2$$

potential energy = mgh

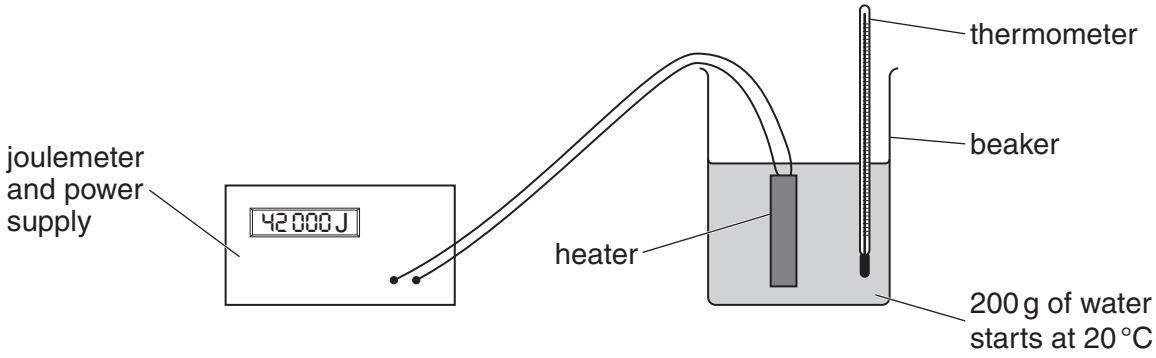
weight = mass × gravitational field strength

Answer **all** the questions.

Section A – Module P1

1 Wesley investigates heating water.

Look at the apparatus he uses.



The joulemeter records that **42 000 J** of energy is supplied to the **200 g** of water.

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

The temperature of the water at the start is **20 °C**.

Calculate the **final** temperature of the water.

The equations on page 2 may help you.

.....

.....

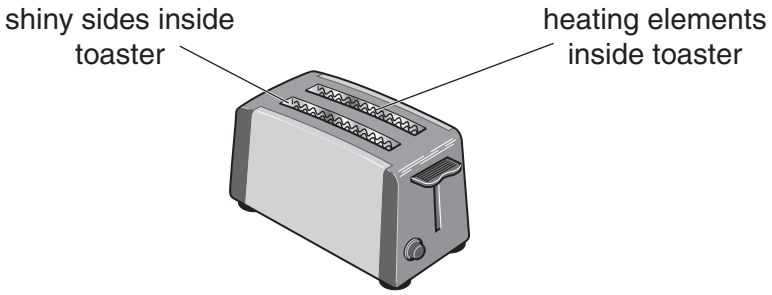
.....

.....

final temperature ..... °C **[3]**

[Total: 3]

2 Abir has an electric toaster in her kitchen.



She puts some bread in the toaster.

(a) (i) The bread is toasted (heated) by **infrared** radiation given off by the heating elements.

Describe how the infrared radiation toasts the bread.

In your answer write about

- what part of the bread is toasted
- how the shiny sides help to toast the bread quickly.

.....

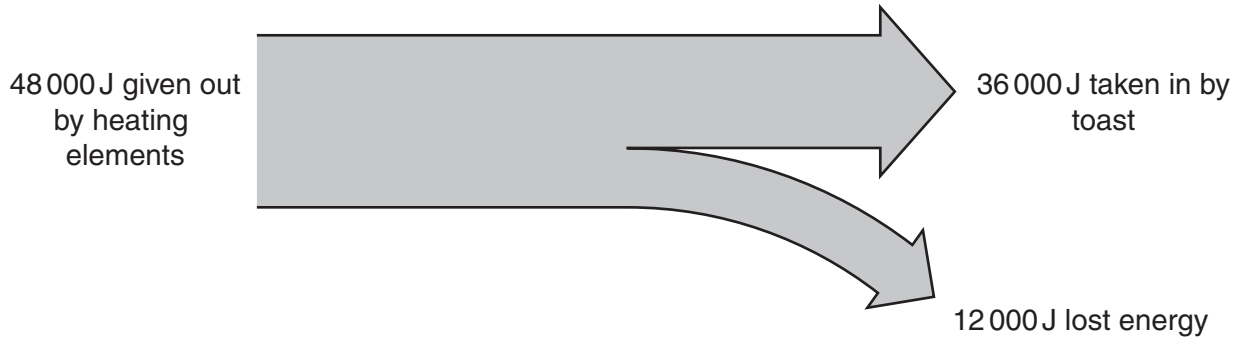
.....

.....

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

(ii) When the bread is toasted

- the heating elements give out **48 000 J** of energy
- the toast takes in **36 000 J** of this energy
- the rest of the energy is taken in by the toaster or lost into the atmosphere.



Calculate how efficient the heating elements are at toasting the bread.

The equations on page 2 may help you.

.....

.....

.....

answer ..... **[2]**

(b) Abir heats a meal in a microwave oven.

Explain how the **microwaves** heat the meal.

In your answer write about

- the absorption of microwaves
- kinetic energy
- how **all** of the meal becomes hot.

.....

.....

.....

..... **[3]**

[Total: 7]

3 This question is about ultraviolet (UV) radiation from the Sun.

(a) Thomas wants to go outside on a sunny day.

He has two sun creams.

'**SPF**' means **S**un **P**rotection **F**actor.

(i) Thomas uses Cool Tan sun cream.

How long can Thomas safely stay in the sun?

Complete the table.

safe time in the sun without sun cream	**safe time in the sun with *COOL TAN* sun cream, SPF 15**
7 minutes	..... minutes

[1]

(ii) Thomas uses **Tan Fastic** sun cream instead of Cool Tan.

The Tan Fastic sun cream has an SPF of 45.

He can now safely stay in the sun for a longer time.

How much longer?

.....

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

(b) A layer of the Earth's atmosphere protects us from some of the harmful effects of UV radiation.

Scientists are concerned that the amount of protection has fallen.

This is the result of human activity.

Complete the sentences.

The part of the Earth's atmosphere that protects us from UV radiation is the

..... layer. This layer is becoming ..... because of

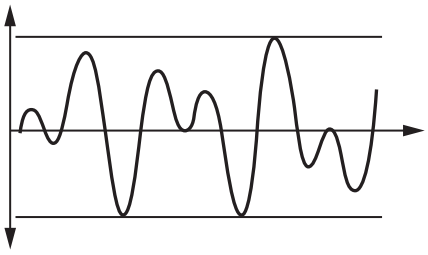
..... gases released on Earth. **[2]**

[Total: 4]

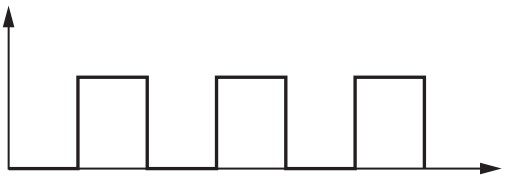
4 This question is about waves.

(a) Jack is listening to his radio.

Radio waves are transmitted using two **types** of signal.



A



B

Jack thinks that **A** is an analogue signal and **B** is a digital signal.

Complete the sentences to explain why Jack is correct.

Signal **A** is **analogue** because .....

..... .

Signal **B** is **digital** because .....

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

(b) Jack carries his radio around the house.

He can hear music from another radio station as well as the one he wants to listen to.

This is because the waves from the two radio stations overlap and **interfere**.

Why do the waves from the **two radio stations** interfere?

.....

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

Turn over for the remainder of question 4

(c) Some radio waves use a region of the Earth's upper atmosphere to travel long distances.

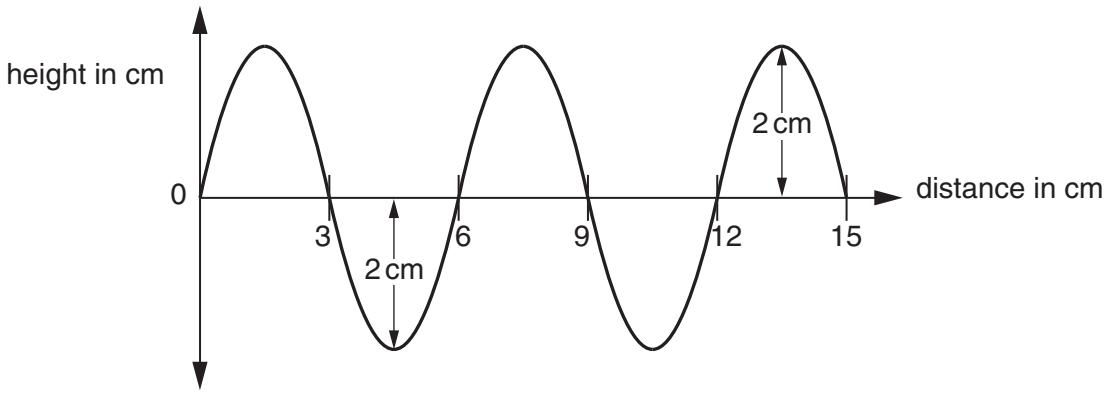
Complete the sentences to explain how this is achieved.

The radio waves ..... off a region of the Earth's atmosphere.

This region is called the ..... . **[1]**

(d) **(i)** Light waves and water waves are examples of **transverse** waves.

Look at the diagram of a transverse water wave.



What is the **wavelength** of the wave in cm?

Choose from

2

3

4

6

9

12

answer ..... cm **[1]**

(ii) This water wave has a frequency of 4 Hz.

Which sentence best describes what is meant by the frequency of the wave?

Put a tick (✓) in the box beside the best description of the frequency of this wave.

the wave is 4 cm high	☐
the wave travels 4 cm in 1 second	☐
the wave is 4 cm long	☐
there are 4 complete waves every second	☐
there are a total of 4 cycles in the whole wave	☐

[1]

[Total: 6]

Section B – Module P2

5 This question is about nuclear radiation.

(a) Nuclear radiation has many uses.

Draw lines to join each **radiation** to its **correct use**.

radiation	use
beta	sterilising medical equipment
alpha	smoke alarms
gamma	thickness testing for paper

[2]

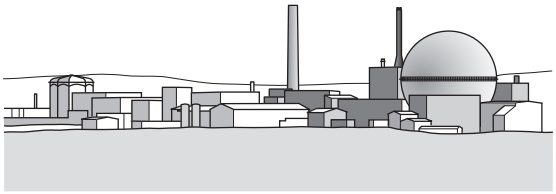
(b) **Background** radiation is around us all the time.

All living things emit very small amounts of nuclear radiation.

Write down **one other** source of background radiation.

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

(c) Nuclear power stations produce energy.



(i) Plutonium is one fuel used in some nuclear power stations. Name another fuel used in **nuclear** power stations.

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

(ii) Write down one **other** use for plutonium.

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

(d) Nuclear power has advantages and disadvantages.

Write about the advantages **and** disadvantages of using nuclear power.

.....

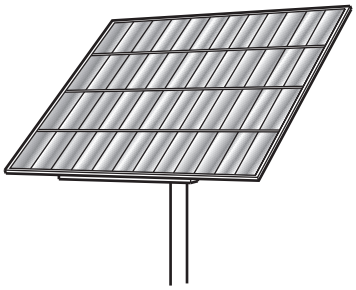
.....

.....

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

[Total: 7]

6 Photocells absorb light energy from the Sun to produce direct current.



Explain how electricity is produced in a photocell.

In your answer write about

- what direct current means
- what carries the charge
- how this charge is released.

.....

.....

.....

.....

..... **[3]**

[Total: 3]

7 This question is about using electricity in the home.

(a) Bob tests an electric shower.

Its power is 7.0 kW.

The shower is switched on for 0.2 hours.

The cost of electricity is 12p for a kilowatt-hour unit.

Calculate the cost of using the shower for 0.2 hours.

The equations on page 2 may help you.

.....

.....

.....

answer ..... pence **[3]**

(b) Bob thinks that using **off-peak** electricity may be better.

Write down one **advantage** and one **disadvantage** of using off-peak electricity.

advantage .....

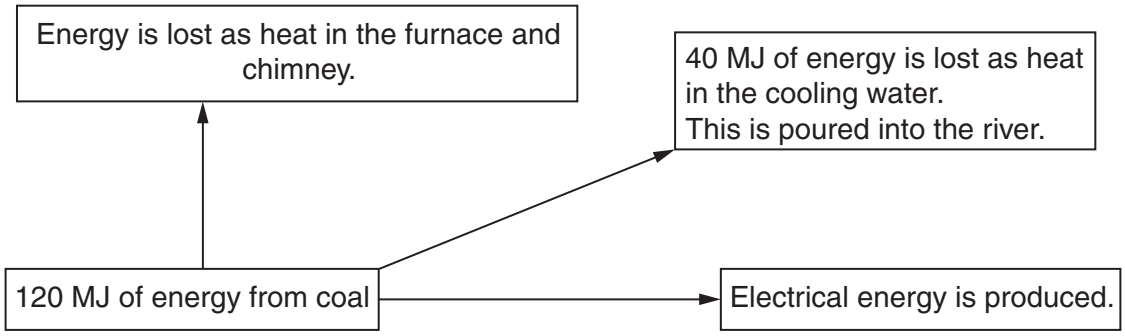
.....

disadvantage .....

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

[Total: 5]

8 Look at the energy diagram for a power station.



(a) (i) This power station only has an efficiency of 0.4 (40%).

Calculate how much electrical energy is produced.

The equations on page 2 may help you.

.....

.....

answer ..... MJ **[2]**

(ii) Look at the energy diagram.

How much energy is lost as heat through the furnace and chimney?

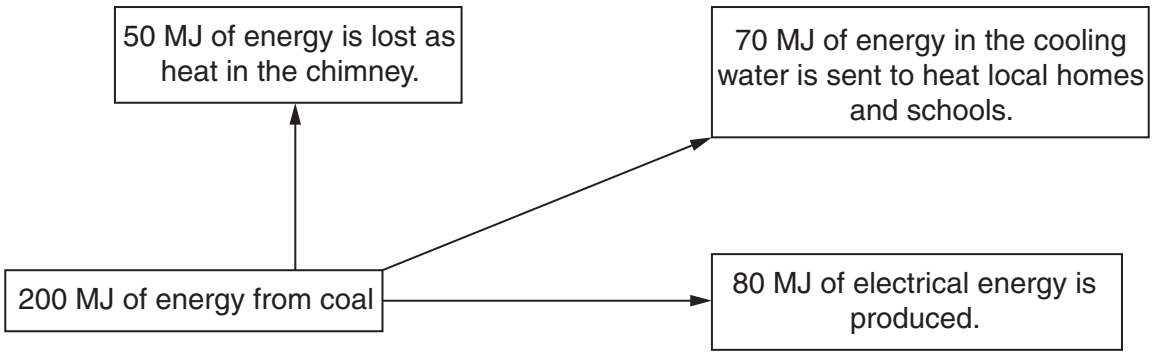
.....

.....

..... MJ **[1]**

(b) Power stations can be made more efficient.

Look at the energy diagram for this more efficient power station.



This is a community power station.

The power station has an overall efficiency of 0.75 (75%).

Use the information in the diagram to explain why.

.....

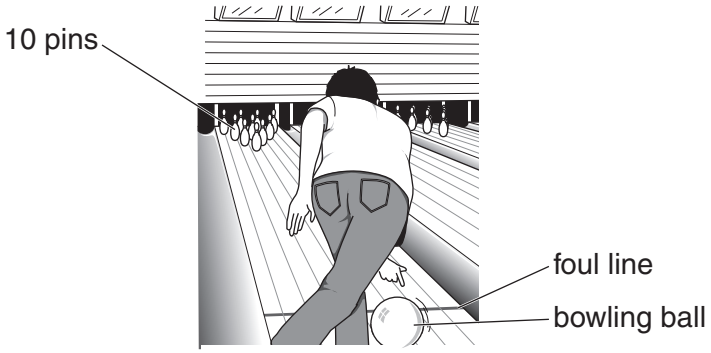
.....

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

[Total: 5]

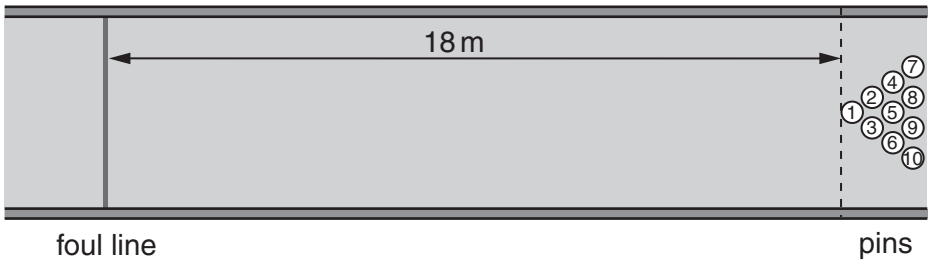
Section C – Module P3

9 Jay goes tenpin bowling.



(a) Jay wants to measure the **speed** of the bowling ball.

He measures **distance** and **time**.



The distance from the foul line to the front pin is **18 m**.

The bowling ball travels from the foul line to the front pin in **4.5 seconds**.

Calculate the average speed of the bowling ball.

The equations on page 2 may help you.

.....

.....

.....

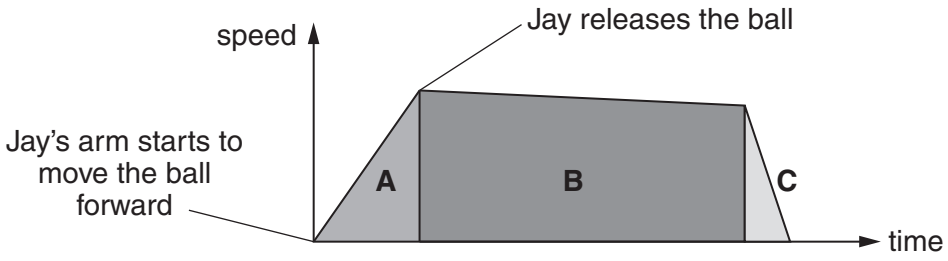
answer ..... m/s **[2]**

(b) Jay draws a sketch graph of the speed of the ball.

He labels when his arm starts to move the ball forward.

He also labels the point when the ball is released from his hand.

Look at these labels on the graph.



(i) What happens to the ball in part **A** of the graph?

Put a tick (✓) in the box next to the correct answer.

accelerates ☐

stays stationary ☐

slows down gradually (decelerates gradually) ☐

moves at a constant speed ☐

slows down rapidly (decelerates rapidly) ☐

[1]

(ii) Compare parts **B** and **C** of the graph.

What happens in part **C** of the graph?

Put a tick (✓) in the box next to the correct answer.

stays stationary ☐

slows down (decelerates) more than in **B** ☐

slows down (decelerates) at the same rate as in **B** ☐

slows down (decelerates) less than in **B** ☐

moves at a constant speed ☐

[1]

Turn over for the remainder of question 9

(iii) Jay calculates the **area** under the graph.

What does the area under the graph represent?

.....

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

[Total: 5]

10 Alisha drives a truck.

(a) When the truck is moving it has **kinetic** energy (KE).

Write down two things that will **increase** the KE of the truck.

1 .....

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

(b) **(i)** The mass of the truck is **3000 kg**.

Alisha drives the truck with an acceleration of **3 m/s^2**.

What is the **driving force**?

The equations on page 2 may help you.

Put a (ring) around the correct answer.

0.001 N **1000 N** **2997 N** **3003 N** **9000 N** **[1]**

(ii) Alisha drives the truck with **less** acceleration.

The new driving force is **900 N**.

She drives the truck for a distance of **450 m**.

What is the **work done**?

The equations on page 2 may help you.

Put a (ring) around the correct answer.

405 000 J **1350 J** **450 J** **2 J** **0.5 J** **[1]**

(c) Alisha drives her truck at a higher speed.

Higher speed is a factor that **increases** her thinking distance **and** the braking distance of the truck.

Complete these sentences.

Another factor that would increase **thinking** distance is .....

.....

Another factor that would increase **braking** distance is .....

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

(d) Alisha's brother Samuel also drives her truck.

The fuel consumption is greater when Samuel drives the truck.

Alisha thinks it is because he has a different **driving style** and has nothing to do with the truck itself.

Examples of different driving styles are

- driving with the windows open
- driving with the radio and air conditioning on.

Describe one **other** way that Samuel could drive the truck that would increase the fuel consumption.

.....

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

[Total: 7]

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11 Seat belts and air bags in cars are designed to absorb energy in a crash.

Do seat belts and air bags in cars save lives?

Look at the data from the USA about these safety features.

year	number of lives saved due to wearing seat belts	number of lives saved due to air bags
2005	15688	2752
2006	15458	2824
2007	15223	2800
2008	13250	2546

Which safety feature appears to save most lives?

answer .....

Explain how **this** safety feature saves lives by reducing the forces on the driver and passengers in a crash.

.....

.....

.....

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

[Total: 2]

12 Lexi drops two identical paper cake cases.

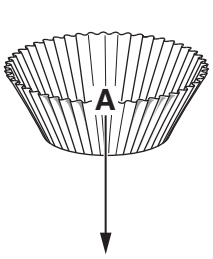
She squashes one cake case into a ball shape.

She drops them from a bridge.

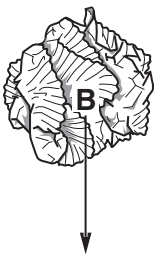
There is **no** wind blowing.

The cake cases fall into the stream below.

The two cake cases look like this.



A is a cake case



B is a cake case crushed into a ball shape

(a) The two paper cake cases have the **same weight**.

The cake cases reach different **terminal speeds**.

Explain why **A** and **B** both reach terminal speed **and** why one has a higher terminal speed than the other.

Use ideas about forces in your answer.

.....

.....

.....

.....

..... **[3]**

(b) When **A** and **B** start to fall they lose gravitational potential energy and gain kinetic energy.

When **A** and **B** are travelling at terminal speed their gravitational potential energy continues to decrease but they do **not** gain **any more** kinetic energy.

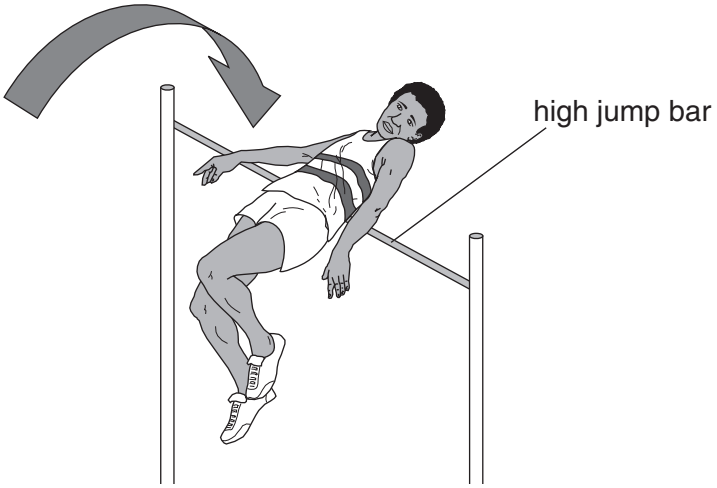
Explain what happens to the gravitational potential energy at terminal speed.

.....

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

[Total: 4]

13 Dwayne is a high jumper.



His mass is 70 kg.

Dwayne jumps his personal best.

The increase in gravitational potential energy (GPE or PE) needed to **just** clear the bar is 1540 J.

Gravitational field strength (g) is 10 N / kg.

Calculate the height of his high jump.

The equations on page 2 may help you.

.....

.....

.....

.....

answer ..... m **[2]**

[Total: 2]

END OF QUESTION PAPER

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