AQA GCSE Physics | 8463

SPECIFICATION POINT 4.1.1.2

Changes in energy

Past-paper questions

Tier	**Foundation**
Question groups	**47**
Available paper years	**2007–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.1.1.2 Changes in energy

Question 01

June 2007 | PHY1A | Original Q4 | Legacy

QUESTION FOUR

The Sankey diagram shows energy transfers in a petrol engine.

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

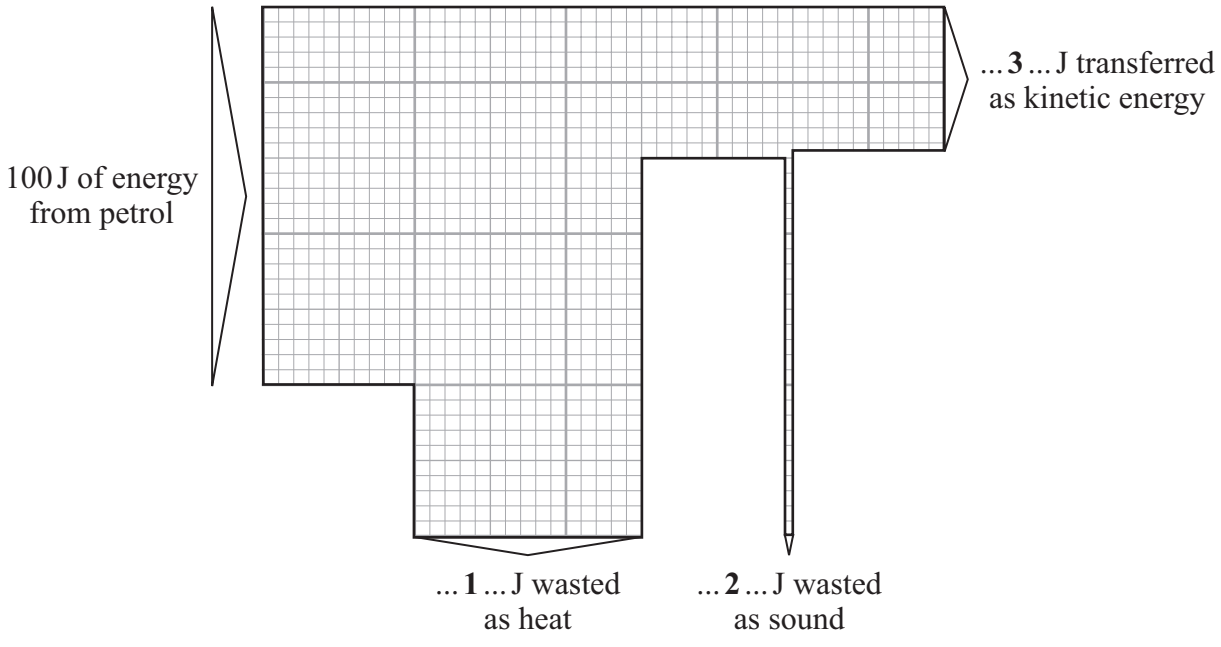
Match numbers, **A**, **B**, **C** and **D**, with the spaces **1–4** on the diagram.

A 0.38

B 2

C 38

D 60



The efficiency of the engine is ... **4** ... .

4.1.1.2 Changes in energy

Question 02

June 2007 | PHY1A | Original Q5 | Legacy

QUESTION FIVE

Convection currents are formed when liquids are heated.

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A decreases

B increases

C is unchanged

D rises

When liquids are heated, the particles gain kinetic energy.

The space between the particles in the liquid . . . **1** . . . so the density of the liquid . . . **2** . . . .

The warm liquid . . . **3** . . . .

The total mass of the liquid . . . **4** . . . .

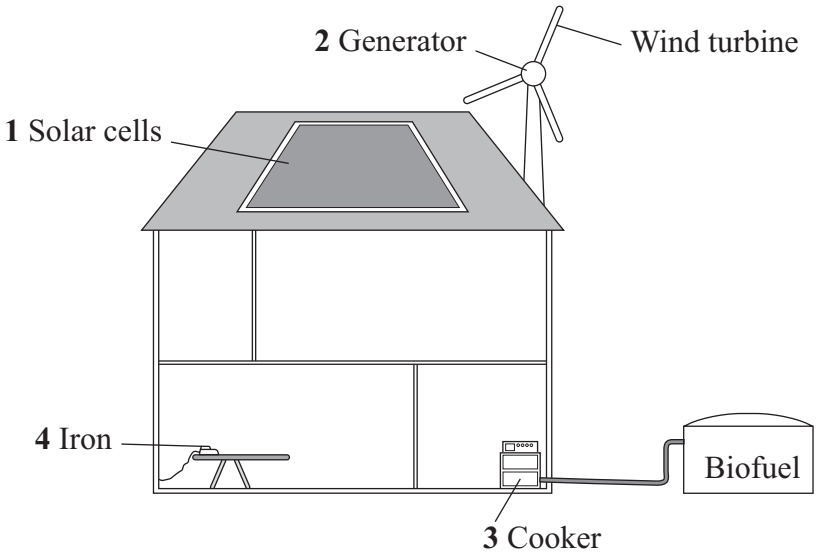
4.1.1.2 Changes in energy

Question 03

November 2007 | PHY1A | Original Q1 | Legacy

QUESTION ONE

The diagram shows an eco-friendly house.



Match energy transformations, **A**, **B**, **C** and **D**, with the devices **1–4** in the diagram.

A chemical energy to heat

B electrical energy to heat

C light energy to electrical energy

D kinetic energy to electrical energy

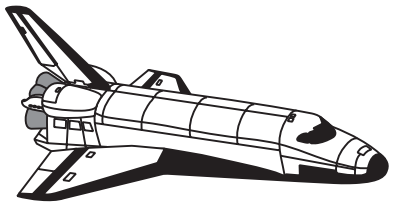
4.1.1.2 Changes in energy

Question 04

November 2007 | PHY1A | Original Q6 | Legacy

QUESTION SIX

The diagram shows the space shuttle returning to Earth. As it moves towards Earth, it moves faster.



Match forms of energy, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A gravitational potential energy

B kinetic energy

C light energy

D thermal energy

As the shuttle moves towards Earth, it loses . . . **1** . . . .

When the shuttle moves faster, it gains . . . **2** . . . .

When the shuttle enters the Earth's atmosphere, there is a lot of friction. This makes the tiles covering the shuttle glow red. As a result, the shuttle gives off a lot of . . . **3** . . . and a little . . . **4** . . . .

4.1.1.2 Changes in energy

Question 05

January 2008 | PHY1F | Original Q5 | Legacy

5 (a) Water waves are a renewable energy source.

The government wants more electricity to be generated from renewable energy sources. Some people do not think this is a good idea.

What reasons could a government scientist give to show people that using more renewable energy sources is a good idea?

.....

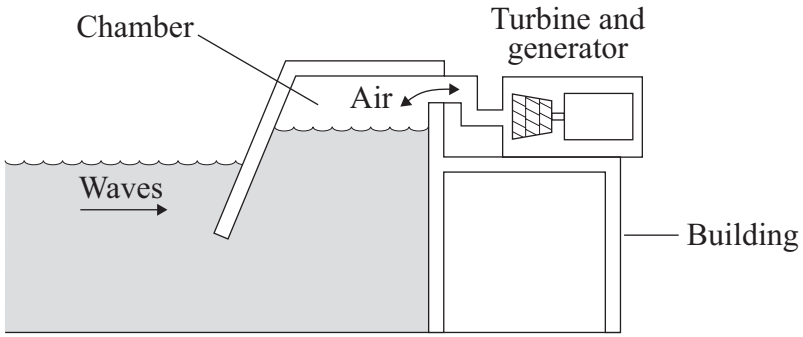
.....

.....

.....

(2 marks)

(b) The diagram shows a wave-powered generator. The generator transforms kinetic energy from the waves to electrical energy.



The following sentences describe how the wave generator works. The sentences are in the wrong order.

R Waves push air up and down a chamber inside the building.
S The turbine turns the generator.
T The generator transforms kinetic energy to electrical energy.
U The air rushes through a turbine making it spin.
V Strong waves move towards the wave-powered generator.

Arrange these sentences in the correct order. Start with letter **V**.

V → ☐ → ☐ → ☐ → ☐

(3 marks)

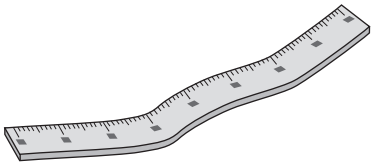
5

4.1.1.2 Changes in energy

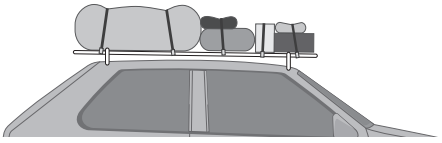
Question 06

January 2008 | PHY2F | Original Q1 | Legacy

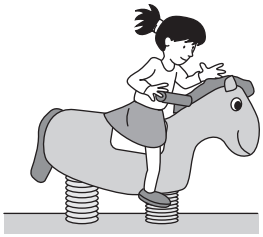
1 (a) The pictures show four objects. Each object has had its shape changed.



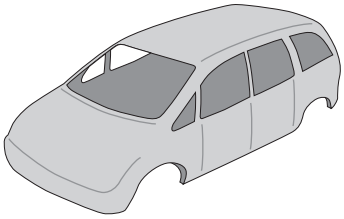
Bent metal ruler
A



Stretched bungee cords
B



Springs on a playground ride
C



Moulded plastic model car body
D

Which of the objects are storing elastic potential energy?

.....

Explain the reason for your choice or choices.

.....

.....

.....

.....

.....

.....

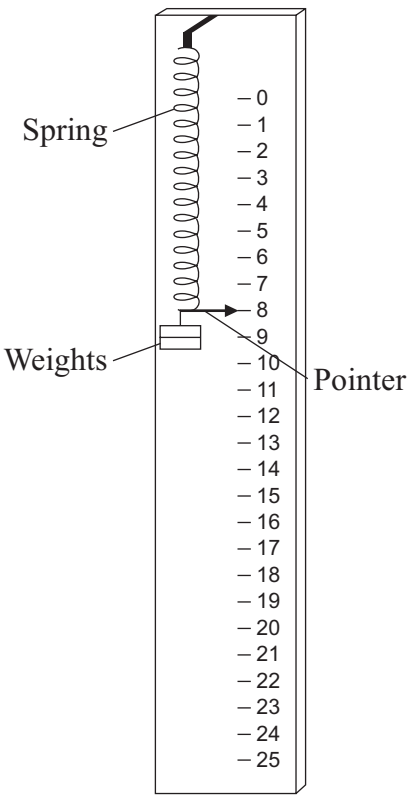
(3 marks)

Question 1 continues on the next page

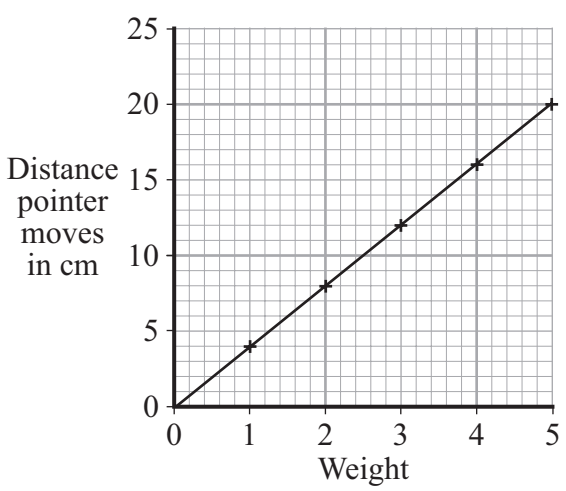
Question 06 · continued

BLANK

(b) A student makes a simple spring balance. To make a scale, the student uses a range of weights. Each weight is put onto the spring and the position of the pointer marked.



The graph below shows how increasing the weight made the pointer move further.



4.1.1.2 Changes in energy

Question 06 · continued

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(i) Which **one** of the following is the unit of weight?

Draw a ring around your answer.

joule **kilogram** **newton** **watt**

(1 mark)

(ii) What range of weights did the student use?

.....

(1 mark)

(iii) How far does the pointer move when 4 units of weight are on the spring?

.....

(1 mark)

(iv) The student ties a stone to the spring. The spring stretches 10 cm.

What is the weight of the stone?

.....

(1 mark)

7

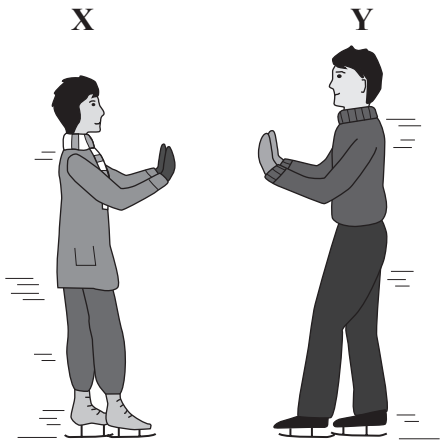
4.1.1.2 Changes in energy

Question 07

January 2008 | PHY2F | Original Q2 | Legacy

2 The picture shows two children, **X** and **Y**, skating towards each other at an ice rink.

The children collide with each other, fall over and stop.



(a) Before the collision the children had different amounts of kinetic energy.

(i) What are the **two** factors that determine the kinetic energy of the children?

1 .....

2 .....

(2 marks)

(ii) What was the total kinetic energy of the children after they had fallen over and stopped?

.....

(1 mark)

4.1.1.2 Changes in energy

Question 07 · continued

BLANK

(b) The total momentum of the children before and after the collision is zero.

(i) Use the equation in the box and the data given in the diagram to calculate the momentum of child **Y** before the collision.

momentum = mass × velocity

Show clearly how you work out your answer.

.....

.....

Momentum = ... kg m/s
(2 marks)

(ii) Complete the following sentence using one of the words in the box.

conserved	**decreased**	**increased**

The total momentum of the two children was ..... .
(1 mark)

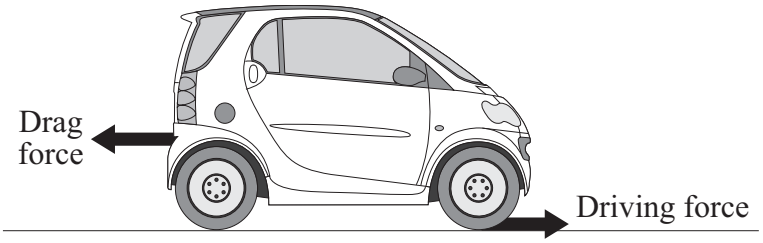
6

4.1.1.2 Changes in energy

Question 08

January 2008 | PHY2F | Original Q3 | Legacy

3 The diagram shows the horizontal forces acting on a car travelling along a straight road.



(a) Complete the following sentences by drawing a ring around the correct word in each box.

(i) When the driving force equals the drag force, the speed of the car is

decreasing
constant
increasing

.

(1 mark)

(ii) Putting the brakes on transforms the car's kinetic energy mainly into

heat
light
sound

.

(1 mark)

4.1.1.2 Changes in energy

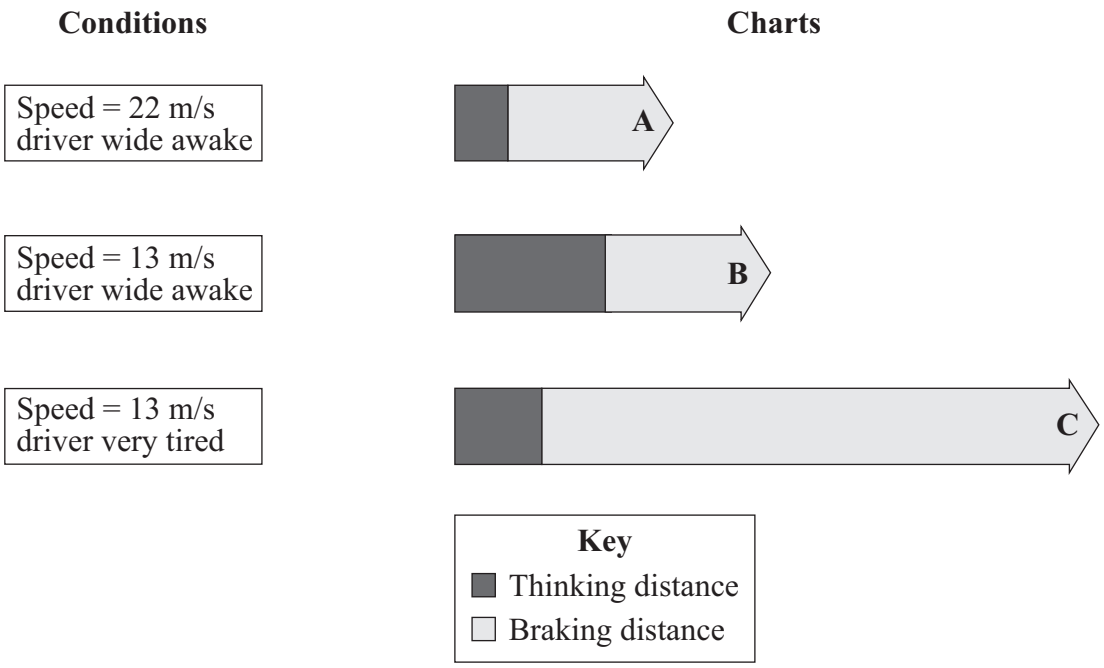
Question 08 · continued

BLANK

(b) The charts, **A**, **B** and **C** give the thinking distance and the braking distance for a car driven under different conditions.

(i) Draw straight lines to match each chart to the correct conditions.

Draw only **three** lines.



(2 marks)

(ii) The three charts above all apply to dry road conditions.

How would the braking distances be different if the road were wet?

.....

.....

(1 mark)

5

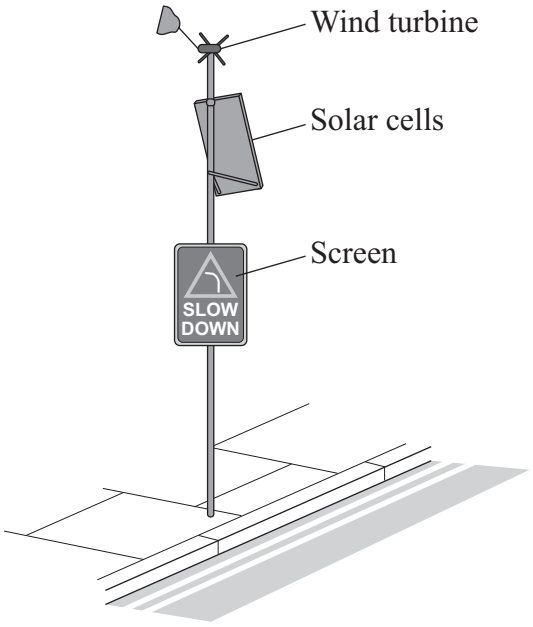
4.1.1.2 Changes in energy

Question 09

March 2008 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

The diagram shows an electronic road sign.



Match types of energy, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A electrical energy

B thermal energy

C light energy

D kinetic energy

The useful energy output from the screen is . . . **1** . . . .

The energy input to the wind turbine is . . . **2** . . . .

The useful energy output from the solar cells is . . . **3** . . . .

The wasted energy output from the road sign is . . . **4** . . . .

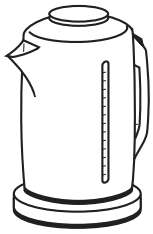
4.1.1.2 Changes in energy

Question 10

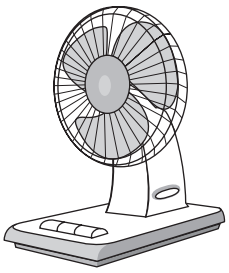
June 2008 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

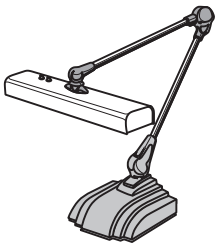
These devices transform electrical energy into other useful forms of energy.



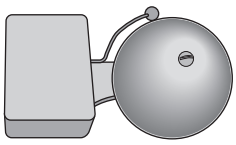
1
Kettle



2
Fan



3
Reading lamp



4
Bell

Match the useful forms of energy, **A**, **B**, **C** and **D**, with the devices numbered **1–4**.

A heat (thermal energy)

B light

C movement (kinetic energy)

D sound

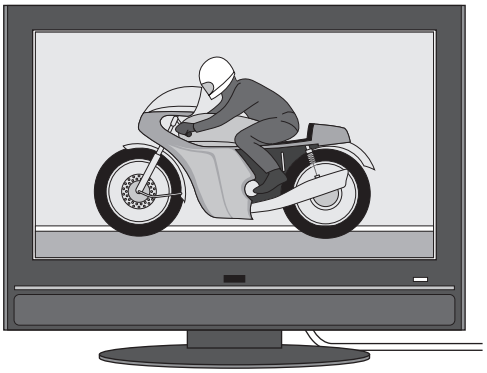
4.1.1.2 Changes in energy

Question 11

November 2008 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

The drawing shows a television set.



Match types of energy, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A electrical

B heat

C light

D sound

The television is designed to transform . . . **1** . . . energy into . . . **2** . . . energy at the screen.

The loudspeaker transforms kinetic energy into . . . **3** . . . energy.

Some energy is wasted as . . . **4** . . . .

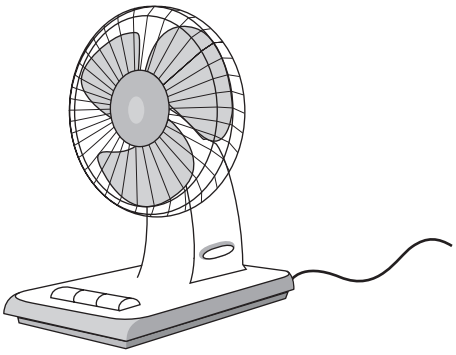
4.1.1.2 Changes in energy

Question 12

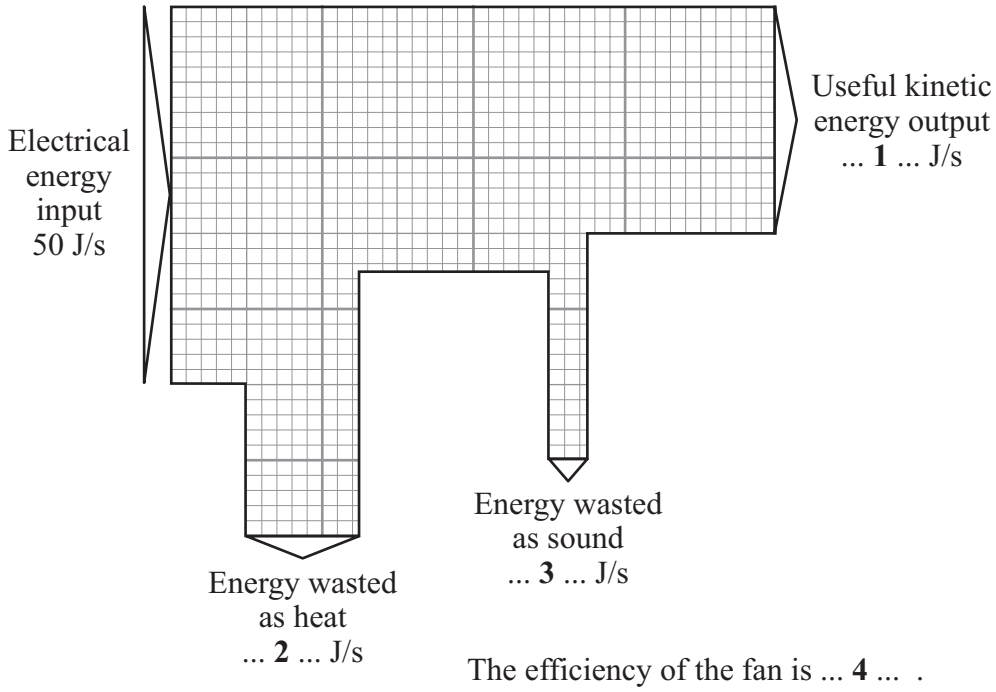
November 2008 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The diagram shows an electric fan.



The Sankey diagram gives the energy transformations for the fan.



The efficiency of the fan is ... **4** ... .

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

Match numbers, **A**, **B**, **C** and **D**, with the labels **1–4** on the Sankey diagram.

A 0.6

B 5

C 15

D 30

4.1.1.2 Changes in energy

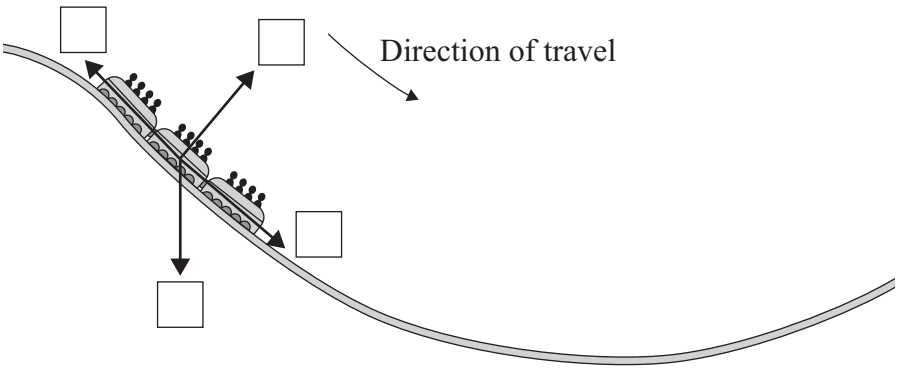
Question 13

January 2009 | PHY2F | Original Q7 | Legacy

7 The diagram shows the passenger train on part of a rollercoaster ride.

7 (a) Which arrow shows the direction of the resultant force acting on the passenger train?

Put a tick (✓) in the box next to your choice.



(1 mark)

7 (b) At the bottom of the slope, the passengers in the train all have the same speed but they each have a different kinetic energy.

Why is the kinetic energy of each passenger different?

.....

.....

(1 mark)

7 (c) For part of the ride, the maximum gravitational field strength acting on the passengers seems 3 times bigger than normal.

Normal gravitational field strength = 10 N/kg

7 (c) (i) Calculate the maximum gravitational field strength that seems to act on the passengers during the ride.

.....

.....

Maximum gravitational field strength = ... N/kg

(1 mark)

4.1.1.2 Changes in energy

Question 13 · continued

for mark

7 (c) (ii) One of the passengers has a mass of 80 kg.

Use the equation in the box to calculate the maximum weight this passenger seems to have during the ride.

weight = mass × gravitational field strength

Show clearly how you work out your answer.

.....

.....

Maximum weight = ... N
(2 marks)

5

Turn over for the next question

4.1.1.2 Changes in energy

Question 14

March 2009 | PHY1AP | Original Q6 | Legacy

QUESTION SIX

This question is about the use of energy in cars that use petrol.

6A A car engine transfers kinetic energy.

The kinetic energy is transformed from . . .

1 chemical energy.

2 electrical energy.

3 light energy.

4 sound energy.

6B Car makers are producing engines that are more efficient.

Compared with a less efficient engine of the same power, a more efficient engine always . . .

1 has a higher top speed.

2 has a lower top speed.

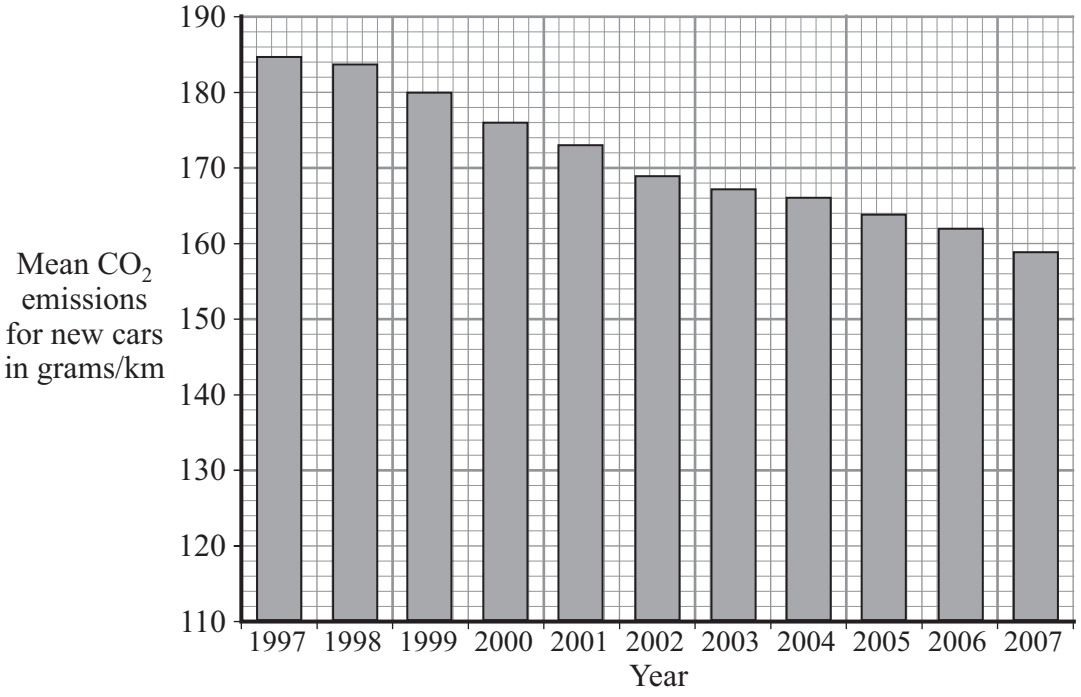
3 uses less petrol.

4 uses more petrol.

4.1.1.2 Changes in energy

Question 14 · continued March 2009 | PHY1AP | Original Q6 | Legacy

Cars release harmful gases into the atmosphere. The mean amount of carbon dioxide (CO_2) emitted by new cars for every kilometre driven has changed. The display shows how these emissions have changed since 1997.



6C The display is called a . . .

1 bar chart.

2 line graph.

3 pie chart.

4 scattergram.

6D The display shows that between 1997 and 2007, the amount of carbon dioxide released per kilometre by new cars has . . .

1 steadily increased.

2 steadily decreased.

3 decreased and then increased.

4 stayed the same.

4.1.1.2 Changes in energy

Question 15

June 2009 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

This question is about useful electrical devices.

Match devices, **A**, **B**, **C** and **D**, with the statements **1**–**4** in the table.

A fan

B lamp

C oven

D radio

1	an electrical device designed to produce sound energy
2	an electrical device designed to produce light energy
3	an electrical device designed to produce kinetic energy
4	an electrical device designed to produce heat (thermal energy)

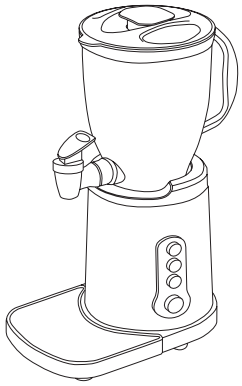
4.1.1.2 Changes in energy

Question 16

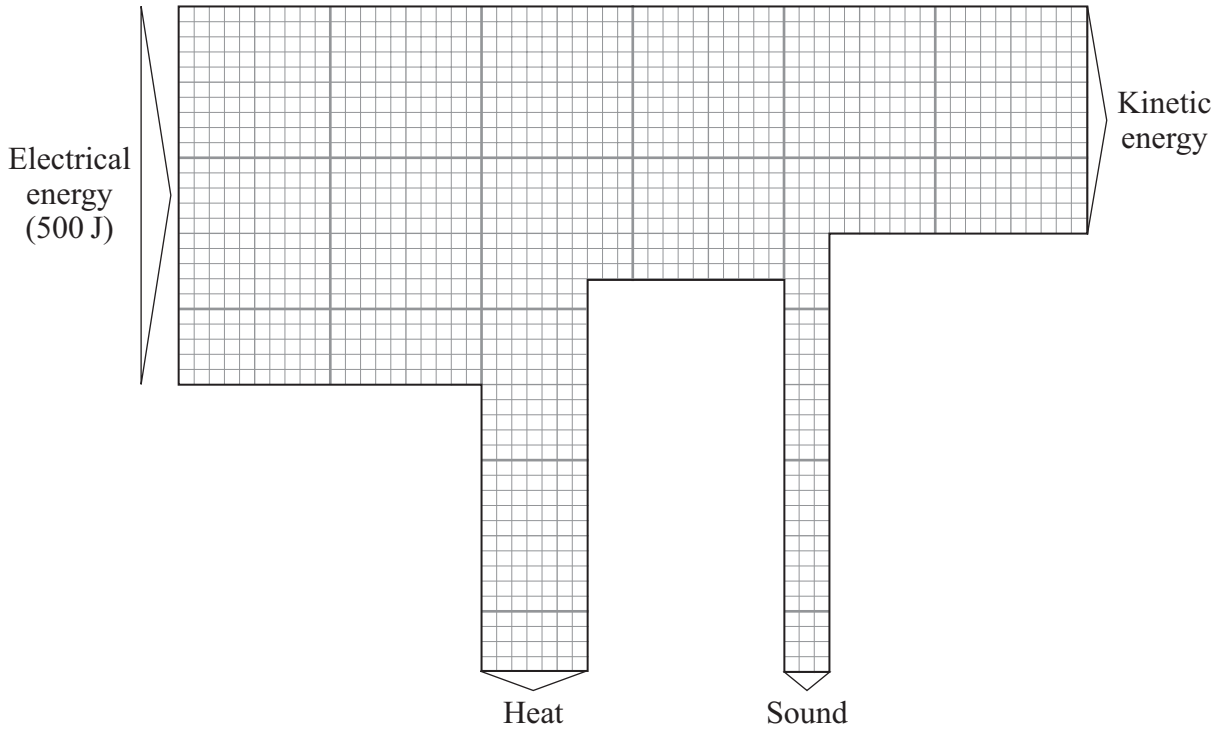
November 2009 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The diagram shows a smoothie maker.



The Sankey diagram shows the energy transfers that take place each second in this smoothie maker.



$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

4.1.1.2 Changes in energy

Question 16 · continued

Match figures, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A 0.6

B 140

C 200

D 300

The kinetic energy produced each second is . . . **1** . . . J.

The heat produced each second is . . . **2** . . . J.

The total energy wasted each second is . . . **3** . . . J.

The efficiency of the smoothie maker is . . . **4** . . . .

Turn over for the next question

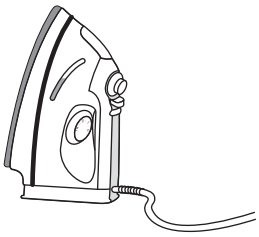
4.1.1.2 Changes in energy

Question 17

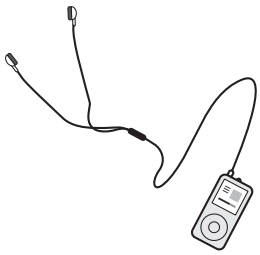
March 2010 | PHY1AP | Original Q2 | Legacy

QUESTION TWO

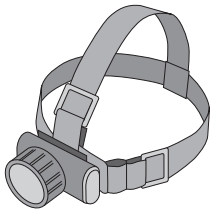
These devices transform electrical energy into other useful forms of energy.



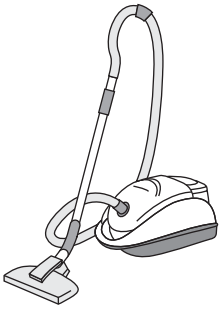
1
Iron



2
MP3 player



3
Head torch



4
Vacuum cleaner

Match the useful forms of energy, **A**, **B**, **C** and **D**, with the devices **1–4**.

A heat (thermal energy)

B light

C movement (kinetic energy)

D sound

4.1.1.2 Changes in energy

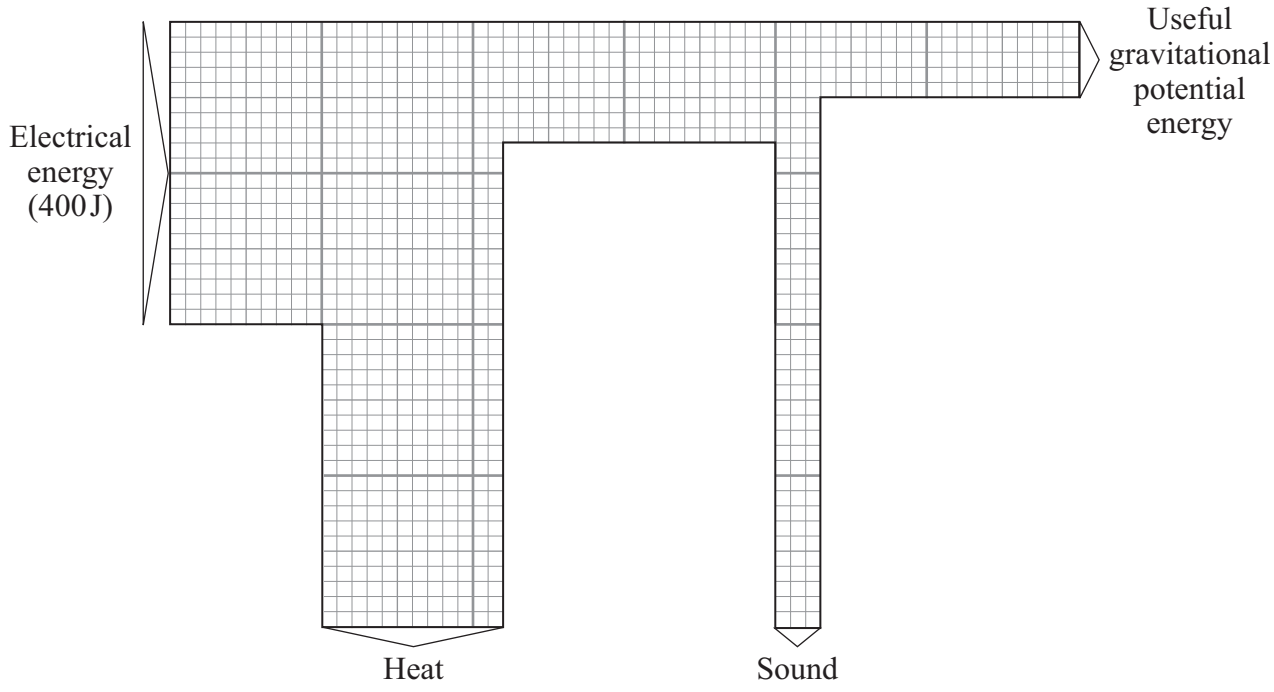
Question 18

March 2010 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

An electric motor is used to lift a weight.

The Sankey diagram shows the energy transformations that take place each second in the electric motor.



Match figures, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A 0.25

B 60

C 100

D 240

$$\text{efficiency} = \frac{\text{useful energy transferred by the device}}{\text{total energy supplied to the device}}$$

The useful gravitational potential energy gained each second is . . . **1** . . . J.

The heat (thermal energy) produced each second is . . . **2** . . . J.

The sound energy produced each second is . . . **3** . . . J.

The total energy wasted each second is 300 J. The efficiency of the electric motor is . . . **4** . . . .

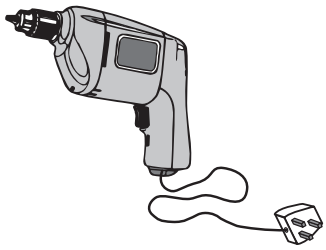
4.1.1.2 Changes in energy

Question 19

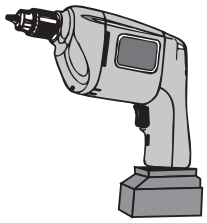
June 2010 | PHY1AP | Original Q1 | Legacy

QUESTION ONE

The diagrams show a mains electric drill and a cordless electric drill. The cordless drill has a rechargeable battery.



Mains electric drill



Cordless electric drill

Match types of energy, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A chemical energy

B electrical energy

C heat (thermal energy)

D kinetic energy

Drills are designed to produce . . . **1** . . . .

The drills also produce . . . **2** . . . and sound energy which are wasted.

Both drills use . . . **3** . . . to make their motors work.

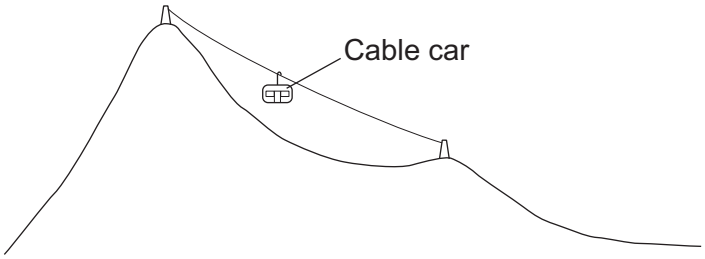
The cordless drill has a battery that stores . . . **4** . . . .

4.1.1.2 Changes in energy

Question 20

June 2010 | PHY2F | Original Q6 | Legacy

6 (a) The diagram shows a cable car used to take skiers to the top of a mountain.



6 (a) (i) The total mass of the cable car and skiers is 7500 kg.

Use the equation in the box to calculate the weight of the cable car and skiers.

weight = mass × gravitational field strength

gravitational field strength = 10 N/kg

Show clearly how you work out your answer and give the unit.

.....

.....

Weight = ...

(3 marks)

4.1.1.2 Changes in energy

Question 20 · continued

6 (a) (ii) The cable car moves at a constant speed. It lifts skiers through a vertical height of 800 metres in 7 minutes.

Use the following equation to calculate the work done to lift the cable car and skiers.

work done = force applied × distance moved in the direction of force

Show clearly how you work out your answer.

.....

.....

Work done = ... J

(2 marks)

6 (b) The diagram shows a skier who is accelerating down a steep ski slope.



6 (b) (i) Draw an arrow on the diagram to show the direction of the resultant force acting on the skier.

(1 mark)

6 (b) (ii) How and why does the kinetic energy of the skier change?

.....

.....

.....

.....

(2 marks)

Question 6 continues on the next page

4.1.1.2 Changes in energy

Question 20 · continued

6 (c) Last year, 18 000 skiers suffered a head injury. It is thought that nearly 8000 of these injuries could have been avoided if the skier had been wearing a helmet. However, at present, there are no laws to make skiers wear helmets.

Suggest why skiers should be made aware of the benefits of wearing a helmet.

.....

.....

(1 mark)

9

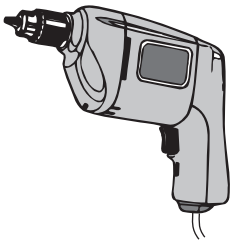
4.1.1.2 Changes in energy

Question 21

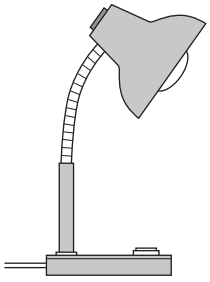
November 2010 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

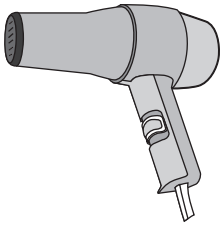
The diagrams show four electrical devices. The Sankey diagrams show the energy transformations involved in the four electrical devices.



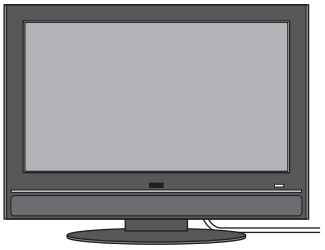
A
Electric drill



B
Desk lamp



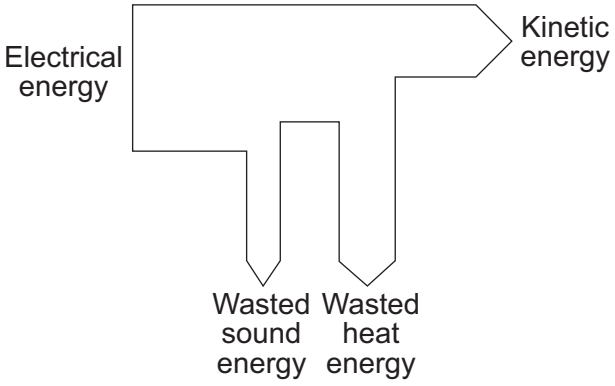
C
Hair dryer



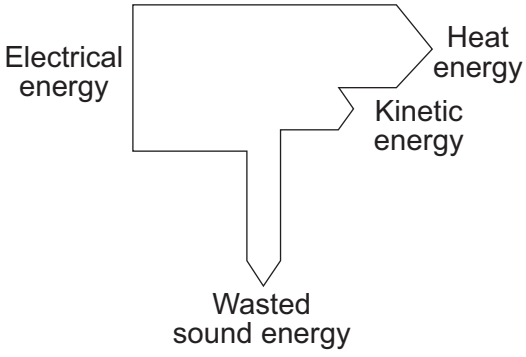
D
Television

Match devices, **A**, **B**, **C** and **D**, with the Sankey diagrams **1**–**4**.

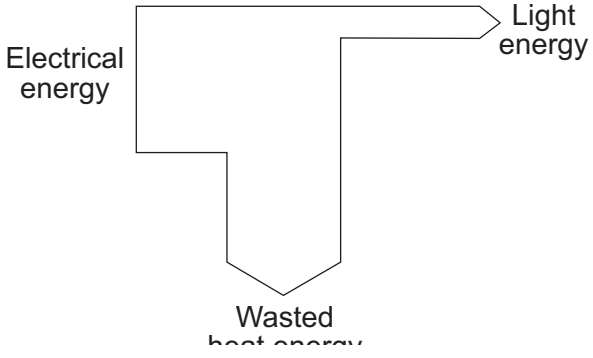
1



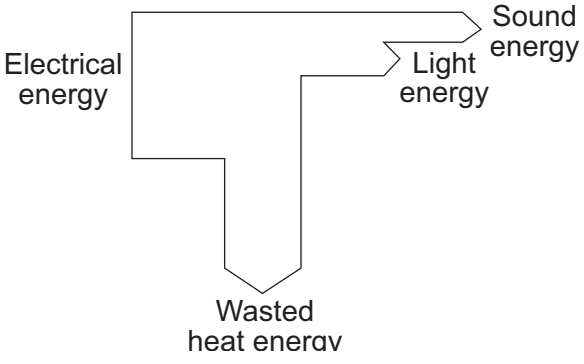
2



3



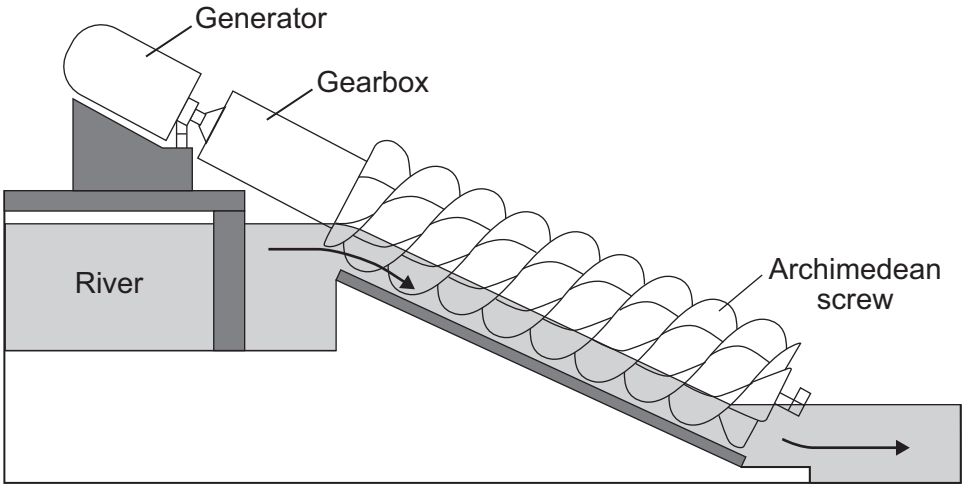
4



4.1.1.2 Changes in energy

Question 22

5 The diagram shows a small-scale, *micro-hydroelectricity* generator which uses the energy of falling river water to generate electricity. The water causes a device, called an Archimedean screw, to rotate.
The Archimedean screw is linked to the generator by a gearbox.



5 (a) Complete the following sentence by drawing a ring around the correct word in the box.

The gravitational potential energy of the falling water is transformed

into the | chemical | electrical | kinetic | energy of the Archimedean screw.

(1 mark)

4.1.1.2 Changes in energy

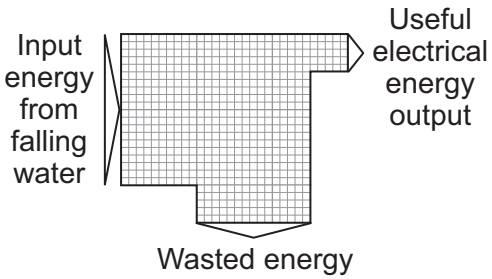
Question 22 · continued

5 (b) A micro-hydroelectric generator is very efficient. Most of the input energy from the falling water is transformed into useful electrical energy.

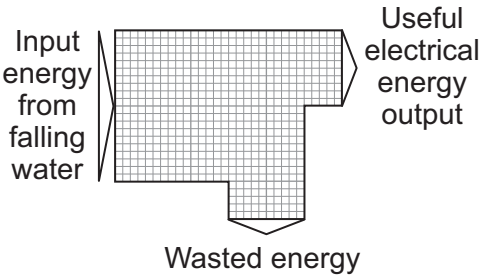
Which **one** of the following Sankey diagrams, **X**, **Y** or **Z**, shows the energy transformations produced by this generator?

Write your answer, **X**, **Y**, or **Z**, in the box.

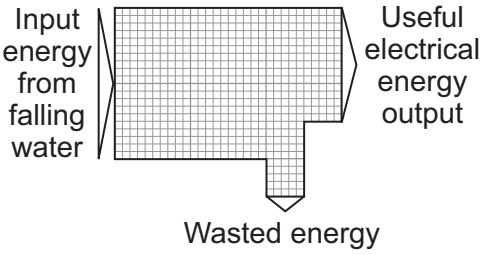
Sankey diagram **X**



Sankey diagram **Y**



Sankey diagram **Z**



Sankey diagram ☐

(1 mark)

Question 5 continues on the next page

4.1.1.2 Changes in energy

Question 22 · continued

5 (c) A micro-hydroelectric system generates about 60 kW of electricity, enough for 50 homes. A conventional large-scale hydroelectric power station may generate more than 5 000 000 kW of electricity.

5 (c) (i) Give **one** advantage of a conventional large-scale hydroelectric power station compared to a micro-hydroelectric system.

.....

.....

(1 mark)

5 (c) (ii) Which **one** of the following statements gives a **disadvantage** of a conventional large-scale hydroelectric power station compared to a micro-hydroelectric system?

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

Energy is wasted as heat and sound. ☐

Large areas of land are flooded. ☐

A constant flow of water is needed. ☐

(1 mark)

5 (d) The electricity generated by the micro-hydroelectric system is transferred directly to local homes. The electricity generated by a conventional large-scale hydroelectric power station is transferred to homes anywhere in the country through a system of cables and transformers.

5 (d) (i) What name is given to the system of cables and transformers used to transfer electricity to homes anywhere in the country?

.....

(1 mark)

5 (d) (ii) Using short cables to transfer electricity to local homes is much more efficient than using very long cables to transfer electricity to homes anywhere in the country.

Why?

.....

.....

(1 mark)

4.1.1.2 Changes in energy

Question 22 · continued

5 (e) Nepal is a mountainous country with over 6000 rivers. In Nepal, 9000 kW of electricity are generated using micro-hydroelectric generators.

Suggest **one** reason why in the UK much less electricity is generated using micro-hydroelectric generators, than in Nepal.

.....

.....

(1 mark)

7

Turn over for the next question

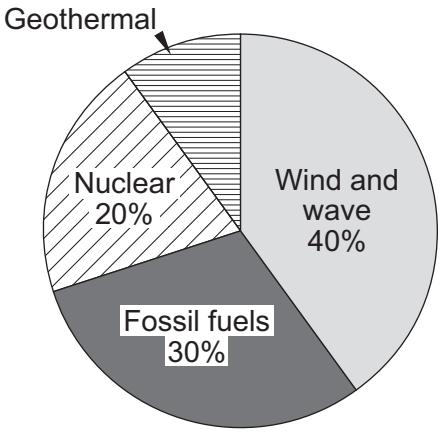
4.1.1.2 Changes in energy

Question 23

June 2011 | PHY1AP | Original Q5 | Legacy

QUESTION FIVE

The pie chart shows how a country's electricity demands are met using different energy sources.



Match percentages, **A**, **B**, **C** and **D**, with the numbers **1**–**4** in the sentences.

A 10 %

B 20 %

C 40 %

D 50 %

The percentage of electricity generated from non-renewable sources is . . . **1** . . . .

The percentage of electricity generated from geothermal sources is . . . **2** . . . .

The percentage of electricity generated using a source that produces radioactive waste is . . . **3** . . . .

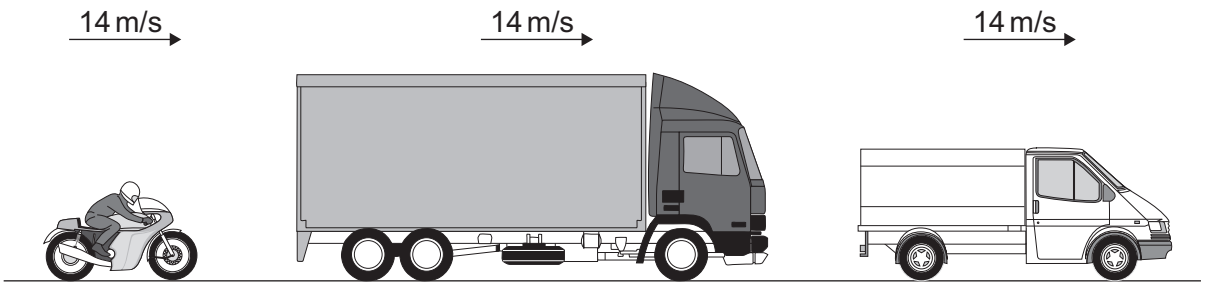
The percentage of electricity generated using the kinetic energy of the source directly is . . . **4** . . . .

4.1.1.2 Changes in energy

Question 24

June 2011 | PHY2F | Original Q3 | Legacy

3 (a) (i) The diagram shows three vehicles travelling along a straight road at 14 m/s.



Motorbike
Mass = 175 kg

Lorry
Mass = 10 000 kg

Van
Mass = 3000 kg

Which vehicle has the greatest momentum?

.....

Give the reason for your answer.

.....

.....

.....

(2 marks)

3 (a) (ii) Use the equation in the box to calculate the momentum of the motorbike when it travels at 14 m/s.

momentum = mass × velocity

Show clearly how you work out your answer.

.....

.....

Momentum = ...kg m/s

(2 marks)

4.1.1.2 Changes in energy

Question 24 · continued

3 (b) The motorbike follows the lorry for a short time, and then accelerates to overtake both the lorry and van.

3 (b) (i) Complete the following sentence by drawing a ring around the correct line in the box.

When the motorbike starts to overtake, the kinetic energy

of the motorbike

decreases.
stays the same.
increases.

(1 mark)

3 (b) (ii) Give a reason for your answer to part (b)(i).

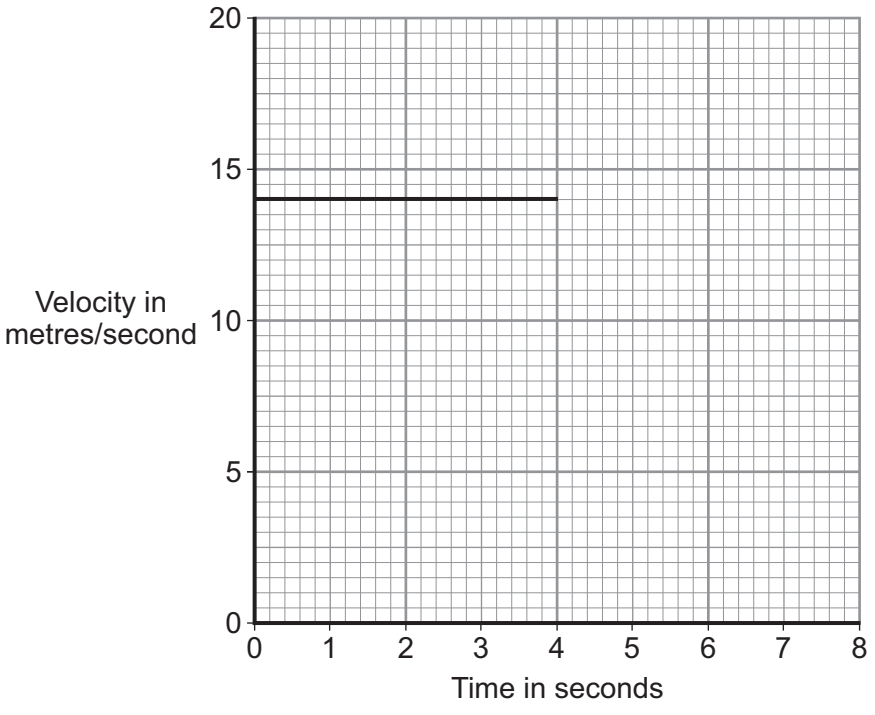
.....

.....

(1 mark)

3 (b) (iii) The graph shows the velocity of the motorbike up to the time when it starts to accelerate. The motorbike accelerates constantly, going from a speed of 14 m/s to a speed of 20 m/s in a time of 2 seconds. The motorbike then stays at 20 m/s.

Complete the graph to show the motion of the motorbike over the next 4 seconds.



(3 marks)

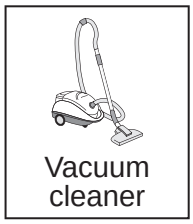
9

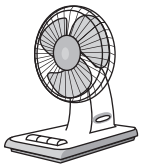
4.1.1.2 Changes in energy

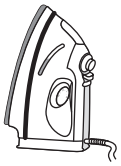
Question 25

June 2012 | PH1FP | Original Q1 | Legacy

1 The appliances shown below transfer electrical energy to other types of energy.

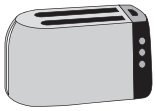

Vacuum cleaner


Fan


Iron


Drill


Washing machine


Toaster


Television

1 (a) The vacuum cleaner is designed to transfer electrical energy to kinetic energy.

Three more of the appliances are also designed to transfer electrical energy to kinetic energy. Which **three**?

Draw a ring around each correct appliance.

(3 marks)

4.1.1.2 Changes in energy

Question 25 · continued

1 (b) Which **two** of the following statements are true?

Tick (✓) **two** boxes.

Appliances only transfer part of the energy usefully. ☐

The energy transferred by appliances will be destroyed. ☐

The energy transferred by appliances makes the surroundings warmer. ☐

The energy output from an appliance is bigger than the energy input. ☐

(2 marks)

5

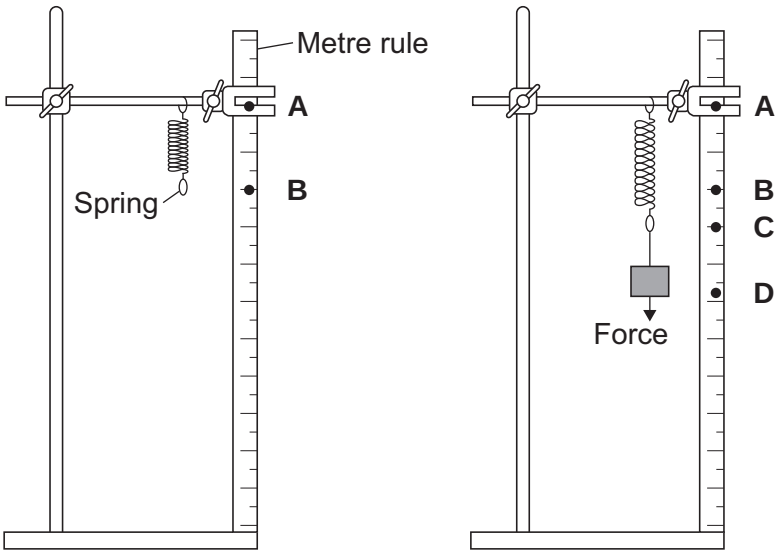
Turn over for the next question

4.1.1.2 Changes in energy

Question 26

7 A student investigated how the extension of a spring depends on the force applied to the spring.

The diagram shows the spring before and after a force had been applied.



7 (a) (i) Complete the following sentence using letters, **A**, **B**, **C** or **D**, from the diagram.

The extension of the spring is the distance between the positions labelled .....

and ..... on the metre rule.

(1 mark)

7 (a) (ii) What form of energy is stored in the stretched spring?

.....

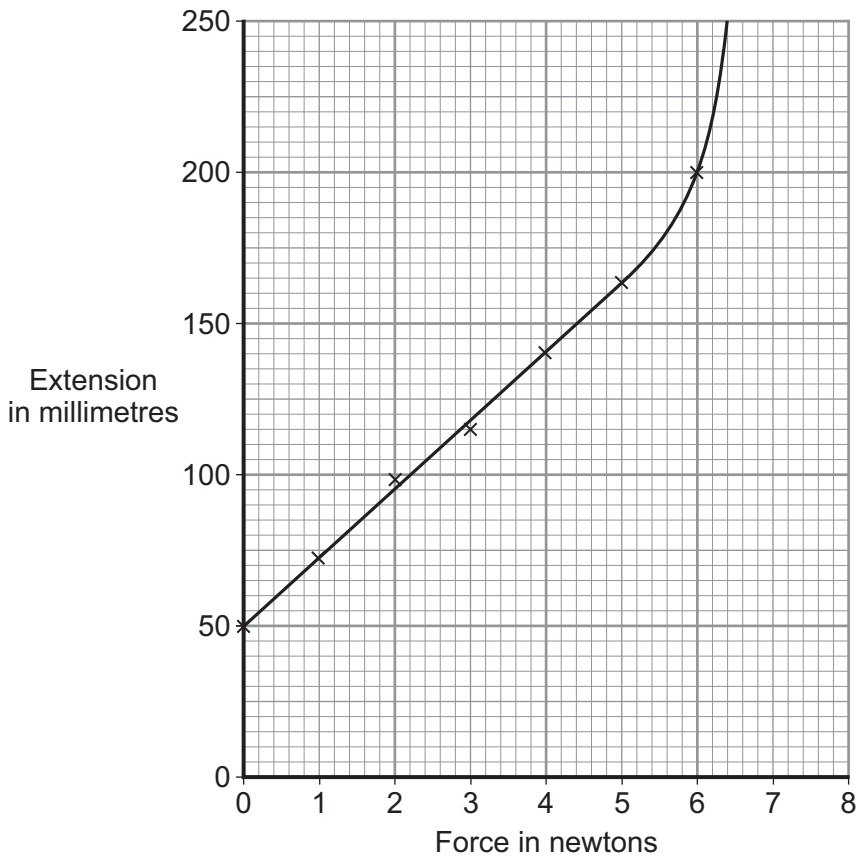
(1 mark)

Question 7 continues on the next page

4.1.1.2 Changes in energy

Question 26 · continued

7 (b) The results from the investigation are plotted on the following graph.



7 (b) (i) The graph shows that the student has made an error throughout the investigation.

What error has the student made?

.....

.....

Give the reason for your answer.

.....

.....

(2 marks)

4.1.1.2 Changes in energy

Question 26 · continued

7 (b) (ii) The student has loaded the spring beyond its *limit of proportionality*.

Mark on the graph line the *limit of proportionality* of the spring. Label the point **P**.

Give the reason for choosing your point **P**.

.....

.....

.....

(2 marks)

7 (c) The student uses a different spring as a spring balance. When the student hangs a stone from this spring, its extension is 72 mm.

The spring does not go past the limit of proportionality.

Calculate the force exerted by the stone on the spring.

spring constant = 25 N/m

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

Force = ... N

(2 marks)

8

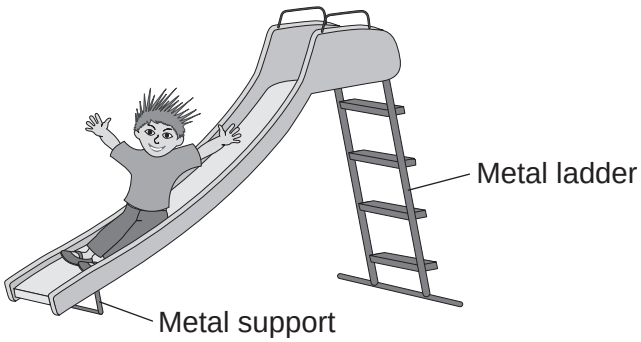
4.1.1.2 Changes in energy

Question 27

June 2014 | PH2FP | Original Q7 | Legacy

7 **Figure 12** shows a slide in a children's playground.

Figure 12



7 (a) A child of mass 18 kilograms goes down the slide.

The vertical distance from the top to the bottom of the slide is 2.5 metres.

Calculate the decrease in gravitational potential energy of the child sliding from the top to the bottom of the slide.

Gravitational field strength = 10 N/kg

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Decrease in gravitational potential energy = ... J

4.1.1.2 Changes in energy

Question 27 · continued

7 (b) The slide is made of plastic.

7 (b) (i) The child becomes electrically charged when he goes down the slide.

Explain why.

[2 marks]

.....

.....

.....

.....

7 (b) (ii) Going down the slide causes the child's hair to stand on end.

What conclusion about the electrical charge on the child's hair can be made from this observation?

[2 marks]

.....

.....

Give a reason for your answer.

.....

.....

7 (b) (iii) Why would the child **not** become electrically charged if the slide was made from metal?

[1 mark]

.....

.....

7

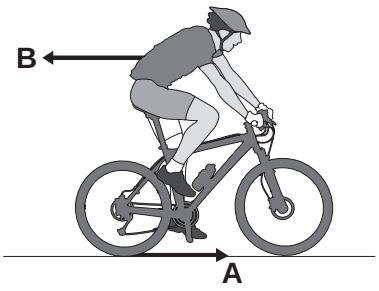
4.1.1.2 Changes in energy

Question 28

June 2014 | PH2FP | Original Q8 | Legacy

8 (a) **Figure 13** shows the horizontal forces acting on a moving bicycle and cyclist.

Figure 13



8 (a) (i) What causes force **A**?

Draw a ring around the correct answer.

[1 mark]

friction **gravity** **weight**

8 (a) (ii) What causes force **B**?

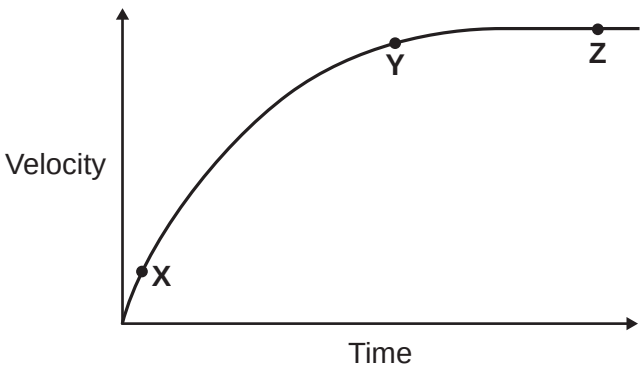
[1 mark]

.....

8 (a) (iii) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Figure 14 shows how the velocity of the cyclist changes during the first part of a journey along a straight and level road. During this part of the journey the force applied by the cyclist to the bicycle pedals is constant.

Figure 14



4.1.1.2 Changes in energy

Question 28 · continued

Describe how **and** explain, in terms of the forces **A** and **B**, why the velocity of the cyclist changes:

- between the points **X** and **Y**
- and between the points **Y** and **Z**, marked on the graph in **Figure 14**.

[6 marks]

.....

.....

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Extra space .....

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Question 8 continues on the next page

4.1.1.2 Changes in energy

Question 28 · continued

8 (b) (i) The cyclist used the brakes to slow down and stop the bicycle.

A constant braking force of 140 N stopped the bicycle in a distance of 24 m.

Calculate the work done by the braking force to stop the bicycle. Give the unit.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

.....

.....

.....

Work done = ...

8 (b) (ii) Complete the following sentences.

[2 marks]

When the brakes are used, the bicycle slows down. The kinetic energy of the bicycle ..... .

At the same time, the ..... of the brakes increases.

13

4.1.1.2 Changes in energy

Question 29

June 2015 | PH2FP | Original Q3 | Legacy

3 (a) When a force is applied to a spring, the spring extends by 0.12 m.
The spring has a spring constant of 25 N/m.

Calculate the force applied to the spring.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

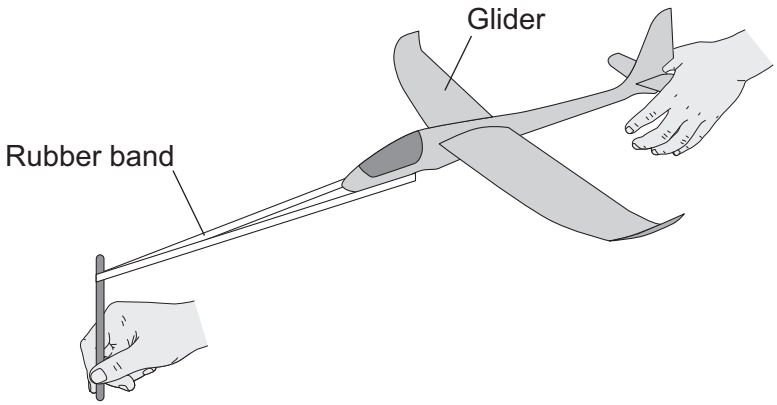
.....

.....

Force = ... N

3 (b) **Figure 2** shows a toy glider. To launch the glider into the air, the rubber band and glider are pulled back and then the glider is released.

Figure 2



3 (b) (i) Use the correct answers from the box to complete the sentence.

[2 marks]

chemical	**elastic potential**	**kinetic**	**thermal**

When the glider is released, the ..... energy stored in the rubber band decreases and the glider gains ..... energy.

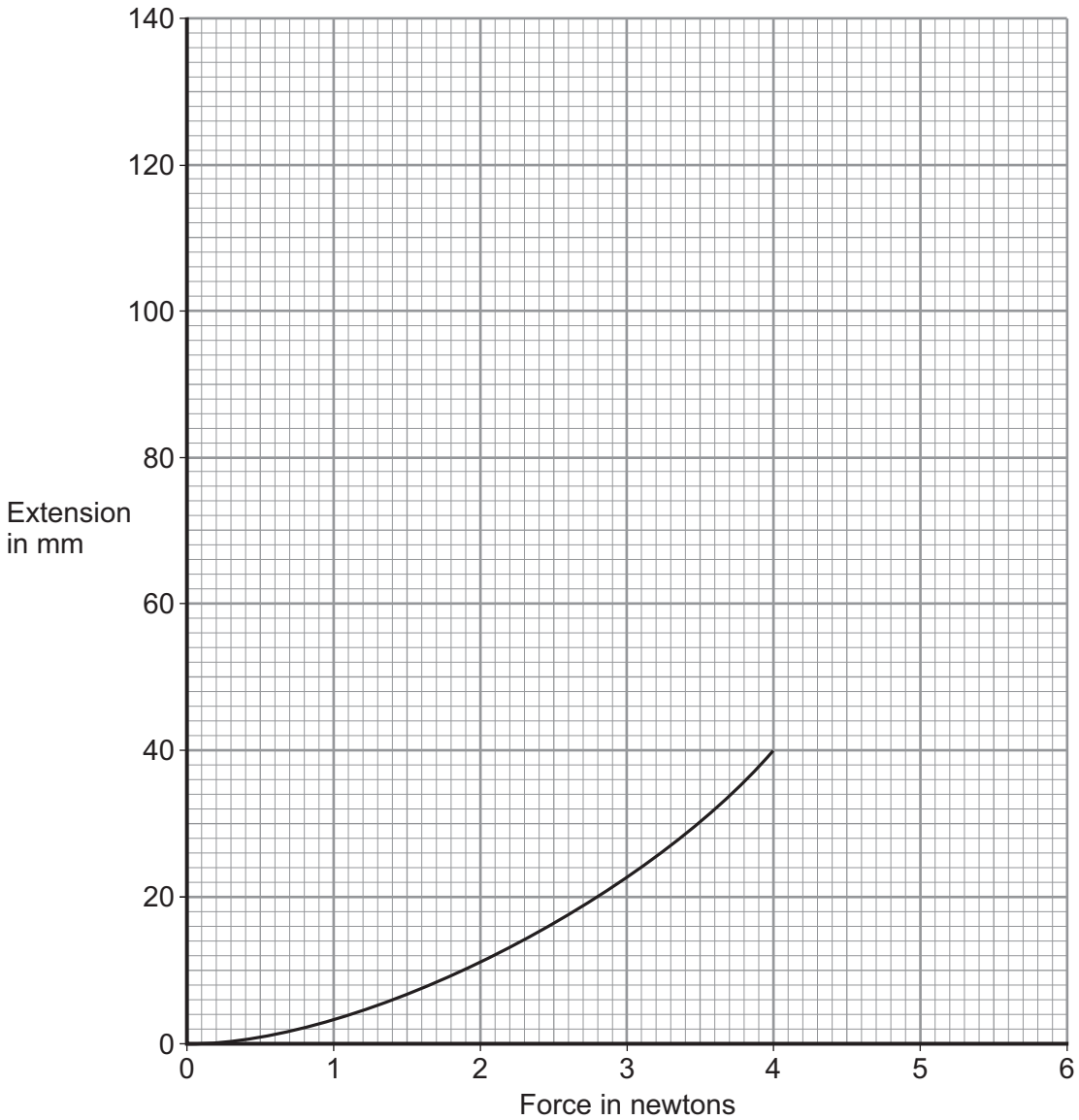
Question 3 continues on the next page

4.1.1.2 Changes in energy

Question 29 · continued

3 (b) (ii) **Figure 3** shows how the extension of the rubber band varies with the force applied to the rubber band.

Figure 3



What can you conclude, from **Figure 3**, would happen to the extension of the rubber band if the force applied to the rubber band was increased to 6 N?

The rubber band does **not** break.

[2 marks]

.....

.....

.....

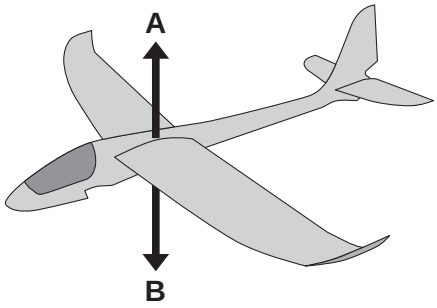
.....

4.1.1.2 Changes in energy

Question 29 · continued

3 (c) **Figure 4** shows the vertical forces, **A** and **B**, acting on the glider when it is flying.

Figure 4



3 (c) (i) What name is given to the force labelled **B**?

[1 mark]

Draw a ring around the correct answer.

drag **friction** **weight**

3 (c) (ii) Which **one** of the following describes the downward speed of the glider when force **B** is greater than force **A**?

[1 mark]

Tick (✓) **one** box.

Downward speed increases ☐

Downward speed is constant ☐

Downward speed decreases ☐

8

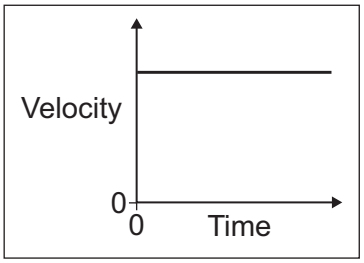
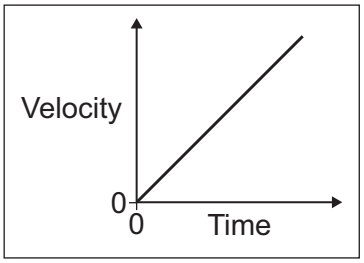
4.1.1.2 Changes in energy

Question 30

June 2015 | PH2FP | Original Q5 | Legacy

5 (a) Draw **one** line from each velocity–time graph to the statement describing the motion shown by the graph.

[2 marks]

Velocity–time graph	Motion shown by graph
	Constant acceleration
	Not moving
	Constant deceleration
	Constant velocity

5 (b) Use the correct answer from the box to complete the sentence.

[1 mark]

energy	**momentum**	**speed**

The velocity of an object includes both the ..... of the object and the direction the object is moving.

Question 5 continues on the next page

Question 30 · continued

5 (c) At the start of a race, a horse accelerates from a velocity of 0 m/s to a velocity of 9 m/s in 4 seconds.

5 (c) (i) Calculate the acceleration of the horse.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

Acceleration = ... m/s^2

5 (c) (ii) When the horse accelerates, what, if anything, happens to the air resistance acting against the horse?

[1 mark]

Tick (✓) **one** box.

The air resistance decreases. ☐

The air resistance is constant. ☐

The air resistance increases. ☐

5 (d) A horse and a pony walk across a field at the same constant speed.

The horse has 4000 joules of kinetic energy.

The pony is **half** the mass of the horse.

What is the kinetic energy of the pony?

[2 marks]

Draw a ring around the correct answer.

2000 J **4000 J** **8000 J**

Give a reason for your answer.

.....

.....

8

4.1.1.2 Changes in energy

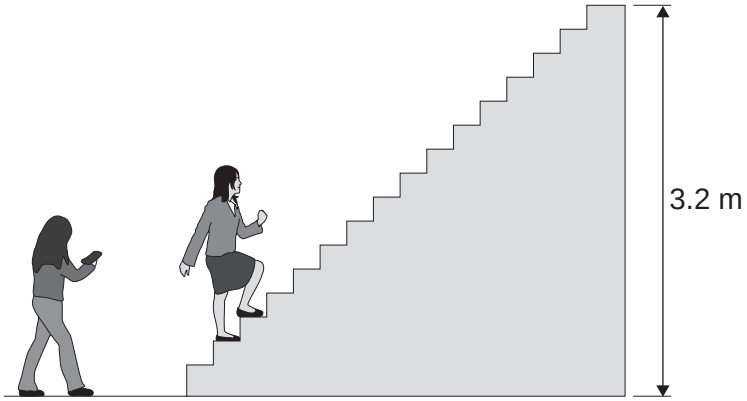
Question 31

June 2016 | PH2FP | Original Q6 | Legacy

6 A student did an experiment to calculate her power.
Figure 9 shows how she obtained the measurements needed.

The student first weighed herself and then ran up a flight of stairs. A second student timed how long it took her to go from the bottom to the top of the stairs. The height of the stairs was also measured.

Figure 9



6 (a) Complete the following sentence.

[1 mark]

To run up the stairs the student must do work against

the force of _____ .

6 (b) The student did 2240 J of work going from the bottom of the stairs to the top of the stairs.
The student took 2.8 seconds to run up the stairs.

6 (b) (i) Calculate the power the student developed when running up the stairs.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

Power = _____ W

4.1.1.2 Changes in energy

Question 31 · continued

6 (b) (ii) How much gravitational potential energy did the student gain in going from the bottom to the top of the stairs?

[1 mark]

Tick (✓) **one** box.

much more than 2240 J ☐

2240 J ☐

much less than 2240 J ☐

6 (c) Another four students did the same experiment.
The measurements taken and the calculated values for power are given in **Table 1**.

Table 1

Student	Weight in newtons	Time taken in seconds	Power in watts
A	285	3.8	240
B	360	2.4	480
C	600	3.4	560
D	725	4.0	580

6 (c) (i) To make a fair comparison of their powers the students kept **one** variable in the experiment constant.

What variable did the students keep constant?

[1 mark]

6 (c) (ii) From the data in **Table 1** a student wrote the following conclusion.

'The greater the weight of the student the greater the power developed.'

Suggest why this conclusion may **not** be true for a larger group of students.

[1 mark]

6

4.1.1.2 Changes in energy

Question 32

June 2017 | PH2FP | Original Q2 | Legacy

2 A car driver sees the traffic lights ahead change to red. The driver applies the brakes to stop the car.

The stopping distance of the car is the thinking distance plus the braking distance.

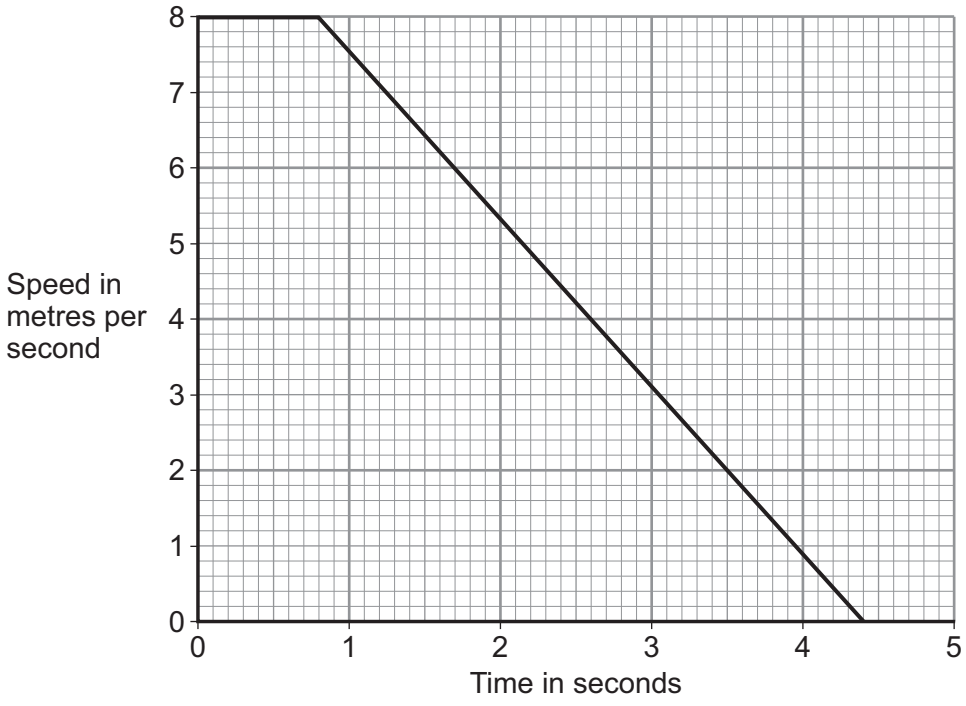
2 (a) Draw **one** line from each distance to the description of that distance.

[2 marks]

Distance	Description
Stopping	The distance the car moves between the brakes being applied and the car stopping.
Braking	The distance the car moves between the driver seeing the red light and the car stopping.
	The distance the car moves between the driver seeing the red light and applying the brakes.

2 (b) **Figure 3** shows how the speed of the car changes from the instant that the driver sees the traffic lights change to red.

Figure 3



4.1.1.2 Changes in energy

Question 32 · continued

2 (b) (i) What is the reaction time of the driver?

[1 mark]

Tick (✓) **one** box.

0.8 s ☐ 3.6 s ☐ 4.4 s ☐

2 (b) (ii) Using a mobile phone while driving may increase the reaction time of the driver.

Explain the effect of an increased reaction time on the stopping distance of the car.

[2 marks]

_____

_____

_____

_____

2 (b) (iii) The car has a mass of 750 kg

How is the kinetic energy of the car calculated when the car is travelling at 8 m/s?

[1 mark]

Tick (✓) **one** box.

$\frac{1}{2} \times 750 \times 8$ ☐

$\frac{1}{2} \times 750 \times 8^2$ ☐

$\frac{1}{2} \times 750^2 \times 8^2$ ☐

2 (b) (iv) Use the correct answers from the box to complete the sentence.

Each answer may be used once, more than once or not at all.

[2 marks]

decreases	**does not change**	**increases**

When the brakes of the car are applied,

the kinetic energy of the car _____ and

the temperature of the brakes _____ .

8

4.1.1.2 Changes in energy

Question 33

June 2018 | 8463/1F | Original Q1

0 1 **Figure 1** shows a cyclist riding along a flat road.

Figure 1



0 1 . 1 Complete the sentence.

Choose answers from the box.

[2 marks]

chemical	**elastic potential**	**gravitational potential**	**kinetic**

As the cyclist accelerates, the _____ energy store in the cyclist's body decreases and the _____ energy of the cyclist increases.

0 1 . 2 The mass of the cyclist is 80 kg. The speed of the cyclist is 12 m/s.

Calculate the kinetic energy of the cyclist.

Use the equation:

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{speed})^2$$

[2 marks]

_____

_____

_____

_____

Kinetic energy = _____ J

4.1.1.2 Changes in energy

Question 33 · continued

0 1 . 3 When the cyclist uses the brakes, the bicycle slows down.

This causes the temperature of the brake pads to increase by 50 °C.
The mass of the brake pads is 0.040 kg.
The specific heat capacity of the material of the brake pads is 480 J/kg °C.

Calculate the change in thermal energy of the brake pads.

Use the equation:

change in thermal energy = mass × specific heat capacity × temperature change

[2 marks]

Change in thermal energy = _____ J

0 1 . 4 How is the internal energy of the particles in the brake pads affected by the increase in temperature?

Tick **one** box.

[1 mark]

Decreased ☐

Increased ☐

Not affected ☐

7

4.1.1.2 Changes in energy

Question 34

June 2018 | 8463/1F | Original Q9

0 9 **Figure 13** shows a lift inside a building.

Figure 13



0 9 . 1 The motor in the lift does 120 000 J of work in 8.0 seconds.

Calculate the power output of the motor in the lift.

Use the equation:

$$\text{Power output} = \frac{\text{work done}}{\text{time}}$$

[2 marks]

Power output = _____ W

4.1.1.2 Changes in energy

Question 34 · continued

0 9 . 2 The power input to the motor is greater than the power output.

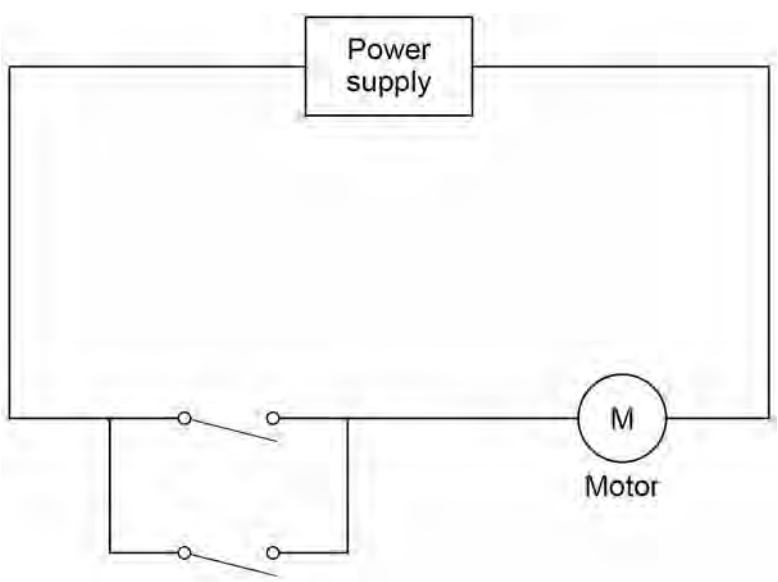
Tick **two** reasons why.

[2 marks]

- Energy is transferred in heating the surroundings. ☐
- Friction causes energy to be transferred in non-useful ways. ☐
- The motor is connected to the mains electricity supply. ☐
- The motor is more than 100% efficient. ☐
- There are only four people in the lift. ☐

0 9 . 3 **Figure 14** shows part of the circuit that operates the lift motor.

Figure 14



The lift can be operated using either of the two switches.

Explain why.

[2 marks]

4.1.1.2 Changes in energy

Question 34 · continued

0 9 . 4 Write down the equation that links gravitational field strength, gravitational potential energy, height and mass.

[1 mark]

0 9 . 5 The lift goes up 14 m. The total mass of the people in the lift is 280 kg.

gravitational field strength = 9.8 N/kg

Calculate the increase in gravitational potential energy of the people in the lift.

Give your answer to 2 significant figures.

[3 marks]

Increase in gravitational potential energy = _____ J

10

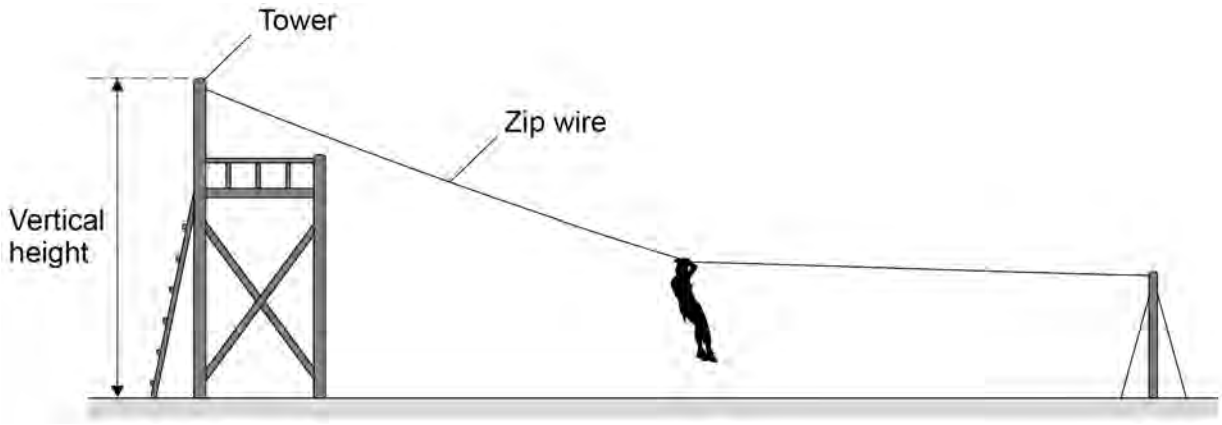
4.1.1.2 Changes in energy

Question 35

June 2019 | 8463/1F | Original Q3

0 3 **Figure 4** shows a person sliding down a zip wire.

Figure 4



0 3 . 1 Describe how the vertical height of the tower could be measured accurately.

[2 marks]

0 3 . 2 When using the zip wire, the person moved through a vertical height of 2.0 m

The person has a mass of 45 kg

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the person.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Change in gravitational potential energy = _____ J

4.1.1.2 Changes in energy

Question 35 · continued

0 3 . 3 Give **three** factors that affected the kinetic energy of the person as she reached the bottom of the zip wire.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

7

Turn over for the next question

4.1.1.2 Changes in energy

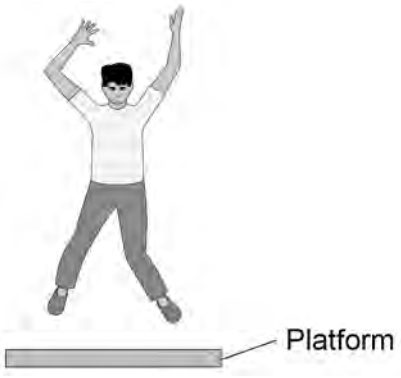
Question 36

1 1 A scientist investigated how the maximum muscle power of humans varies with age and gender.

The scientist asked volunteers to stand on a platform and to jump as high as they could.

Figure 18 shows a volunteer taking part in the experiment.

Figure 18



An electronic timer measured the time that the volunteer was in the air.

1 1 . 1 The muscle power in watts per kg is calculated using the following equation:

$$\text{muscle power} = \frac{9.8 \times \text{jump height}}{\text{time}}$$

One volunteer has a muscle power of 41 W/kg

He was in the air for 0.12 s

Calculate his jump height.

[3 marks]

Jump height = _____ m

Question 36 · continued

1 1 . 2 Write down the equation which links kinetic energy, mass and speed.

[1 mark]

1 1 . 3 One volunteer had a kinetic energy of 270 J and a speed of 3.0 m/s at the moment he left the ground.

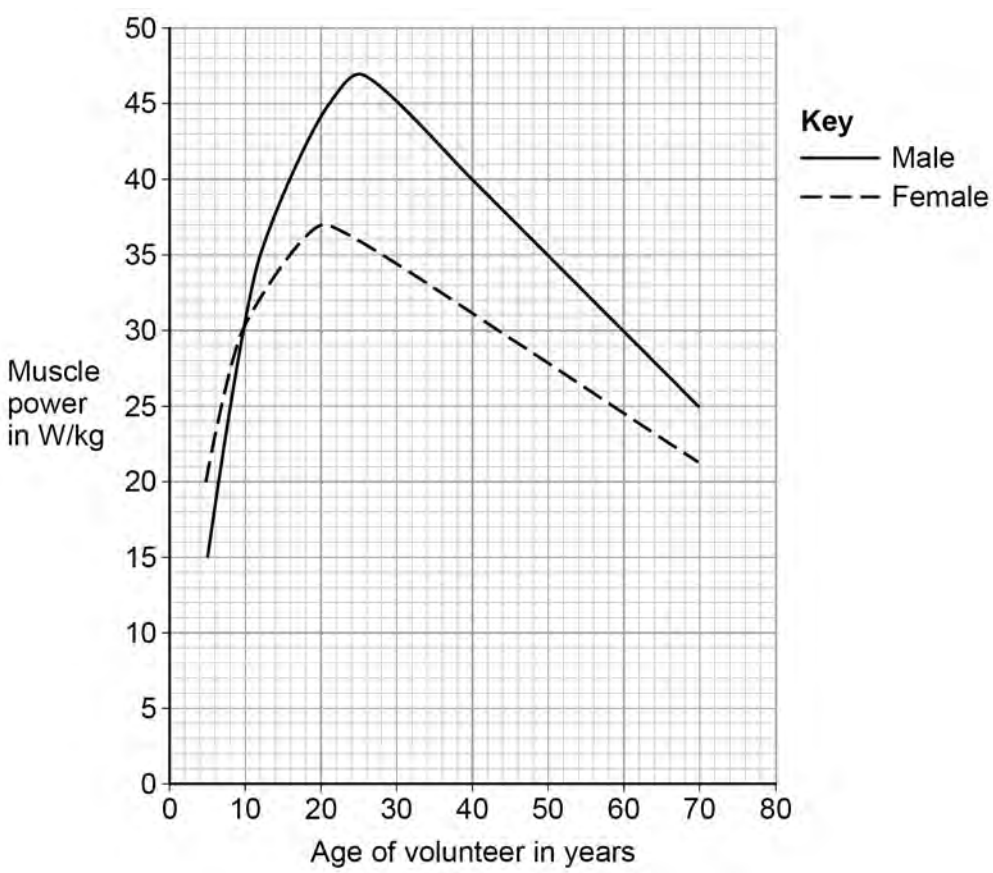
Calculate his mass.

[3 marks]

Mass = _____ kg

Figure 19 shows the scientist's results.

Figure 19



4.1.1.2 Changes in energy

Question 36 · continued

11.4 Compare the muscle power of males with the muscle power of females.

Use data from **Figure 19** in your answer.

[4 marks]

11.5 The muscle power of each volunteer was measured five times.

The highest muscle power reading was recorded instead of calculating an average.

Suggest **one** reason why.

[1 mark]

1

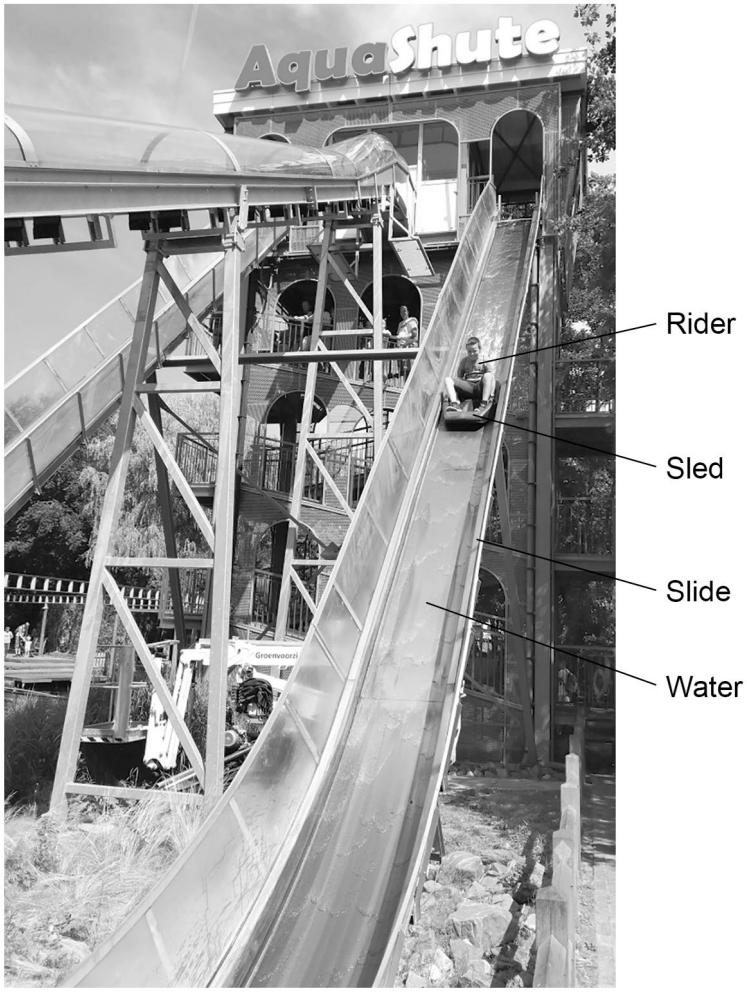
4.1.1.2 Changes in energy

Question 37

November 2020 | 8463/1F | Original Q2

0 2 **Figure 4** shows a theme park ride called AquaShute.

Figure 4



0 2 . 1 Riders of the AquaShute sit on a sled and move down a slide.

There is a layer of water between the sled and the slide.

How does the layer of water affect the friction between the sled and the slide?

[1 mark]

Tick (✓) **one** box.

The friction is decreased. ☐

The friction is increased. ☐

The friction is not affected. ☐

Question 37 · continued

0 2 . 2 The mass of one rider is 62.5 kg.

The height of the slide is 16.0 m.

gravitational field strength = 9.8 N/kg

Calculate the gravitational potential energy of the rider at the top of the slide.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Gravitational potential energy = _____ J

0 2 . 3 At the bottom of the slide the speed of the rider is 12 m/s.

The mass of the rider is 62.5 kg.

Calculate the kinetic energy of the rider at the bottom of the slide.

Use the equation:

kinetic energy = 0.5 × mass × $(\text{speed})^2$

[2 marks]

Kinetic energy = _____ J

Question 2 continues on the next page

4.1.1.2 Changes in energy

Question 37 · continued

0 2 . 4 When a rider reaches the bottom of the slide, the sled decelerates and stops.

Give **two** factors that will affect how far the sled will move before it stops.

[2 marks]

1 _____

_____

2 _____

_____

7

4.1.1.2 Changes in energy

Question 38

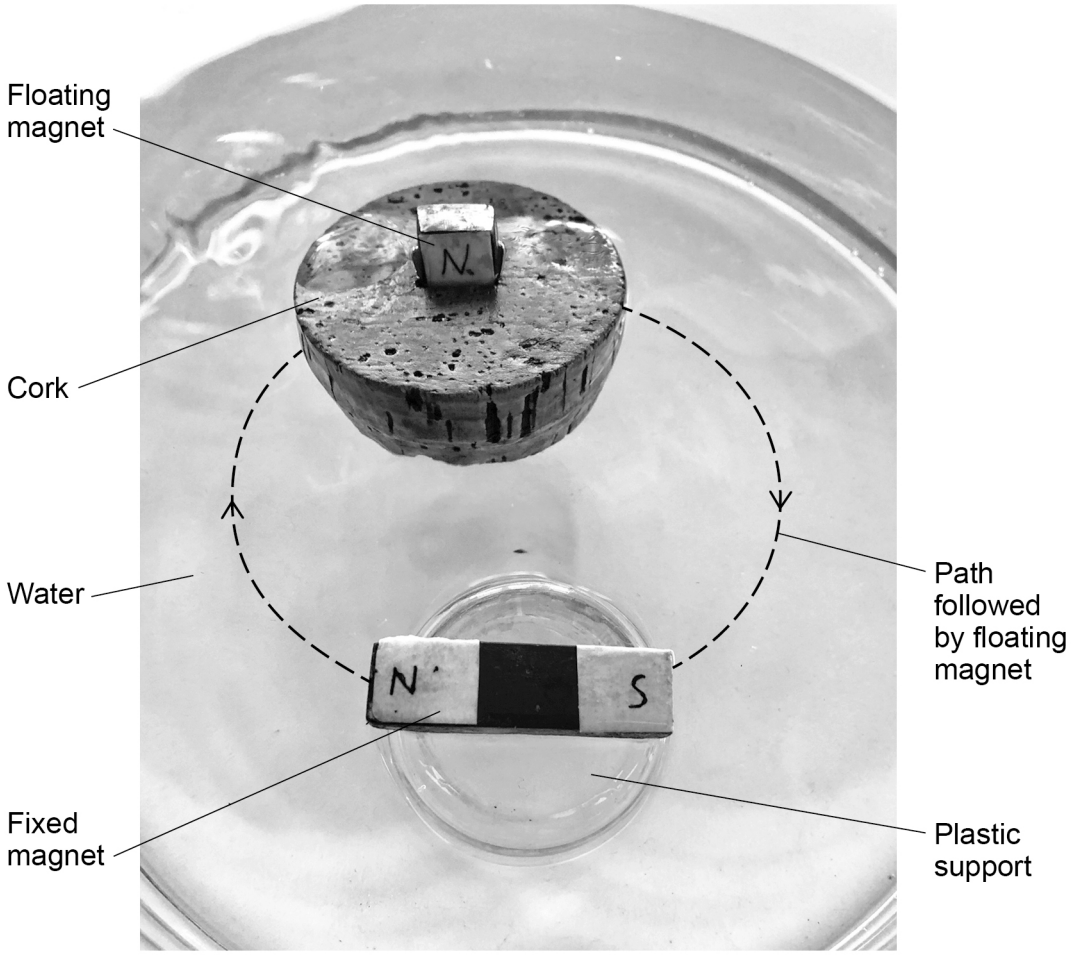
November 2020 | 8463/2F | Original Q5

0 5 A student placed a magnet on top of a plastic support in a bowl of water. This magnet was fixed in position and above the surface of the water.

The student put a second magnet into a piece of cork so that the magnet floated on the water. Only the north pole of the floating magnet was above the surface of the water.

Figure 6 shows the arrangement of the magnets.

Figure 6



0 5 . 1 The floating magnet was placed near to the north pole of the fixed magnet. The floating magnet then moved along the path shown in **Figure 6**.

Explain why.

[2 marks]

Question 38 · continued

0 5 . 2 The student replaced the floating magnet with a piece of iron.

What happened to the piece of iron?

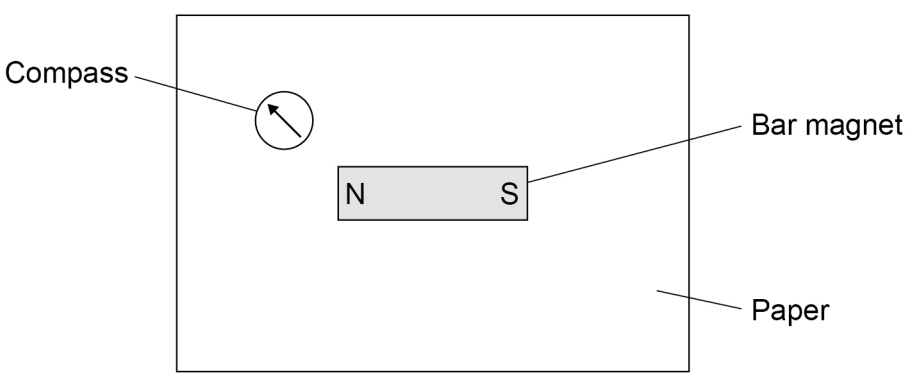
[1 mark]

0 5 . 3 Describe how to use a compass to plot the magnetic field pattern around a bar magnet.

Use **Figure 7** to help you.

[4 marks]

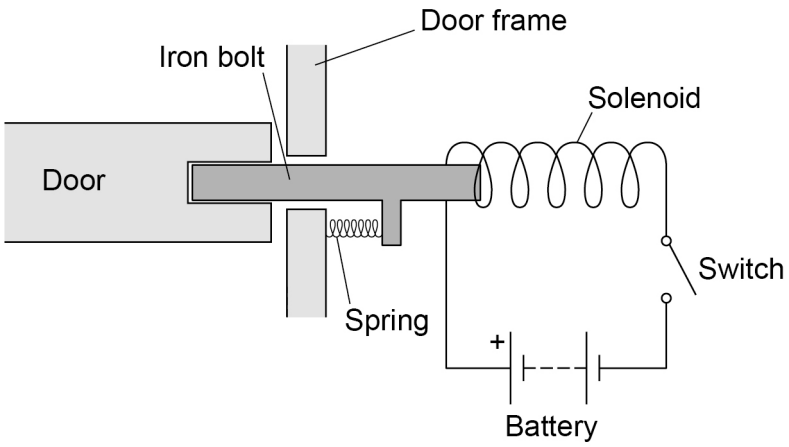
Figure 7



Question 38 · continued

Figure 8 shows a diagram of an electromagnetic lock used to secure a door.

Figure 8



0 5 . 4 **Figure 9** shows an incomplete sequence of how the door unlocks.

Figure 9



Write **one** letter in each box to show the correct sequence.

[2 marks]

A The iron bolt moves.

B A magnetic field is created around the solenoid.

C There is a current in the circuit.

Question 5 continues on the next page

4.1.1.2 Changes in energy

Question 38 · continued

0 5 . 5 The electromagnetic lock contains a spring.

When the door is unlocked the extension of the spring is 0.040 m.

spring constant = 200 N/m

Calculate the elastic potential energy of the spring when the door is unlocked.

Use the equation:

elastic potential energy = 0.5 × spring constant × (extension)^2

[2 marks]

Elastic potential energy = _____ J

11

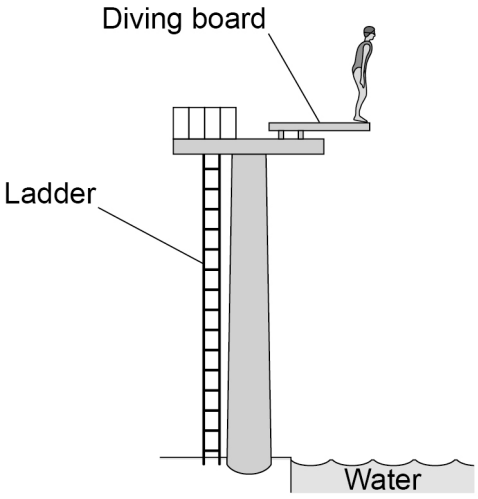
4.1.1.2 Changes in energy

Question 39

November 2021 | 8463/1F | Original Q7

0 7 **Figure 11** shows a diver about to dive off a diving board.

Figure 11



0 7 . 1 Complete the sentences.

Choose answers from the box.

[2 marks]

elastic potential	**gravitational potential**	**kinetic**	**nuclear**

As the diver falls towards the water there is a decrease in

her _____ energy.

As the diver falls towards the water there is an increase in

her _____ energy.

4.1.1.2 Changes in energy

Question 39 · continued

0 7 . 2 Write down the equation which links kinetic energy (E_k), mass (m) and speed (v).

[1 mark]

0 7 . 3 At the instant the diver hits the water, the kinetic energy of the diver is 5040 J.

The speed of the diver is 12 m/s.

Calculate the mass of the diver.

[3 marks]

Mass = _____ kg

0 7 . 4 Most of the kinetic energy of the diver is transferred to the water.

How does this affect the thermal energy of the water?

[1 mark]

Tick (✓) **one** box.

The thermal energy decreases. ☐

The thermal energy stays the same. ☐

The thermal energy increases. ☐

7

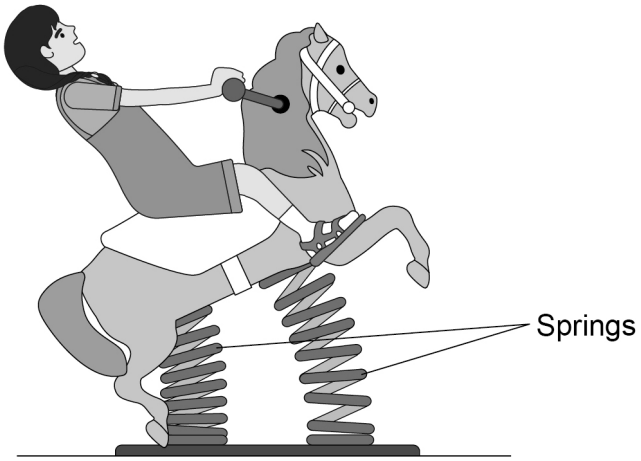
4.1.1.2 Changes in energy

Question 40

November 2021 | 8463/2F | Original Q9

0 9 **Figure 20** shows a child on a playground toy.

Figure 20



0 9 . 1 The springs have been elastically deformed.

Explain what is meant by 'elastically deformed'.

[2 marks]

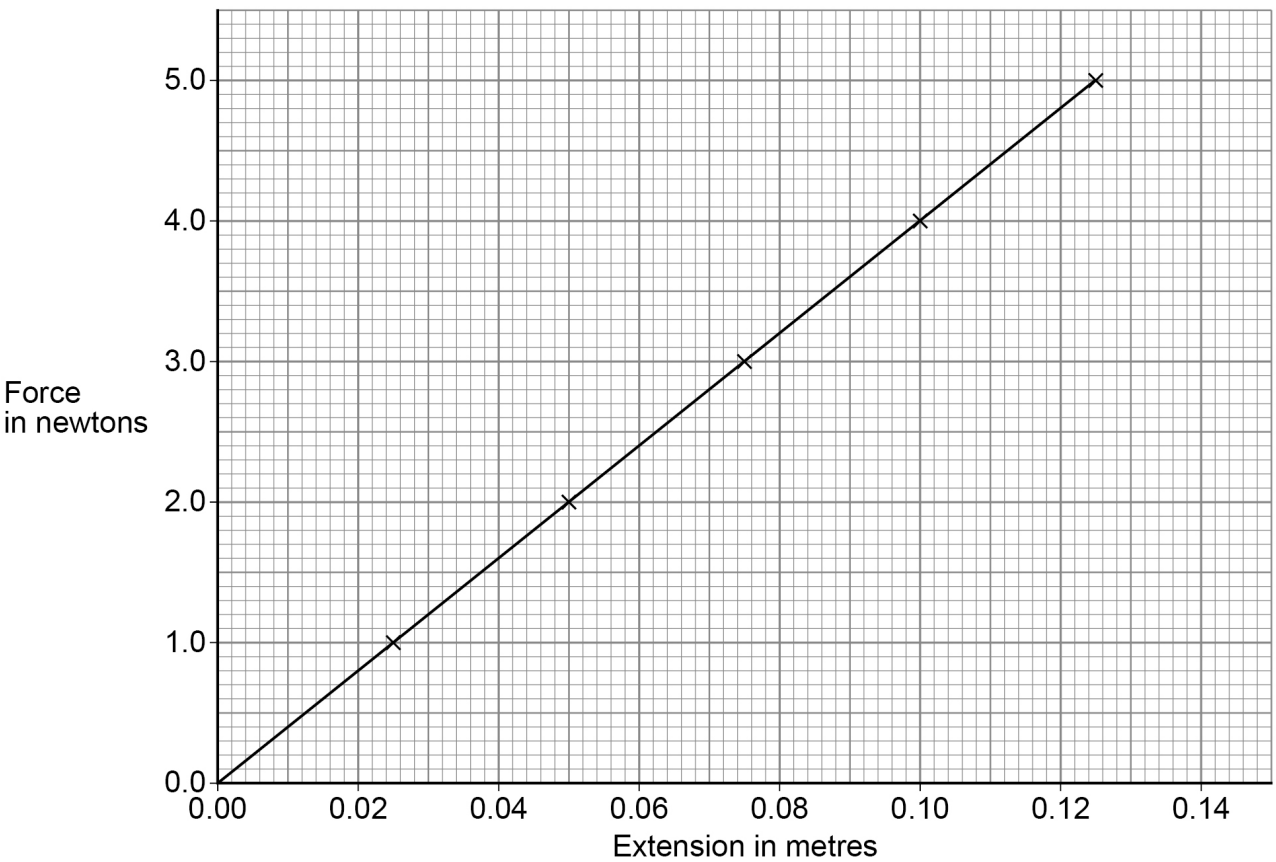
Question 9 continues on the next page

Question 40 · continued

A student investigated the relationship between the force applied to a spring and the extension of the spring.

Figure 21 shows the results.

Figure 21



4.1.1.2 Changes in energy

Question 40 · continued

0 9 . 2 Describe a method the student could use to obtain the results given in **Figure 21**.

You should include a risk assessment for **one** hazard in the investigation.

Your answer may include a diagram.

[6 marks]

Question 9 continues on the next page

4.1.1.2 Changes in energy

Question 40 · continued

0 9 . 3 Which equation links extension (*e*), force (*F*) and spring constant (*k*).

[1 mark]

Tick (✓) **one** box.

force = spring constant × (extension)^2 ☐

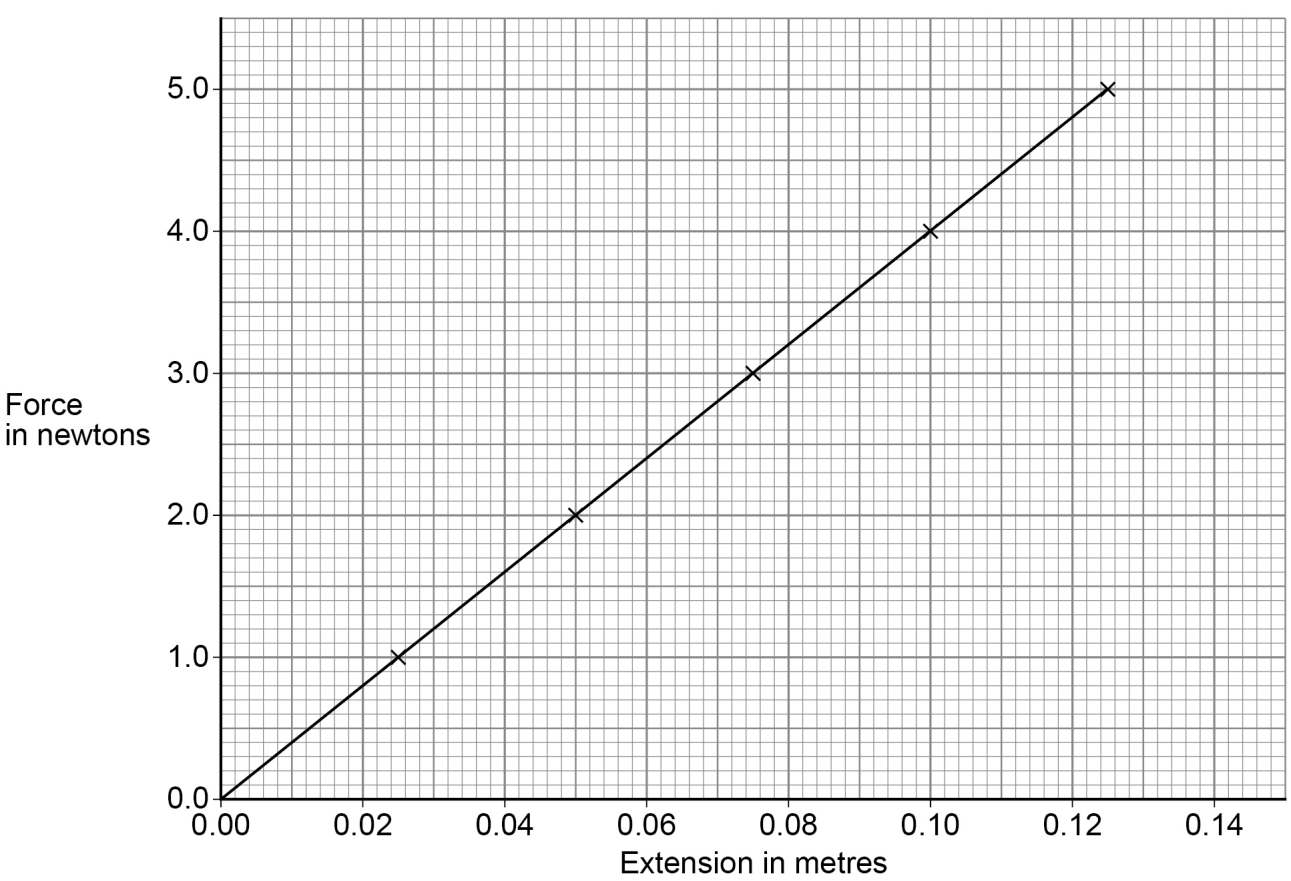
force = spring constant × extension ☐

force = $\frac{\text{extension}}{\text{spring constant}}$ ☐

force = $\frac{\text{spring constant}}{\text{extension}}$ ☐

Figure 21 is repeated below.

Figure 21



4.1.1.2 Changes in energy

Question 40 · continued

0 9 . 4 Determine the spring constant of the spring.

Use **Figure 21**.

[3 marks]

Spring constant = _____ N/m

0 9 . 5 The student concluded:

'The extension of the spring is directly proportional to the force applied to the spring.'

Describe how **Figure 21** supports the student's conclusion.

[2 marks]

Question 9 continues on the next page

4.1.1.2 Changes in energy

Question 40 · continued

0 9 . 6 The student repeated the investigation using a different spring with a spring constant of 13 N/m.

Calculate the elastic potential energy of the spring when the extension of the spring was 20 cm.

Use the Physics Equations Sheet.

[3 marks]

Elastic potential energy = _____ J

17

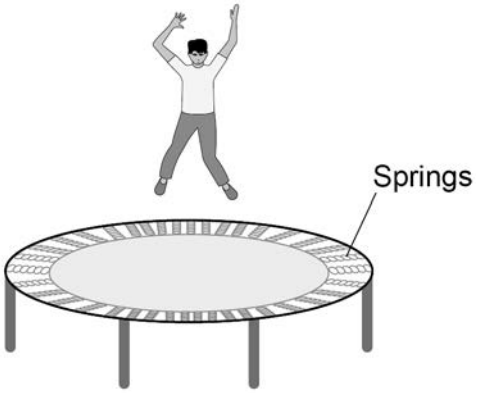
4.1.1.2 Changes in energy

Question 41

June 2022 | 8463/1F | Original Q1

0 1 **Figure 1** shows a boy bouncing on a trampoline.

Figure 1



0 1 . 1 The boy falls from the position in **Figure 1** towards the trampoline.

Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	**elastic potential**	**gravitational potential**
kinetic	**nuclear**	

As the boy falls, there is a decrease in his _____ energy.

As the boy falls, there is an increase in his _____ energy.

4.1.1.2 Changes in energy

Question 41 · continued

0 1 . 2 As the boy lands on the trampoline, each spring stretches 0.015 m.

spring constant of each spring = 120 000 N/m

Calculate the energy stored by each spring.

Use the equation:

elastic potential energy = 0.5 × spring constant × (extension)^2

[2 marks]

Elastic potential energy = _____ J

0 1 . 3 There are 40 springs on the trampoline.

Calculate the total energy stored by the 40 springs when each spring is stretched by 0.015 m.

Use your answer from Question **01.2**

[1 mark]

Total energy stored = _____ J

Question 1 continues on the next page

4.1.1.2 Changes in energy

Question 41 · continued

0 1 . 4 The kinetic energy of the boy as he lands on the trampoline is 600 J.

The maximum kinetic energy of the boy after he bounces is 45% of his kinetic energy as he lands.

Calculate the maximum kinetic energy of the boy after he bounces.

[2 marks]

Maximum kinetic energy = _____ J

0 1 . 5 Why is the kinetic energy of the boy after he bounces less than his kinetic energy as he lands?

[1 mark]

Tick (✓) **one** box.

- Energy is not conserved. ☐
- Energy is transferred to the surroundings. ☐
- The springs transfer energy to the boy. ☐

8

4.1.1.2 Changes in energy

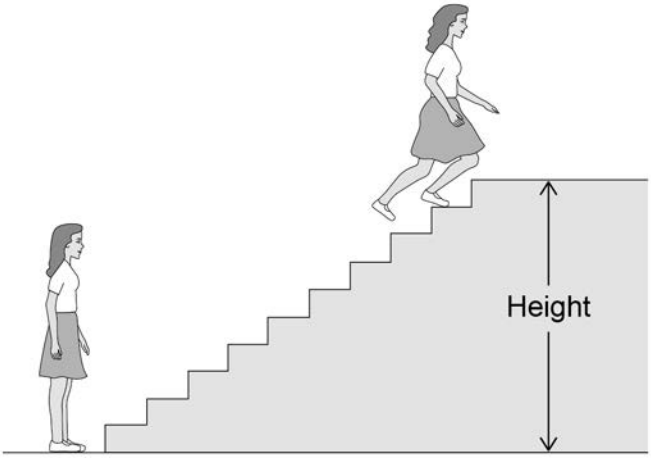
Question 42

June 2022 | 8463/1F | Original Q2

0 2 A girl ran to the top of some stairs.

Figure 2 shows the stairs.

Figure 2



0 2 . 1 The girl measured the height of the stairs.

What measuring instrument should she have used?

[1 mark]

0 2 . 2 The height of the stairs was 1.7 m.

The mass of the girl was 50 kg.

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the girl.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Gravitational potential energy = _____ J

4.1.1.2 Changes in energy

Question 42 · continued

0 2 . 3 A boy ran up the same stairs and did 1800 J of work.

The time it took the boy to run up the stairs was 1.44 s.

Calculate the power of the boy.

Use the equation:

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

[2 marks]

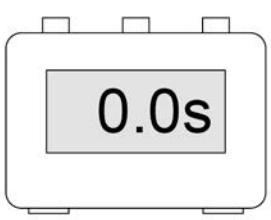
Power = _____ W

0 2 . 4 Which stop-clock was used to measure the time the boy took to run up the stairs?

[1 mark]

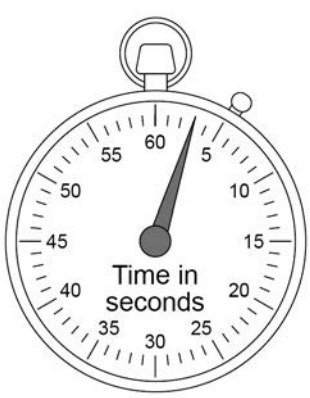
Tick (✓) **one** box.

Stop-clock A



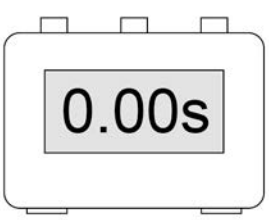
☐

Stop-clock B



☐

Stop-clock C



☐

4.1.1.2 Changes in energy

Question 42 · continued

0 2 . 5 The boy had a speed of 2.0 m/s at the top of the stairs.

The mass of the boy was 70 kg.

Calculate the kinetic energy of the boy at the top of the stairs.

Use the equation:

$$\text{kinetic energy} = 0.5 \times \text{mass} \times (\text{speed})^2$$

[2 marks]

Kinetic energy = _____ J

8

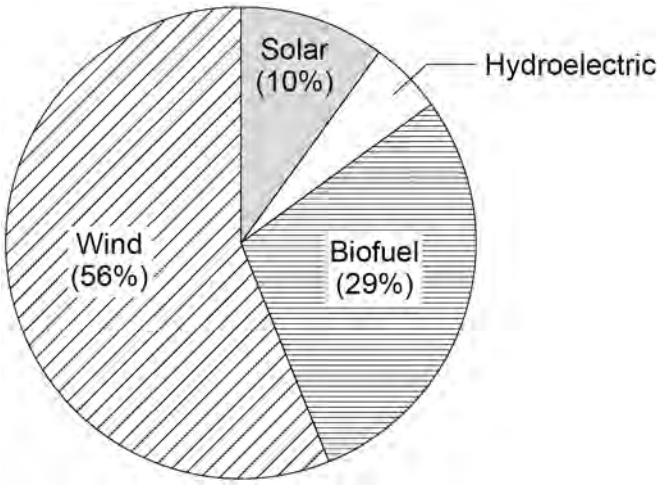
4.1.1.2 Changes in energy

Question 43

0 4 The UK uses renewable energy resources to generate some of its electricity.

Figure 4 shows the proportion of electricity generated by different renewable energy resources in the UK in 2020.

Figure 4



0 4 . 1 Calculate the percentage of electricity generated using hydroelectric power.

[2 marks]

Percentage = _____ %

4.1.1.2 Changes in energy

Question 43 · continued

A remote village in the UK uses a hydroelectric generator to provide electricity.

0 4 . 2 The mass of water that passes through the hydroelectric generator each day is 2 500 000 kg.

The change in vertical height of the water is 15.0 m.

gravitational field strength = 9.8 N/kg

Calculate the decrease in gravitational potential energy of the water.

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Decrease in gravitational potential energy = _____ J

Question 4 continues on the next page

Question 43 · continued

Use the Physics Equations Sheet to answer questions **04.3** and **04.4**.

0 4 . 3 Write down the equation which links energy (*E*), power (*P*) and time (*t*).

[1 mark]

0 4 . 4 The hydroelectric generator transfers electrical power of 3000 W to the village.

Calculate the energy transferred to the village in 60 minutes.

[3 marks]

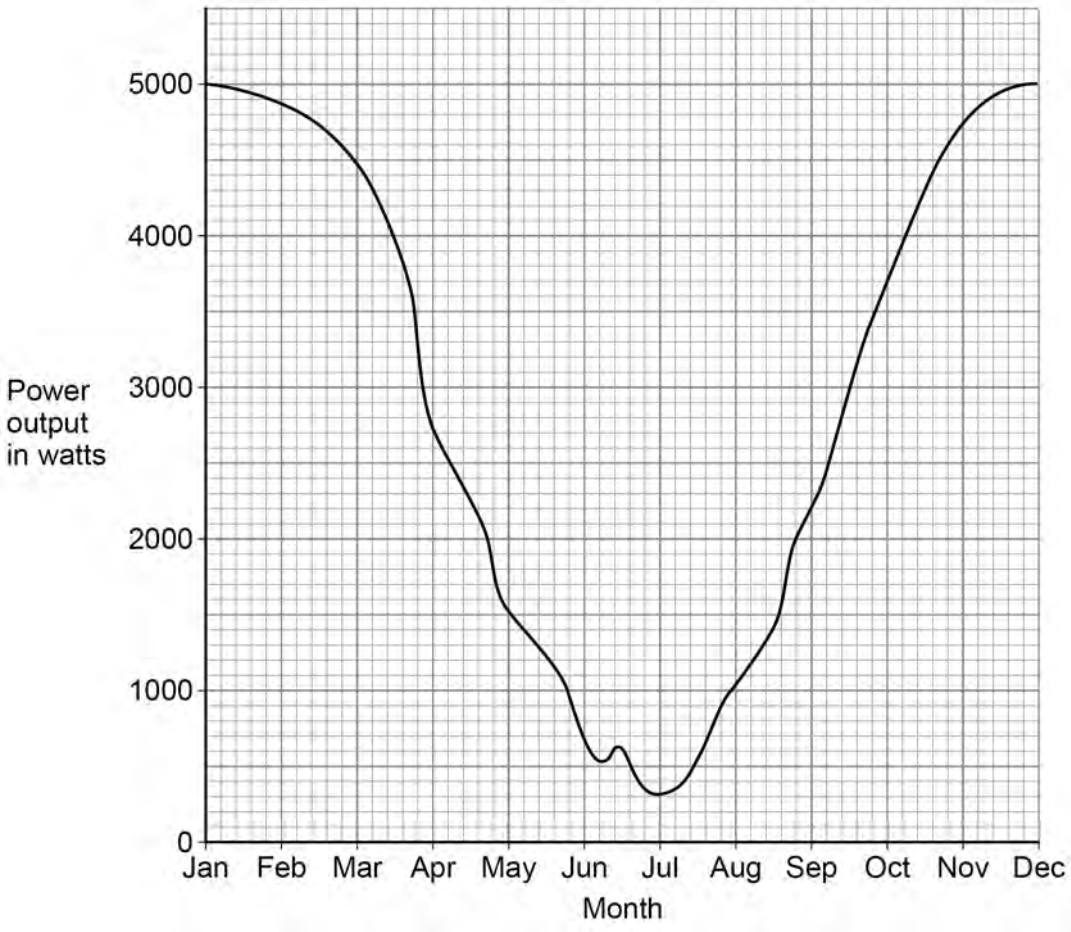
Energy transferred = _____ J

Question 43 · continued

0 4 . 5 The hydroelectric generator is turned by falling river water.

Figure 5 shows how the power output of the hydroelectric generator varied during one year.

Figure 5



Explain **one** reason why the power output varied.

[2 marks]

10

4.1.1.2 Changes in energy

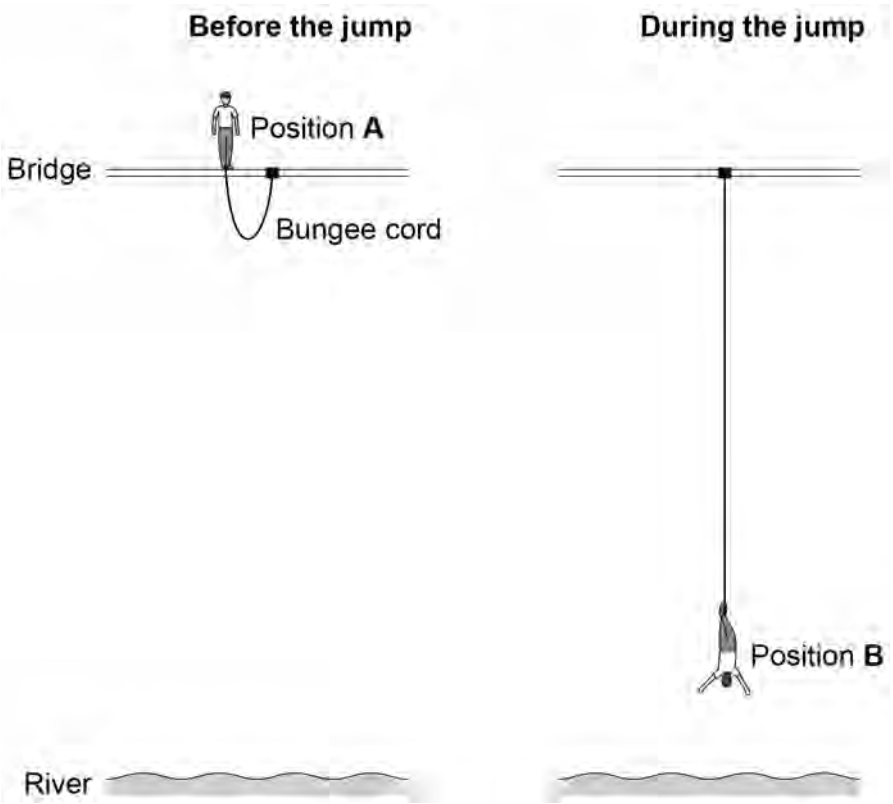
Question 44

June 2023 | 8463/1F | Original Q6

0 6 **Figure 8** shows a student before and during a bungee jump.

The diagram is not to scale.

Figure 8



0 6 . 1 In position **B**, the student is moving towards the river and the bungee cord is stretching.

How do the energy stores in position **B** compare with the energy stores in position **A**?

[3 marks]

Tick (✓) **one** box in **each** row.

Energy store	Less than at A	The same as at A	More than at A
The student's gravitational potential energy			
The student's kinetic energy			
The bungee cord's elastic potential energy			

4.1.1.2 Changes in energy

Question 44 · continued

0 6 . 2 The bungee cord behaves like a spring with a spring constant of 78.4 N/m.

At one point in the bungee jump, the extension of the bungee cord is 25 m.

Calculate the elastic potential energy stored by the bungee cord.

Use the equation:

elastic potential energy = 0.5 × spring constant × extension^2

[2 marks]

Elastic potential energy = _____ J

Question 44 · continued

Table 5 shows information about different bungee cords.

Table 5

Bungee cord	Spring constant in N/m	Maximum extension before snapping in metres
A	78.4	36
B	82.0	24
C	84.5	12

0 6 . 3 Bungee cord **C** will have a smaller extension than **A** or **B** for any bungee jumper.

Give the reason why.

[1 mark]

0 6 . 4 Which bungee cord would be safest to use for a person with a large weight?

Give a reason for your answer.

[2 marks]

Bungee cord _____

Reason _____

8

4.1.1.2 Changes in energy

Question 45

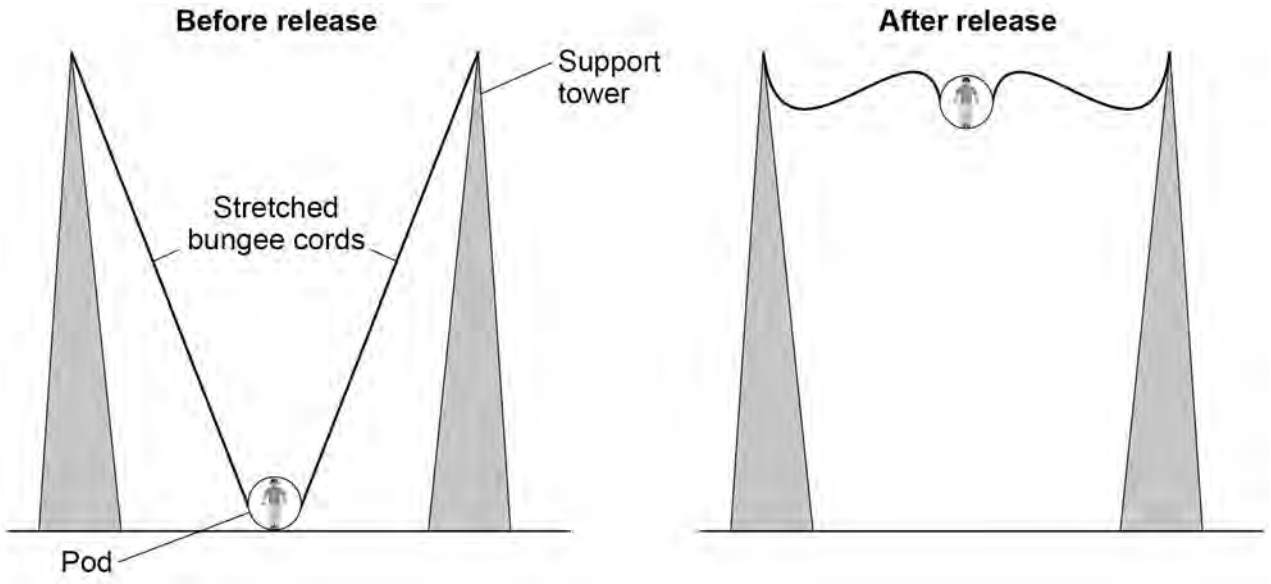
June 2024 | 8463/1F | Original Q3

0 3 In a ride at a theme park, a person is strapped into a pod that is attached to two stretched bungee cords.

The bungee cords behave like springs.

Figure 7 shows a person using the ride.

Figure 7



0 3 . 1 How is the extension of each bungee cord calculated?

[1 mark]

Tick (✓) **one** box.

stretched length + original length ☐

stretched length – original length ☐

stretched length × original length ☐

stretched length ÷ original length ☐

Question 45 · continued

0 3 . 2 Before the pod is released, the extension of each bungee cord is 7.5 m.

spring constant of the bungee cord = 800 N/m

Calculate the elastic potential energy stored in each stretched bungee cord.

Use the equation:

elastic potential energy = 0.5 × spring constant × (extension)^2

[2 marks]

Elastic potential energy = _____ J

0 3 . 3 The maximum speed of the pod is 15 m/s.

The mass of the pod is 240 kg.

Calculate the maximum kinetic energy of the pod.

Use the equation:

kinetic energy = 0.5 × mass × (speed)^2

[2 marks]

Maximum kinetic energy = _____ J

Question 45 · continued

Use the Physics Equations Sheet to answer questions **03.4** and **03.5**.

0 3 . 4 Which equation links gravitational field strength (g), gravitational potential energy (E_p), height (h) and mass (m)?

[1 mark]

Tick (✓) **one** box.

$E_p = \frac{m \times g}{h}$ ☐

$E_p = \frac{m}{g \times h}$ ☐

$E_p = m \times g \times h$ ☐

0 3 . 5 The pod has 24 000 J of gravitational potential energy when at its maximum height.

The mass of the pod is 240 kg.

gravitational field strength = 9.8 N/kg

Calculate the maximum height reached by the pod.

[3 marks]

Maximum height = _____ m

Question 3 continues on the next page

4.1.1.2 Changes in energy

Question 45 · continued

0 3 . 6 Why is the maximum gravitational potential energy of the pod less than the initial elastic potential energy of the bungee cords?

[2 marks]

Tick (✓) **two** boxes.

- Energy is created. ☐
- Energy is destroyed. ☐
- Energy is transferred to the surroundings. ☐
- Work is done against air resistance. ☐
- Work is done by the force of gravity. ☐
- Work is done by the person in the pod. ☐

11

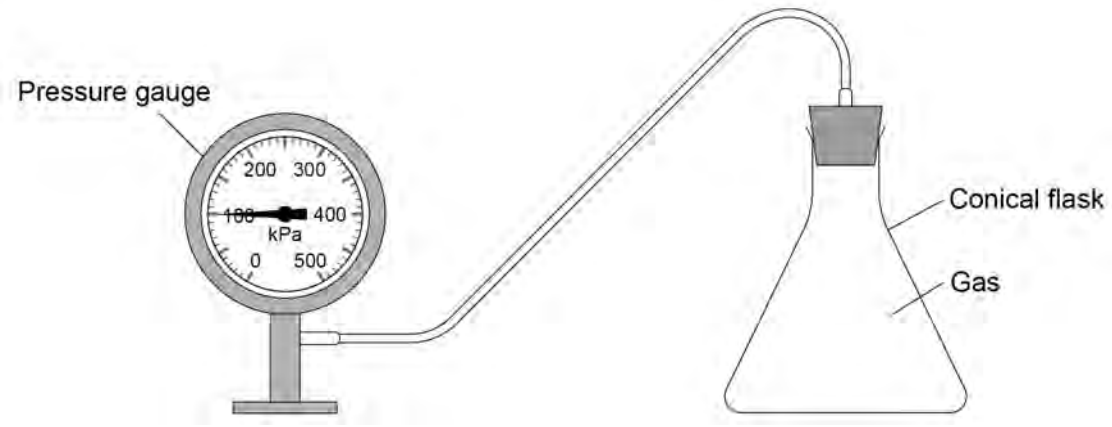
4.1.1.2 Changes in energy

Question 46

0 4 A teacher demonstrated how the pressure in a gas varies with temperature.

Figure 7 shows some of the apparatus used.

Figure 7



The teacher heated the conical flask.

The temperature of the gas in the flask increased.

0 4 . 1 How did heating the gas affect the average speed of the gas particles?

[1 mark]

Tick (✓) **one** box.

The speed decreased. ☐

The speed stayed the same. ☐

The speed increased. ☐

Question 46 · continued

0 4 . 2 How did heating the gas affect the average kinetic energy of the gas particles?

[1 mark]

Tick (✓) **one** box.

The kinetic energy decreased. ☐

The kinetic energy stayed the same. ☐

The kinetic energy increased. ☐

As the temperature of the gas increased, the pressure of the gas inside the flask increased.

0 4 . 3 How did increasing the pressure affect the number of collisions each second between gas particles and the walls of the flask?

[1 mark]

Tick (✓) **one** box.

The number of collisions each second decreased. ☐

The number of collisions each second stayed the same. ☐

The number of collisions each second increased. ☐

Question 4 continues on the next page

Question 46 · continued

0 4 . 4 What happened to the force exerted on the walls of the flask by the gas particles when the pressure increased?

[1 mark]

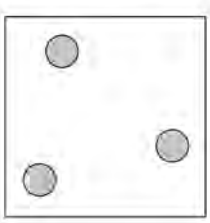
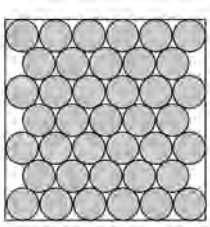
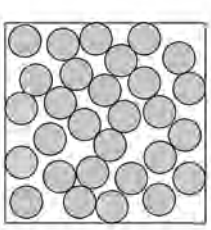
Tick (✓) **one** box.

- The force exerted decreased. ☐
- The force exerted stayed the same. ☐
- The force exerted increased. ☐

0 4 . 5 At different temperatures, nitrogen can be a gas, a liquid or a solid.

Draw **one** line from the state of matter to the arrangement of particles in each state.

[2 marks]

State of matter	Arrangement of particles
Liquid	
Solid	
Gas	

Question 46 · continued

0 4 . 6 The boiling point of nitrogen is –196 °C and the melting point of nitrogen is –210 °C.

What is the state of matter of nitrogen at a temperature of –200 °C?

[1 mark]

Tick (✓) **one** box.

Solid ☐ Liquid ☐ Gas ☐

0 4 . 7 What is the state of matter of nitrogen when the temperature is lower than the melting point of nitrogen?

[1 mark]

Tick (✓) **one** box.

Solid ☐ Liquid ☐ Gas ☐

0 4 . 8 As a substance melts, the temperature of the substance is constant.

What happens to the kinetic energy **and** the potential energy of the particles as the substance melts?

[2 marks]

Tick (✓) **one** box in each row.

	Decreases	Stays the same	Increases
Kinetic energy of particles			
Potential energy of particles			

10

4.1.1.2 Changes in energy

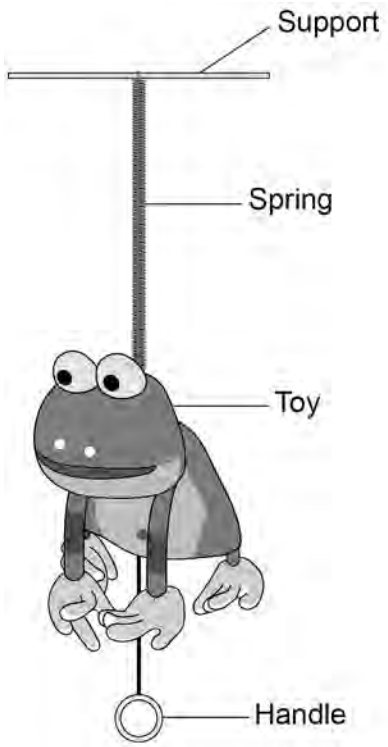
Question 47

June 2025 | 8463/1F | Original Q6

0 6 **Figure 10** shows a toy which is hung from a support.

When the handle is pulled down and then released, the toy bounces up and down.

Figure 10



0 6 . 1 When the handle is pulled down, the spring extends.

The extension of the spring is 0.35 m.

The spring constant of the spring is 5.6 N/m.

Calculate the elastic potential energy stored by the stretched spring.

Use the equation:

elastic potential energy = 0.5 × spring constant × (extension)^2

[2 marks]

Elastic potential energy = _____ J

Question 47 · continued

June 2025 | 8463/1F | Original Q6

Use the Physics Equations Sheet to answer questions **06.2** and **06.3**.

0 6 . 2 Which equation links gravitational field strength (g), gravitational potential energy (E_p), height (h) and mass (m)?

[1 mark]

Tick (✓) **one** box.

$E_p = \frac{mg}{h}$ ☐

$E_p = \frac{m}{gh}$ ☐

$E_p = mgh$ ☐

0 6 . 3 When the handle is released, the toy moves upwards through a height of 0.60 m.

The toy has 0.294 J of gravitational potential energy in its highest position.

gravitational field strength = 9.8 N/kg

Calculate the mass of the toy.

[3 marks]

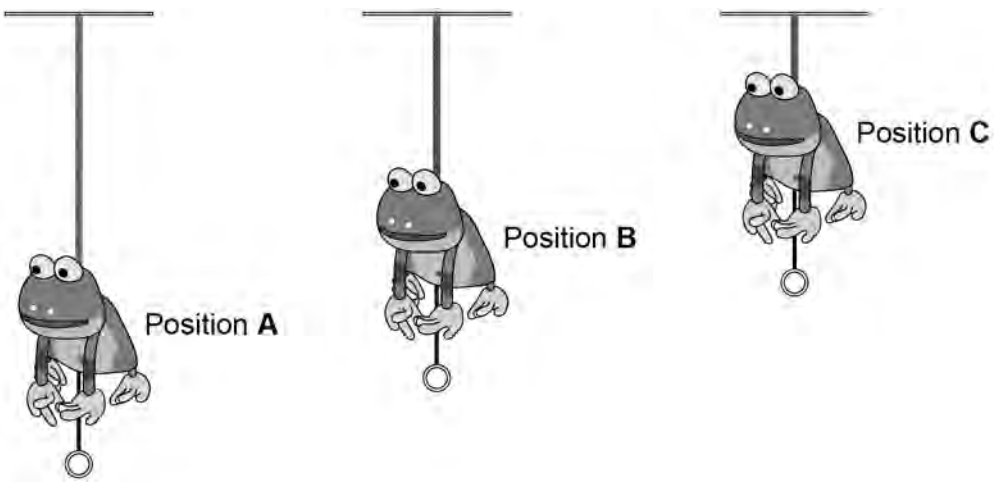
Mass of the toy = _____ kg

Question 6 continues on the next page

Question 47 · continued

Figure 11 shows the toy in three different positions.

Figure 11



The toy is released from position **A** and moves upwards.

The toy is moving upwards in position **B**.

The toy is at maximum height in position **C**.

0 6 . 4 Between position **A** and position **B**, the extension of the spring decreases.

How does the elastic potential energy stored by the spring change as the extension decreases?

[1 mark]

Tick (✓) **one** box.

Elastic potential energy decreases. ☐

Elastic potential energy stays the same. ☐

Elastic potential energy increases. ☐

4.1.1.2 Changes in energy

Question 47 · continued

0 6 . 5 Between position **B** and position **C**, the toy slows down.

How does the kinetic energy of the toy change as the toy slows down?

[1 mark]

Tick (✓) **one** box.

- Kinetic energy decreases. ☐
- Kinetic energy stays the same. ☐
- Kinetic energy increases. ☐

0 6 . 6 How does the gravitational potential energy of the toy change as the toy moves from position **B** to position **C**?

[1 mark]

Tick (✓) **one** box.

- Gravitational potential energy decreases. ☐
- Gravitational potential energy stays the same. ☐
- Gravitational potential energy increases. ☐

Question 6 continues on the next page

4.1.1.2 Changes in energy

Question 47 · continued

0 6 . 7 The toy moves up and down many times before eventually stopping.

Which **two** of the following are reasons why the toy eventually stops?

[2 marks]

Tick (✓) **two** boxes.

- Air resistance opposes the motion of the toy. ☐
- Energy is destroyed. ☐
- Energy is transferred to the surroundings. ☐
- The gravitational field strength decreases. ☐
- The spring loses its elasticity. ☐

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