OCR GCSE GATEWAY PHYSICS A · J249

# PHYSICS



## EXAM QUESTION PACK

### P7.1 WORK DONE

| SCORE | PERCENTAGE |
| --- | --- |
| /102 | % |

STEMUP

# These questions belong to OCR, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by OCR. They are past assessment materials, reproduced here so that students can revise from them.

## What we do not own

STEMUP is not affiliated with OCR and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. OCR has not endorsed, approved or been involved in the production of it. OCR and the qualification titles used here belong to their respective owners and appear for identification only.

## Where to find the originals

OCR publishes its past papers, mark schemes and examiner reports. Always check the current specification at ocr.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

# Gateway Physics A (9-1)

## Work done

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

**OCR supplied materials:**
Additional resources may be supplied with this paper.

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

**Duration:** Not set

| Candidate forename | | Candidate surname | |
|---|---|---|---|

| Centre number | | | | | | Candidate number | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

## INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

## INFORMATION FOR CANDIDATES

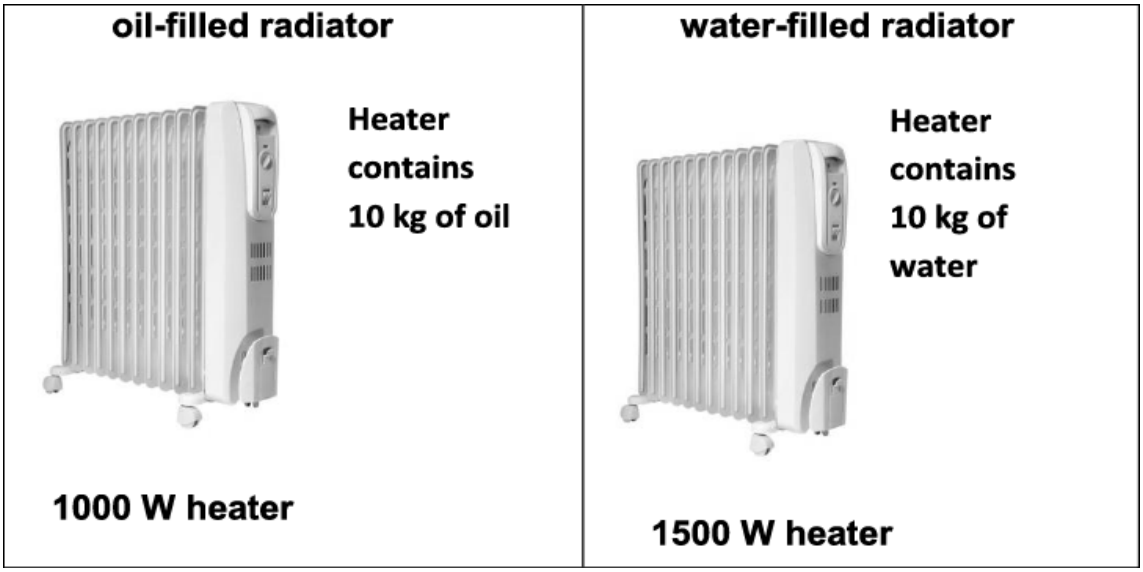
- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **102**.
- The total number of marks may take into account some 'either/or' question choices.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

1(a) Alex has two radiators in her home. They are filled with 10 kg of different liquids.




The table below shows information about oil and water.

| Material | Specific heat capacity (J/kg°C) | Freezing point (°C) | Boiling point (°C) |
|---|---|---|---|
| Oil | 1 700 | −24 | 250 |
| Water | 4 200 | 0 | 100 |

Alex's conservatory can be very cold.

Sometimes it can get as low as −6 °C.

Alex thinks that the oil radiator may be better for the conservatory.

Suggest why.

---

---

[1]

(b) Both radiators in a home have a 'cut-out' which prevents them getting hotter than 60 °C.

Suggest why.

---

---

[1]

(c) Alex does a calculation.

She knows that the oil heater produces 800 J of energy each second.

Calculate the energy produced by the oil heater in 10 minutes.

---

---

**answer:** _____ J [2]

(d)

(i) Alex wants the oil heater to heat up by 40°C.

How much energy is needed? Show your working.

---

---

---

**answer:** _____ J [2]

(ii) She supplies enough energy to heat up the oil radiator by 40°C but it only heats up to 32°C.

Suggest two reasons why.

---

---

---

[2]

2 Explain how energy is transferred and lost from a ball when it bounces.

---

---

---

[2]

3 A car on a roller coaster is stationary at the top of a slope.

It has a weight of 6 500 N and a potential energy of 217 000 J.

Calculate how high above the ground it is.

---

---

answer: _____ m

[2]

4 Josh says his ball is an amazing bouncer.

He says if you drop it from 200 cm it will bounce to a height of 250 cm.

Explain why this is not possible.

---

---

---

[2]

5 Alex has two radiators in her home. They are filled with 10 kg of different liquids.

The radiators have different power ratings.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

| oil-filled radiator | water-filled radiator |
| --- | --- |
|  Heater contains 10 kg of oil<br>400 W heater<br>Specific heat capacity for oil is 1680 J/kg$^0$C |  Heater contains 10 kg of water<br>1000 W heater<br>Specific heat capacity for water is 4200 J/kg$^0$C |

The heaters are turned on and the temperature of each rises by 40 °C in 1 680 seconds.

Use the data to show that the heaters take the same time to heat up.

---

---

---

---

---

---

[4]

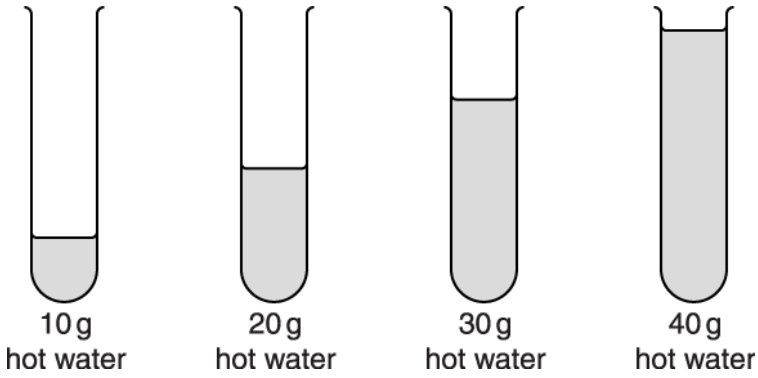
6(a) Susie does some experiments with heating and cooling water.

Susie pours hot water into 4 test tubes.
Look at the diagram.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

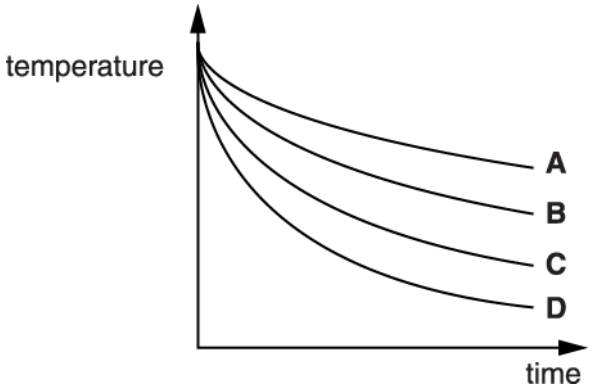
STEMUP.CO.UK




The water cools down.

Susie measures the temperatures of the water in each test tube as it cools.

Look at the graph of her results.




Which line shows the results for the test tube with 40 g of water?

Choose from **A**, **B**, **C** or **D**.

_____

Explain your answer.

_____

_____

_____ [2]

(b) Susie researches information about water and ice.

Table 1 shows the information she collects.

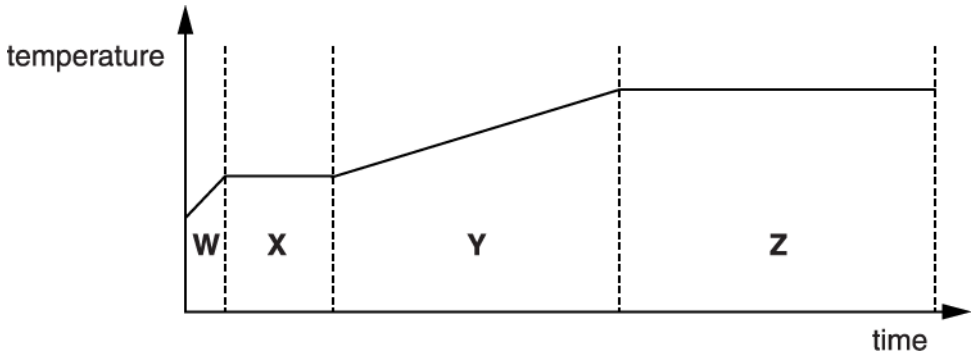
Table 1

| | Specific heat capacity in J/kg °C | Specific latent heat of fusion in kJ/kg | Specific latent heat of vaporisation in kJ/kg |
|---|---|---|---|
| Water | 4186 | 335 | 2272 |
| Ice | 2060 | 335 | – |

Susie heats a sample of ice.

She measures the temperature of the ice as it heats up and changes state.

Look at the simple graph of her results.




(i) Which section of the graph shows the temperature of **ice** rising?

Choose from **W**, **X**, **Y** and **Z**.

---

[1]

(ii) Which section of the graph shows the **water** boiling?

Choose from **W**, **X**, **Y** and **Z**.

---

[1]

(iii) Section **W** is **steeper** than section **Y**.

Use the information in Table 1 and the graph to explain why.

---

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

---

---

[2]

(iv) Suggest why section **Z** takes a **longer** time than section **X**.

Use the information in Table 1 and the graph to explain your answer.

---

---

---

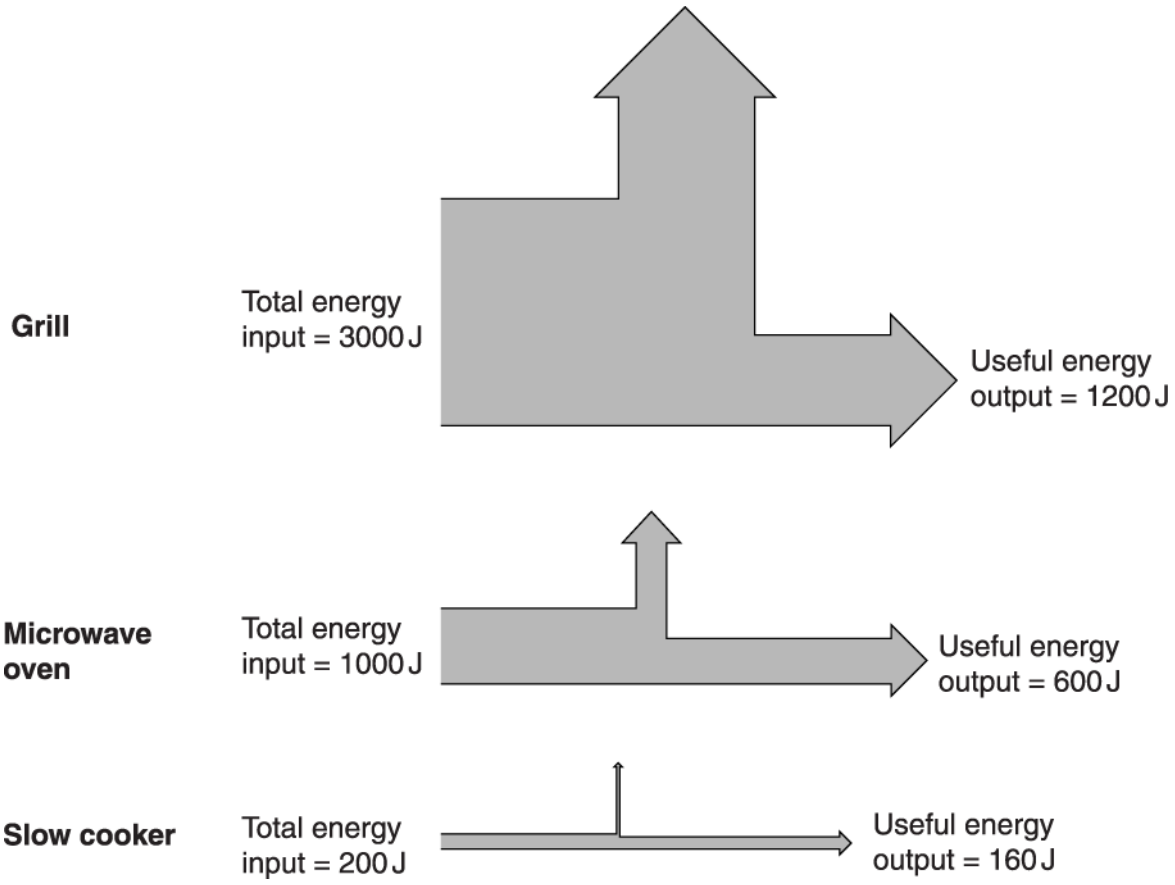
---

[2]

7(a) Radhika has many appliances in her kitchen.

She compares the efficiency of the appliances by looking at these Sankey diagrams.

Each diagram shows the energy transferred in 1 second.




Look at the Sankey diagram for the grill.

Calculate the wasted energy for the grill.

Answer _____ J

[1]

(b) Calculate the efficiency of the microwave oven.

Answer _____

[2]

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

(c) The slow cooker takes the **longest time** to cook food.

However, it is the **most efficient.**

Use the data to explain both these statements.

---

---

---

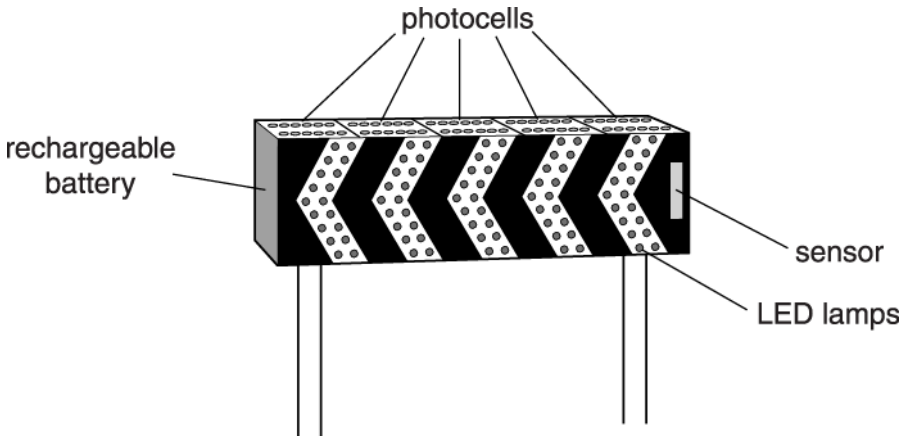
---

---

**[3]**

8(a) Photocells can be used to supply electricity for road signs.

Look at the diagram of a road sign below.




This road sign is in the countryside. It is not connected to mains electricity.

When the sensor detects a car approaching, the LEDs in the road sign light up and flash.

The photocells are essential to make the road sign work.

What do the photocells do during daylight?

---

---

---

**[2]**

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

(b) Describe how the LED lamps are powered at night time.

---

---

---[2]

(c) Write down an advantage of using photocells to power the road sign.

---

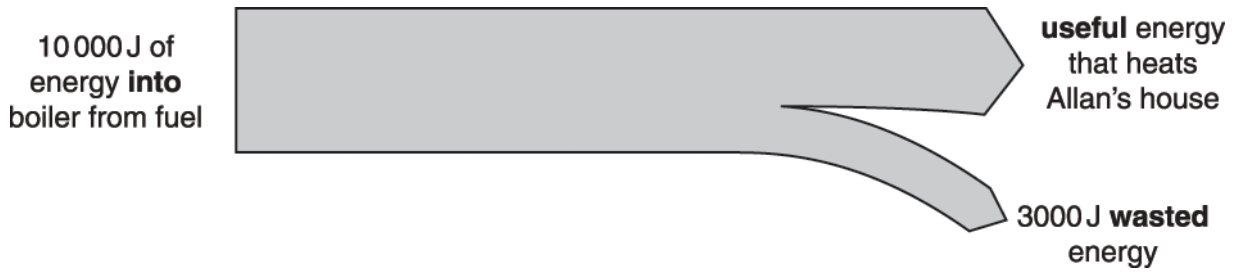
---[1]



STEMUP.CO.UK

9 An energy adviser suggests that Allan replaces his old central heating boiler.

The Sankey diagram shows energy data for Allan's boiler.




(i) Calculate the efficiency of Allan's boiler.

Give your answer as a percentage.

efficiency _____ %

**[3]**

(ii) Allan thinks that some of the energy completely disappears.

How could the adviser use the Sankey diagram to explain that this was **not** scientifically correct?

**[1]**

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

10(a) Tarak has a café.

He uses five appliances in his café.

He writes down the power of each appliance and the time it is used each day.

Look at the table.

| Appliance | Power in kilowatts | Time used each day in hours |
|---|---|---|
| toaster | 2.0 | 4.0 |
| kettle | 3.0 | 2.5 |
| microwave | 1.0 | 3.0 |
| fridge | 0.3 | 8.0 |
| freezer | 0.5 | 12.0 |

Which appliance costs Tarak the **most** to use each day?

---

---

[1]

(b) Which appliance costs Tarak the **least** to use each day?

---

---

[1]

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

11 A pump lifts 500 kg of water to a water tank at the top of a building.

The water gains 240 000 J of gravitational potential energy.

The gravitational field strength is 10 N/kg.

Use the equation: Potential energy = Mass × Height × Gravitational field strength

Calculate the height of the water tank.

**A** 4.8 m

**B** 48 m

**C** 240 m

**D** 480 m

Your answer ☐ **[1]**

12 A scientist uses different drivers to test the stopping distances of the same car.

Look at the results.

| Driver | Speed (m/s) | Thinking distance (m) | Braking distance (m) |
|---|---|---|---|
| A | 8 | 6 | 6 |
| B | 16 | 13 | 24 |
| C | 32 | 24 | 96 |
| D | 16 | 12 | 22 |
| E | 8 | 5 | 6 |
| F | 32 | 30 | 120 |

Driver **C** travels at 32 m/s on the road and then stops. The car has a mass of 1200 kg.

(i) Show that the **kinetic energy** stored by the car at 32 m/s is 614 000 J.

**[3]**

(ii) Describe what happens to the kinetic energy of the car as it brakes and stops.

---

---

---

---

[2]

(iii) The braking distance of the car is 96 m.

Calculate the **braking force** on the car.

Give your answer to **4** significant figures.

Answer = ---------- N [3]

13 A student wants to find out which heater produces the largest temperature rise.

Look at the results she collects and the calculations she makes.

| Heater | Starting temperature (°C) | Finishing temperature (°C) | Change in temperature (°C) |
|---|---|---|---|
| A | 18 | 28 | 20 |
| B | 18 | 36 | 16 |
| C | 18 | 44 | 26 |
| D | 18 | 51 | 23 |

Which heater has results that are correctly calculated?

Your answer ☐ [1]

14 A wooden block has a mass of 2 kg and a specific heat capacity of 2000 J/kg °C.

Calculate the energy needed to raise its temperature by 6 °C.

Use the equation:

Change in thermal energy = Mass × Specific Heat Capacity × Change in Temperature

**A** 1 200 J

**B** 2 400 J

**C** 12 000 J

**D** 24 000 J

Your answer ☐ [1]

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

15 A lorry has a mass of 3500 kg. It travels at a speed of 30 m/s.

Use the equation: Kinetic Energy = 0.5 × Mass × Speed$^2$

Calculate the kinetic energy of this lorry.

**A** 10 500 J

**B** 52 500 J

**C** 1 575 000 J

**D** 3 150 000 J

Your answer ☐ **[1]**

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

16 **Fig. 20.1** shows thinking, braking and stopping distances for the same car travelling at different speeds.

| Speed (m/s) | Thinking distance (m) | Braking distance (m) | Stopping distance (m) |
|---|---|---|---|
| 8 | 6 | 6 | 12 |
| 16 | 12 | 24 | 36 |
| 32 | 24 | 96 | 120 |

Fig. 20.1

* Explain why the stopping distances are different for each speed in **Fig. 20.1.**

------------------------------------------------------------------------

------------------------------------------------------------------------

------------------------------------------------------------------------

------------------------------------------------------------------------

------------------------------------------------------------------------

------------------------------------------------------------------------

------------------------------------------------------------------------

------------------------------------------------------------------------

------------------------------------------------------------------------

------------------------------------------------------------------------

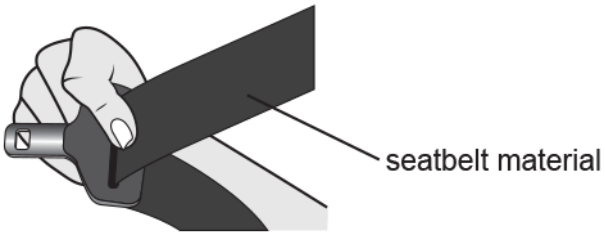
------------------------------------------------------------------------

------------------------------------------------------------------- [6]

© OCR 2022. You may photocopy this page.

17

Seatbelts in cars are made of a wide material that stretches in a crash.




(i) Explain why it is important that the material is **wide.**

---

---

[1]

(ii) Explain why it is important that the material is **stretchy.**

---

---

[1]

18 A car has a mass of 1000 kg and a kinetic energy of 12 500 J.

Calculate its speed.

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

**A** 3.5 m / s

**B** 5.0 m / s

**C** 6.3 m / s

**D** 25.0 m / s

Your answer ☐ [1]

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

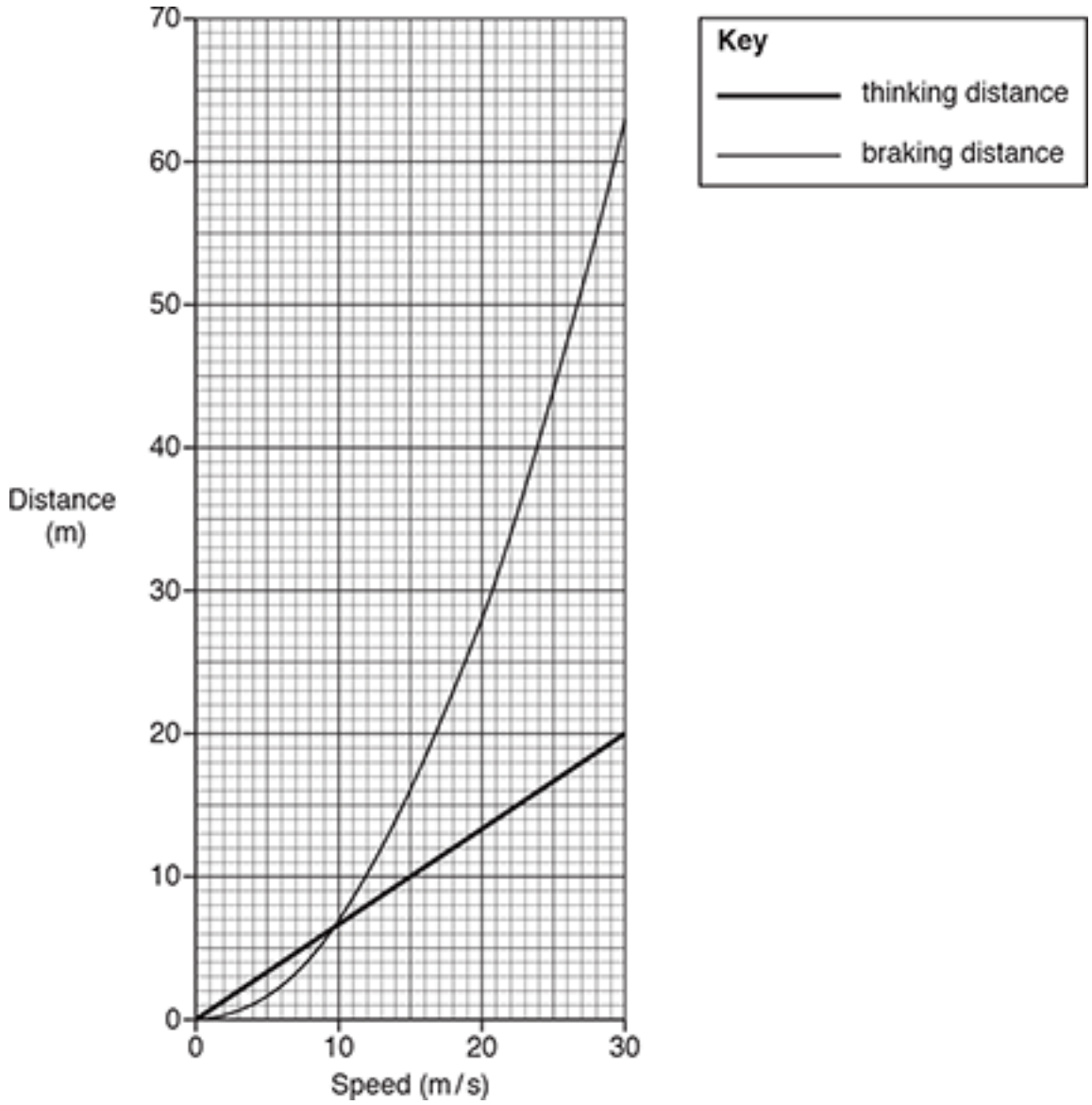
STEMUP.CO.UK

19 A TV has a power rating of 0.2 kW.

Calculate the energy transferred, in kWh, if the TV is switched on for 4 hours.

Energy transferred = ..... kWh **[3]**

20 The graph shows thinking and braking distances for a car at different speeds.






STEMUP.CO.UK

How does the speed affect the **kinetic energy** and **braking distance** of the car?

Use the graph in your answer.

---

---

---

---

---

[3]

21 In the brakes of a car there are brake pads and a brake disc, as shown in **Fig. 21.2**.

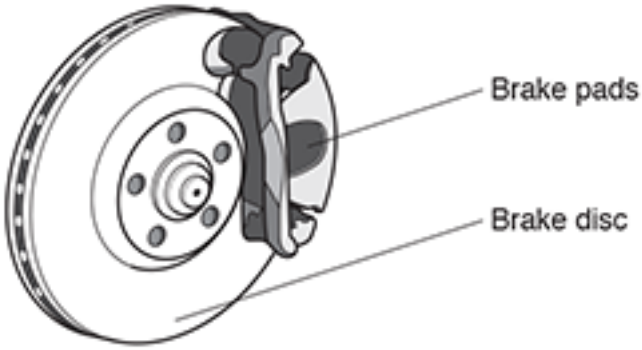



Fig. 21.2

When a car stops, energy transfers between stores.

The brake pads squeeze the brake disc and cause a friction force.

(i) Explain how braking stops the car.

Include ideas about **energy stores** in your answer.

---

---

---

[2]

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

(ii) High speed cars have ventilated brakes with air holes in the disc, as shown in **Fig. 21.3.**

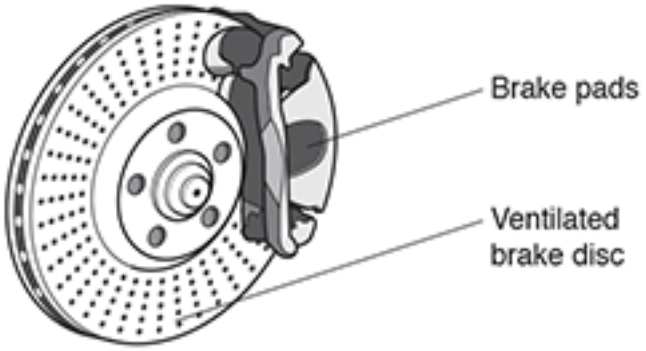



**Fig. 21.3**

The air holes allow more air to circulate around the disc.

Suggest how these brakes can reduce braking distances.

---

---

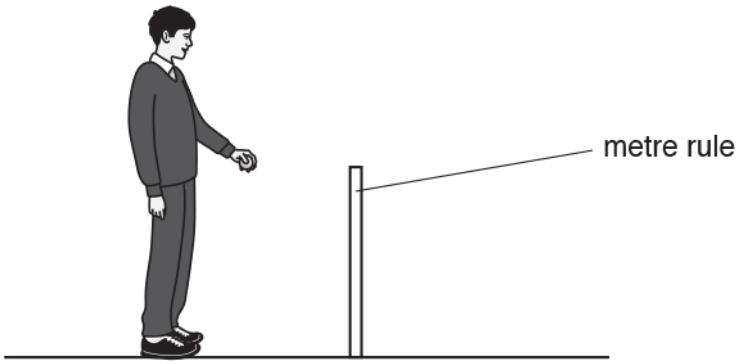
**[1]**



STEMUP.CO.UK

22(a) A student wants to investigate how a ball bounces.

He drops the ball from different heights and measures the bounce height each time.




He calculates the ratio bounce height / drop height.

The table shows his results.

| Drop height (cm) | Bounce height (cm) | Bounce height / drop height |
|---|---|---|
| 100 | 70 | 0.70 |
| 80 | 64 | 0.80 |
| 60 | 54 | 0.90 |
| 40 | 40 | 1.00 |
| 20 | | |

The student predicts the ratio bounce height / drop height to be 1:1 when the drop height is 20 cm.

(i) Suggest why he has made this prediction.

---

---

**[1]**

(ii) Use ideas about energy to explain why this prediction cannot be correct.

---

---

**[1]**

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

(b) Suggest **two** improvements to his experiment.

1 ----------

---

---

2 ----------

---

---

**[2]**

(c) The mass of the ball is 60 grams.

(i) Calculate the mass of the ball in kg.

Mass = ..... kg **[1]**

(ii) Calculate the potential energy of the ball when it is 0.80 m above the ground.

Use your answer to **(i)** and the equation:
potential energy = mass × height × gravitational field strength

Gravitational field strength = 10 N / kg

Potential energy = ..... J **[2]**

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

23 *A student does an experiment using 0.2 kg of water.

Here is some information from the experiment:

| |
|---|
| The aim is to find the energy needed to raise the temperature of the water by 20 °C.<br><br>An electrical heater is used to heat the water. The temperature of the water increases by 20 °C.<br><br>The **specific heat capacity** of water is 4 200 J / kg °C. |

Describe how the student should carry out the experiment, including the equipment used.

In your answer calculate the change in internal energy for the water.

You may include a diagram in your answer.

[6]

24(a) A TV has a power rating of 0.2 kW.

Calculate the energy transferred, in kWh, if the TV is switched on for 4 hours.

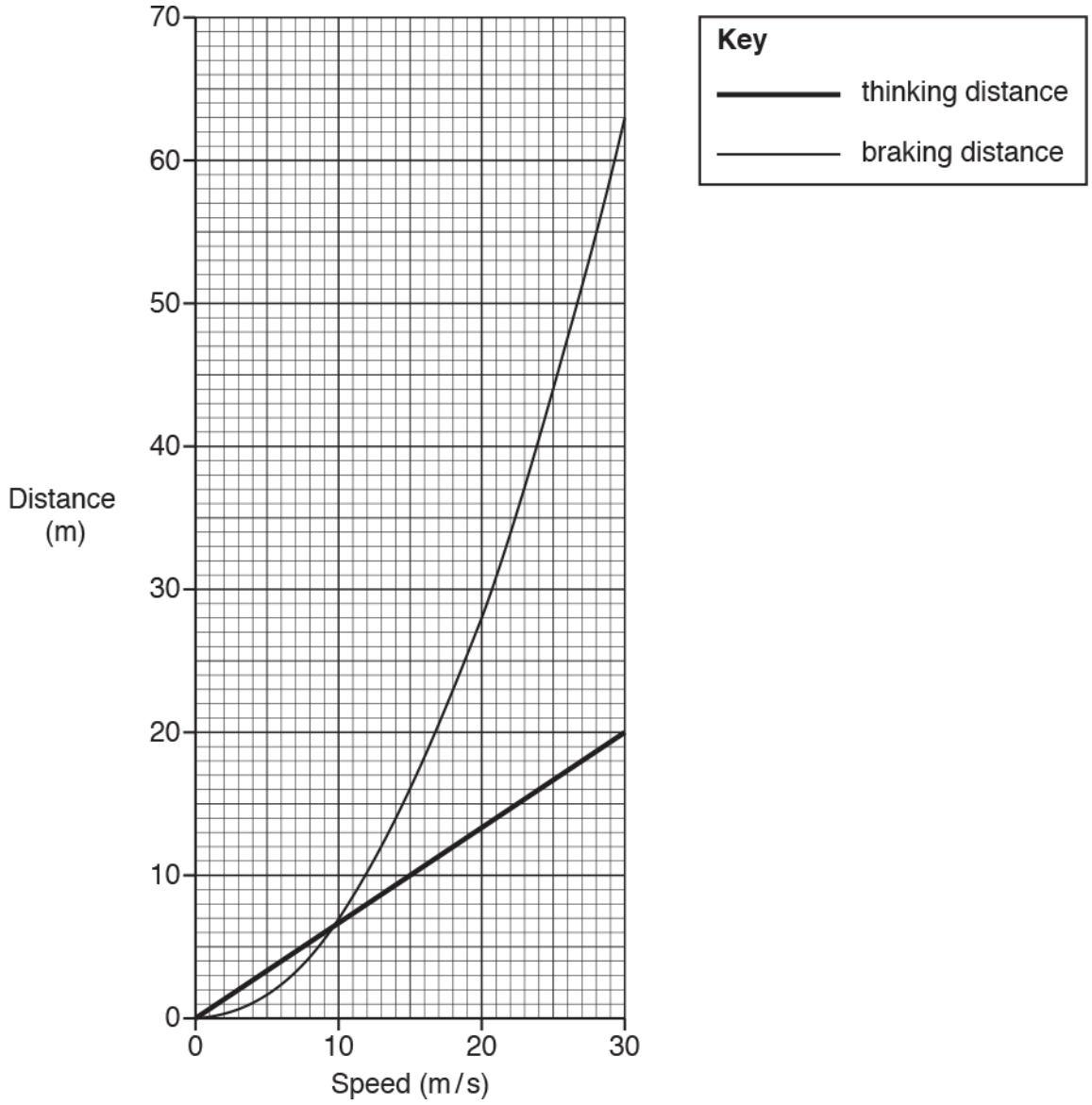
Energy transferred =..... kWh **[3]**

(b) A different TV works with a 12.0 V battery. It has a current of 3.19 A.

Calculate the power rating of the TV.

Power = ..... W **[3]**

25 The graph shows thinking and braking distances for a car at different speeds.




How does the speed affect the **kinetic energy** and **braking distance** of the car?

Use the graph in your answer.

---

---

---

---

---

**[3]**

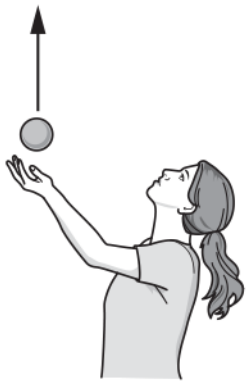
26 A motor has an input energy of 800 J. The useful output energy is 500 J.

What is the wasted energy?

**A** 300 J
**B** 500 J
**C** 800 J
**D** 1300 J

Your answer ☐ **[1]**

27 A ball is thrown vertically into the air.



Energy is transferred from a chemical store.

Where is the useful energy transferred to?

**A** A gravitational store and a thermal store only.
**B** A gravitational store only.
**C** A gravitational store and a chemical store only.
**D** A thermal store and a chemical store only.

Your answer ☐ **[1]**

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

28

This question is about an electric kettle.

(i) An electric kettle is filled with water, connected to the mains and switched on. The electricity for the kettle is generated in a coal-fired power station. Describe the energy transfer that occurs when the kettle is switched on. Include ideas about energy stores in your answer.

---

---

---

**[2]**

(ii) The mains supply has a potential difference of 230 V.

The kettle has a current of 5.0 A. The kettle is switched on for 2.0 minutes.

Calculate the total energy transferred to the kettle in 2.0 minutes.

Total energy transferred = ..... J **[4]**

## END OF QUESTION PAPER

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK