Candidate forename		Candidate surname	

Centre number					Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

GCSE

B651/02

GATEWAY SCIENCE

PHYSICS B

Unit 1 Modules P1 P2 P3 (Higher Tier)

MONDAY 30 JANUARY 2012: Afternoon
DURATION: 1 hour

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

- Use black ink. HB pencil may be used for graphs and diagrams only.

- Answer <u>ALL</u> 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).

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 three.

- The total number of marks for this paper is <u>60</u>.

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

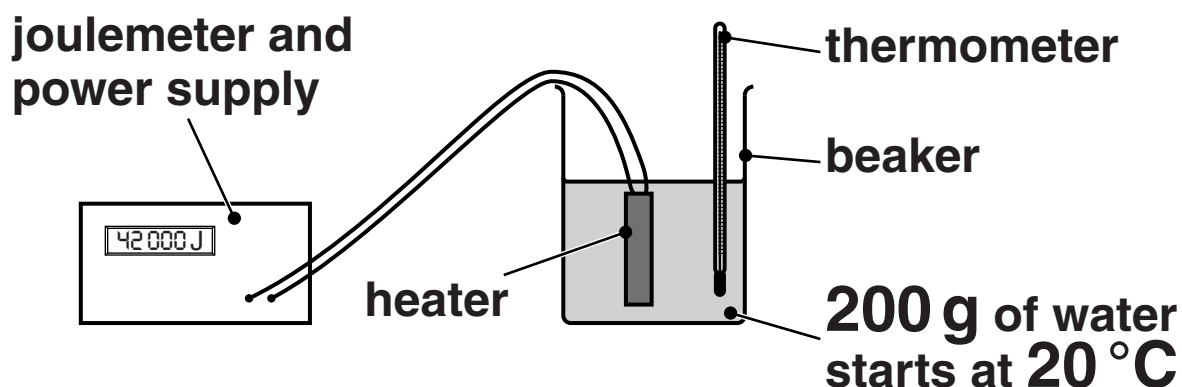weight = mass × gravitational field strength

Answer ALL the questions.

SECTION A – MODULE P1

1   **Wesley investigates heating water.**

   Look at the apparatus he uses.

joulemeter and power supply

42 000 J

thermometer

beaker

heater

200 g of water starts at 20 °C

   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 3 may help you.

_____

_____

_____

_____

final temperature _____°C   **[3]**
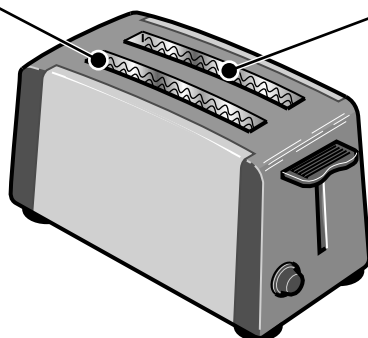
[Total: 3]

2 **Abir has an electric toaster in her kitchen.**

shiny sides inside toaster

heating elements inside toaster

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.

48 000 J
given out
by heating
elements

36 000 J
taken in by
toast

12 000 J
lost energy
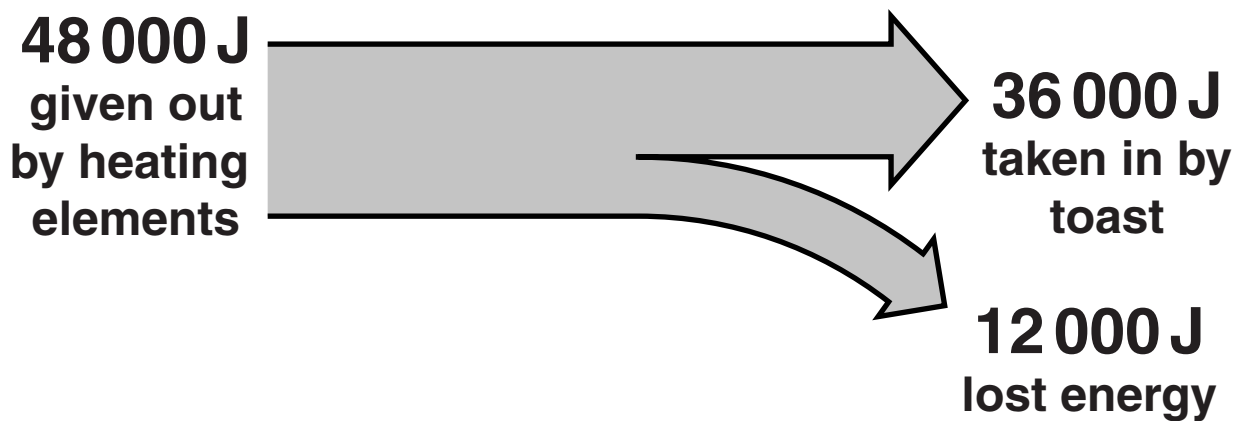
Calculate how efficient the heating elements are at toasting the bread.

The equations on page 3 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.

_____

_____
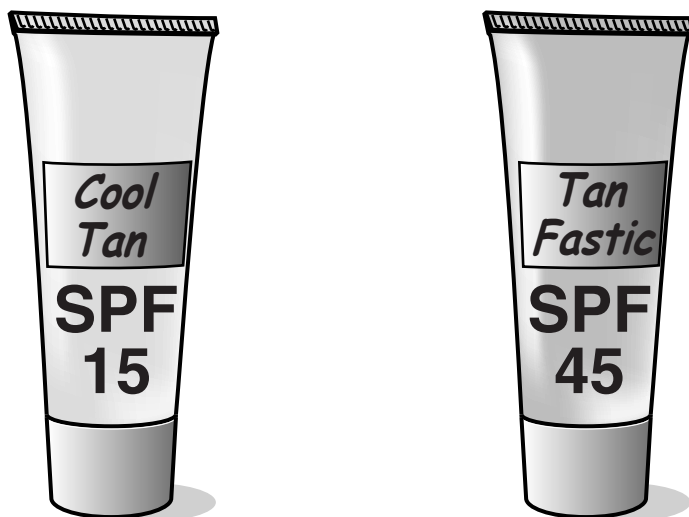
_____

_____ [3]

[Total: 7]

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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 Sun Protection Factor.

(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 _____

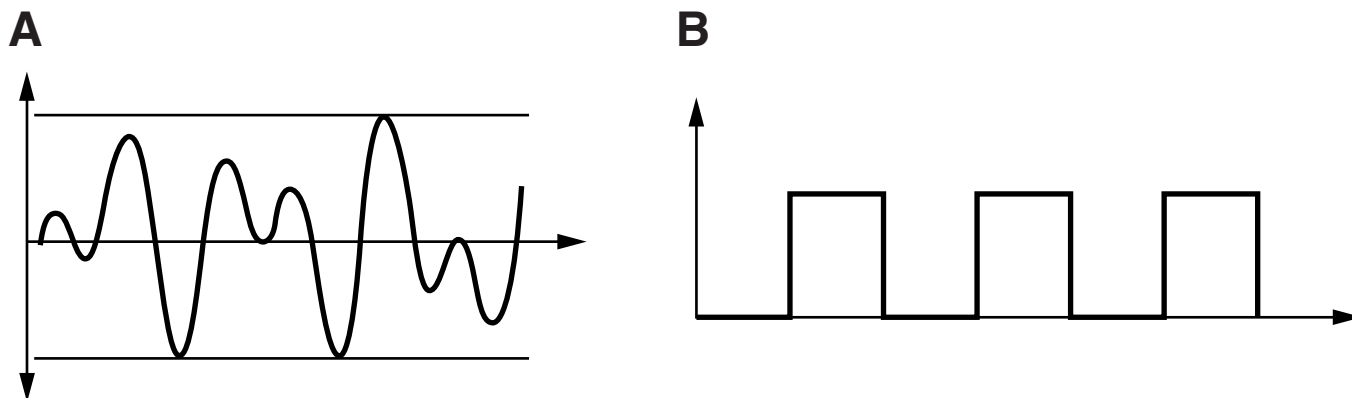because of _____ gases released

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]

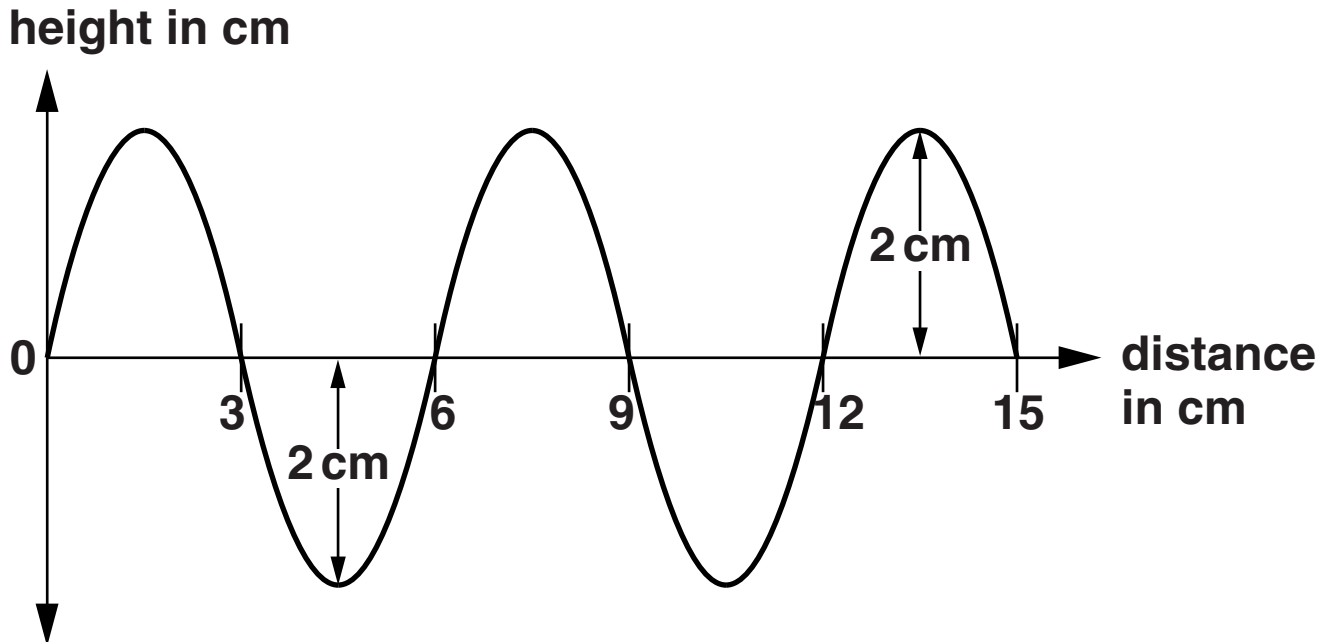**(c)** Some radio waves use a region of the Earth's upper atmosphere to travel long distances.

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]

13

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

Look at the diagram of a transverse water wave.

height in cm

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.

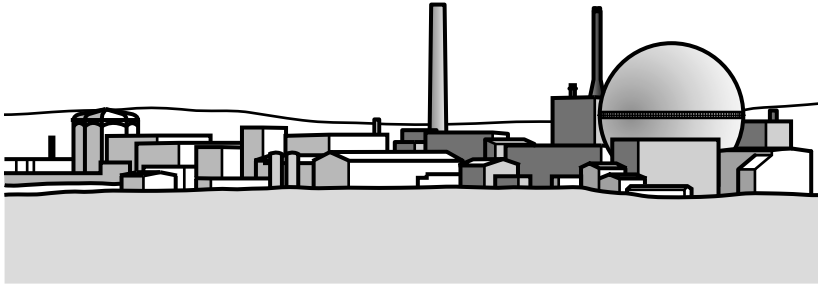| RADIATION	USE
beta	sterilising medical equipment
alpha	smoke alarms
gamma	thickness testing for paper

[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.**

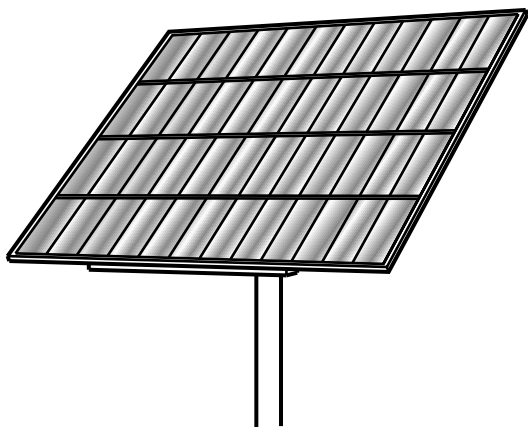_____ **[1]**

(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 3 may help you.

_____

_____

_____

answer _____ pence   [3]

(b) Bob thinks that using OFF-PEAK electricity may be better.

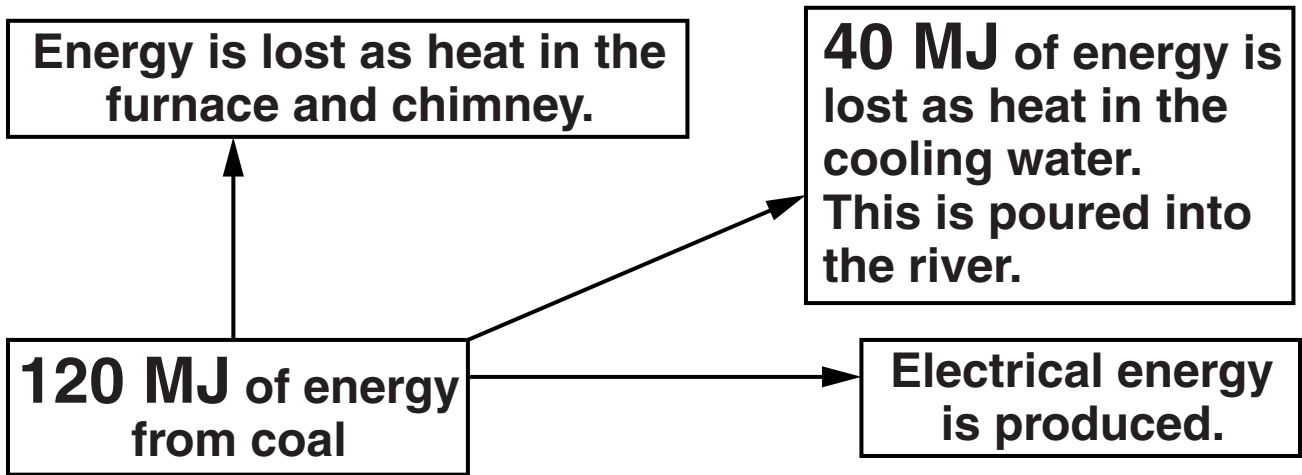Write down one ADVANTAGE and one DISADVANTAGE of using off-peak electricity.

advantage _____

_____

disadvantage _____

_____ [2]

[Total: 5]

8 Look at the energy diagram for a power station.

Energy is lost as heat in the furnace and chimney.	**40 MJ** of energy is lost as heat in the cooling water. This is poured into the river.

120 MJ of energy from coal

Electrical energy is produced.

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

Calculate how much electrical energy is produced.
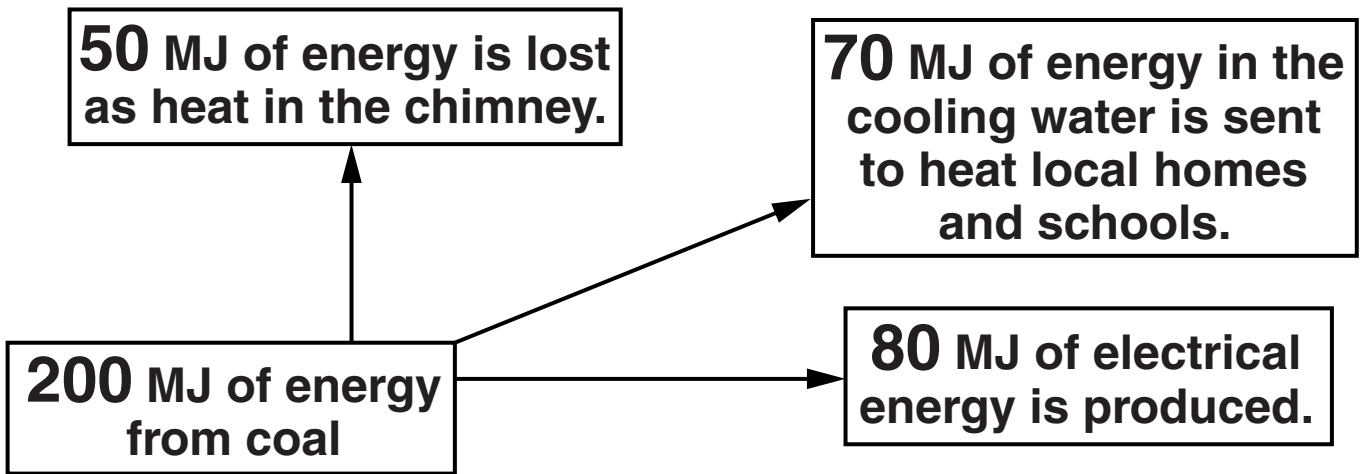
The equations on page 3 may help you.

_____

_____

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.

| 50 MJ of energy is lost as heat in the chimney. | 70 MJ of energy in the cooling water is sent to heat local homes and schools. |

| 200 MJ of energy from coal | 80 MJ of electrical energy is produced. |

This is a community power station.

The power station has an overall efficiency of **0.75 (75%).**
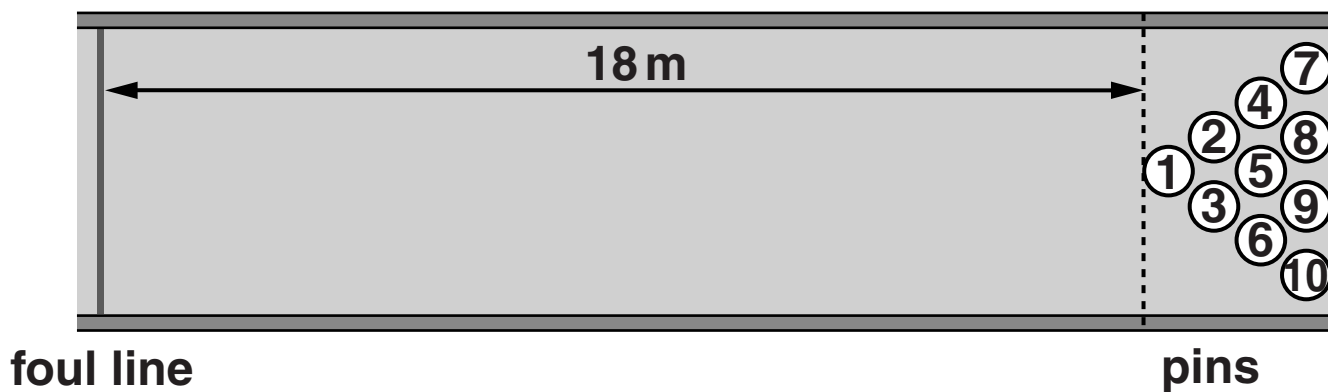
Use the information in the diagram to explain why.

_____

_____

_____ **[2]**

[Total: 5]

9 **Jay goes tenpin bowling.**

10 pins

foul line
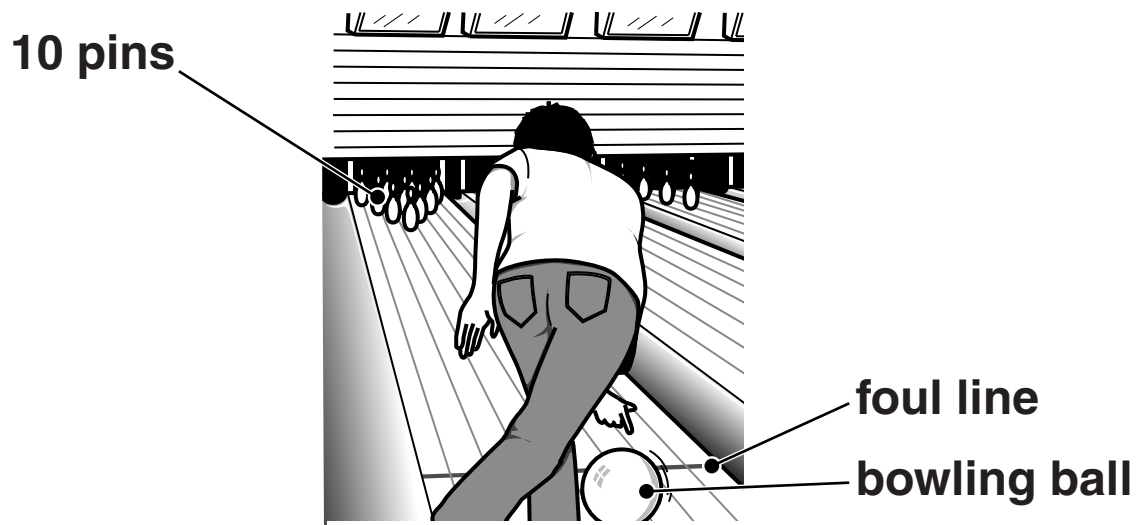
bowling ball

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

He measures DISTANCE and TIME.

18 m

foul line   pins

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.
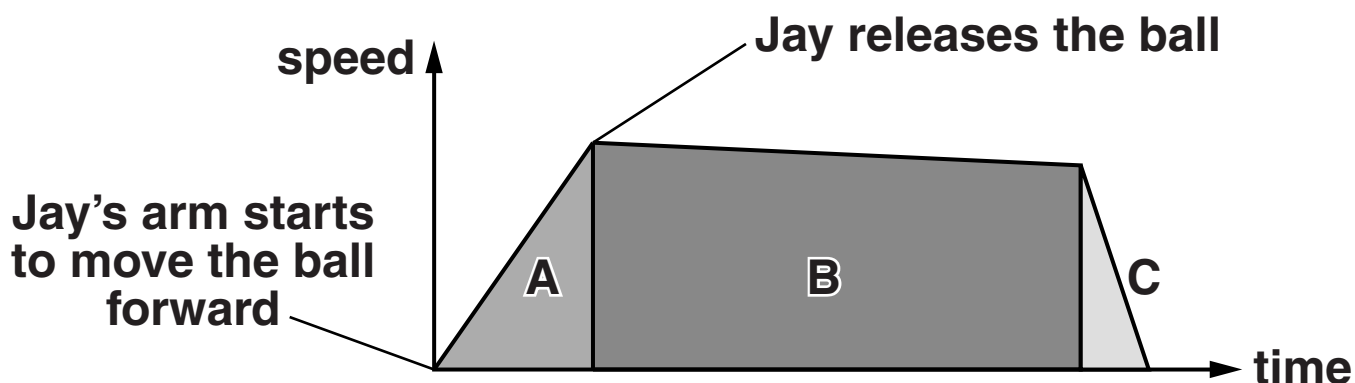
The equations on page 3 may help you.

_____

_____

_____

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]

(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 3 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 3 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]

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.
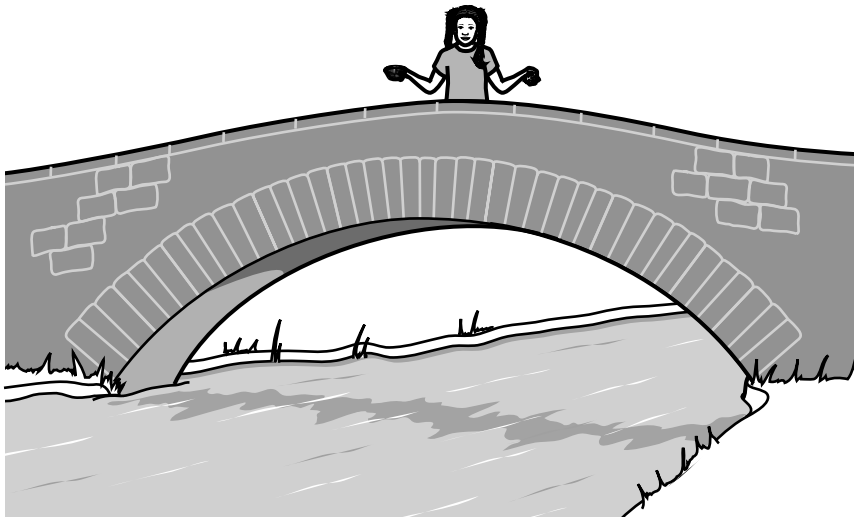
The two cake cases look like this.

A is a cake case
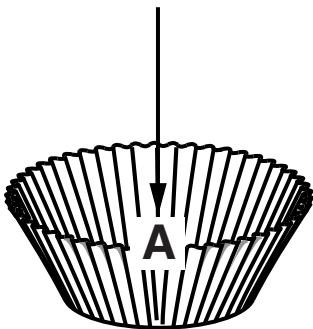
B is a cake case crushed into a ball shape
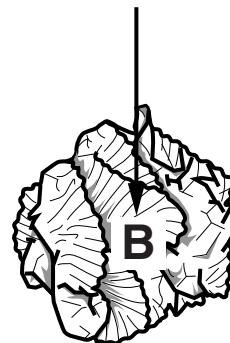
(a) The two paper cake cases have the SAME WEIGHT.

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.**
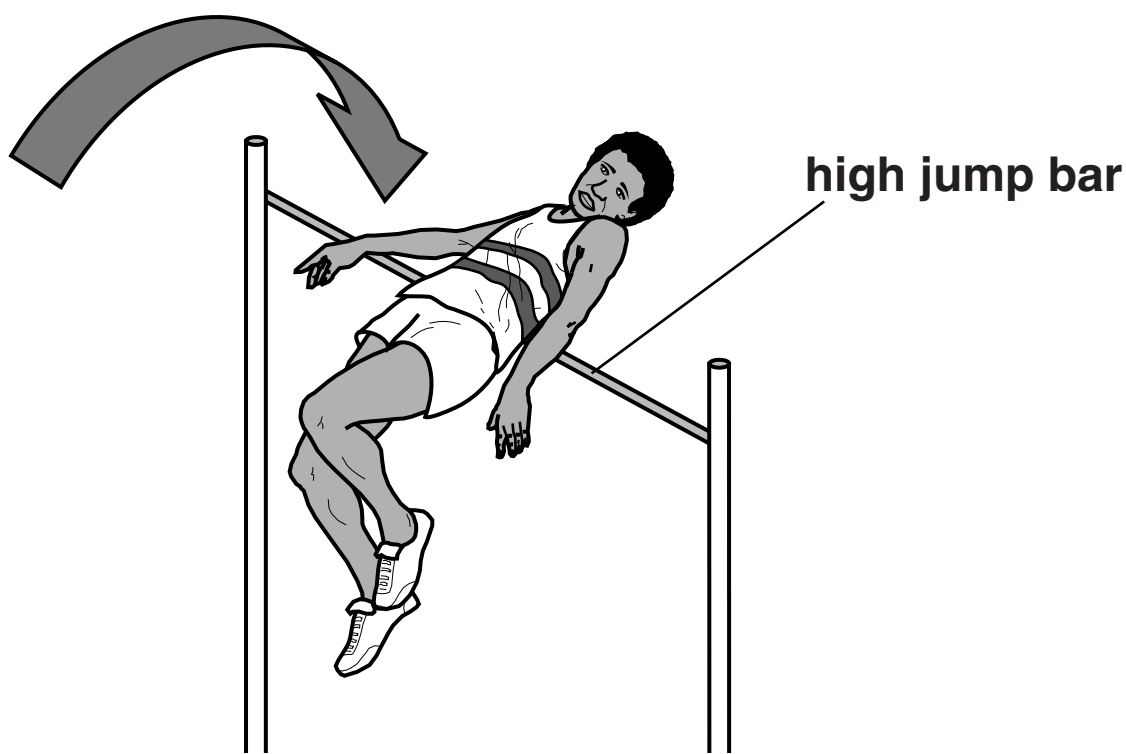
high jump bar

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 3 may help you.

_____

_____

_____

_____

answer _____ m **[2]**

[Total: 2]

END OF QUESTION PAPER