OCR GCSE GATEWAY PHYSICS A · J249

PHYSICS



EXAM QUESTION PACK

WS1.3 ANALYSIS AND EVALUATION

SCORE	PERCENTAGE
/269	%

STEMUP

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Gateway Physics A (9-1)

Analysis and evaluation

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 **269**.
- The total number of marks may take into account some 'either/or' question choices.

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1(a) John wants to buy a new car.

He researches the performance of new cars.

Look at the table.

Car	Fuel used	Number of seats	Fuel consumption in km / litre	Carbon emissions in grams / km
A	petrol	2	4.1	150
B	petrol	4	4.0	172
C	petrol	5	3.6	177
D	diesel	5	5.2	129
E	diesel	7	4.1	149

Describe the trends and patterns in the data.

--- [2]

(b) John wants to buy a car that is cheap to run.

Suggest and explain which car John should buy.

--- [2]

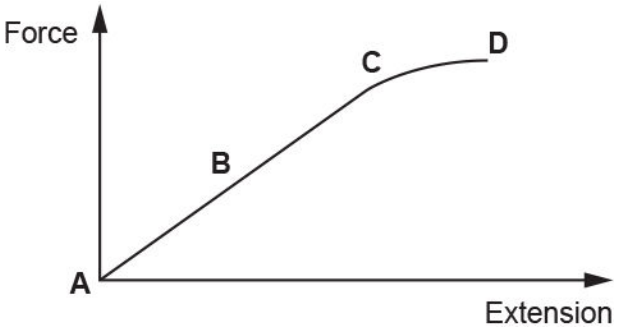
(c) People use data provided by car manufacturers to make decisions on which car to buy.

Why is it important that this data is accurate and independently checked?

---

[2]

2 The diagram shows the relationship between force and extension for a spring.



Which letter on the graph shows the **elastic limit** of the spring being stretched?

Your answer ☐ [1]

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3 An object travelled 800 m in 40 seconds.

Use the equation: distance travelled (m) = speed (m/s) × time (s)

What is the speed of the object?

A 0.05 m/s

B 20 m/s

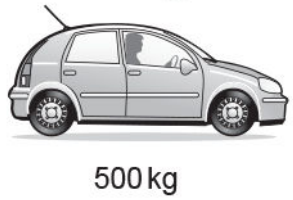
C 840 m/s

D 32 000 m/s

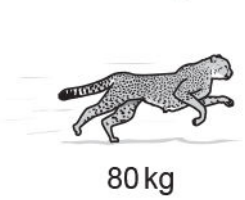
Your answer ☐ [1]

4 Which of the following has the **most** kinetic energy?

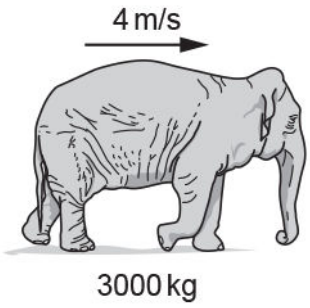
A



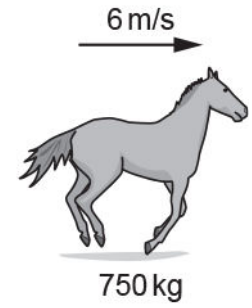
B



C



D



Your answer ☐ [1]

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5 * Four students run in different races.

Student	Race distance (m)	Time (s)
A	50	6
B	100	15
C	100	14
D	200	31

Use the information in the table to **describe** and **compare** the motion of the four students.

Use the data in your answer.

[6]

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6(a) A book rests on a table.

Draw a free body force diagram to show the forces acting on the book.

Use arrows to represent the forces.

[4]

(b) A teacher uses an air-track for motion experiments. Using the air-track means that there is no friction between the glider and the air-track.

The teacher places the glider on the horizontal air-track and gives it a small push to start it moving.

Explain the motion of the glider.

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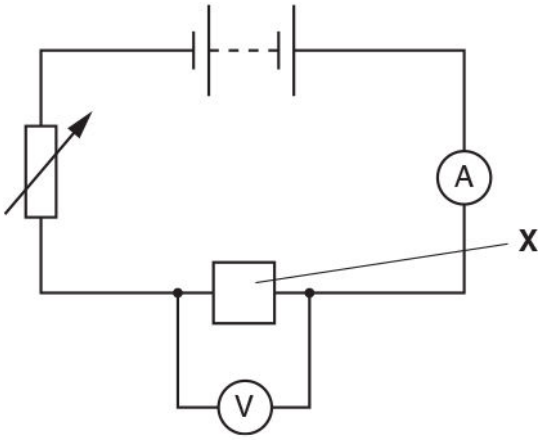
[2]

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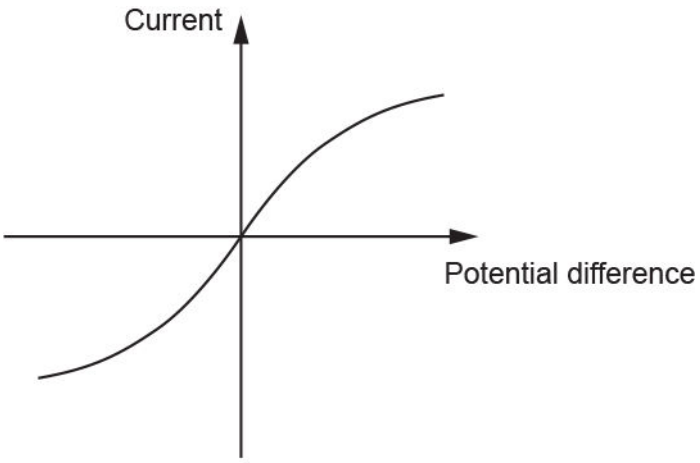
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7 A student builds a circuit to investigate the resistance of component **X**.



The student uses the circuit to take current and potential difference readings.

The student plots a graph of her results.



(i) Look at the graph.

What is component **X** in the circuit?

---

[1]

(ii) The resistance of component **X** varies as the potential difference changes.

Describe **how** the graph shows this and explain **why** this happens.

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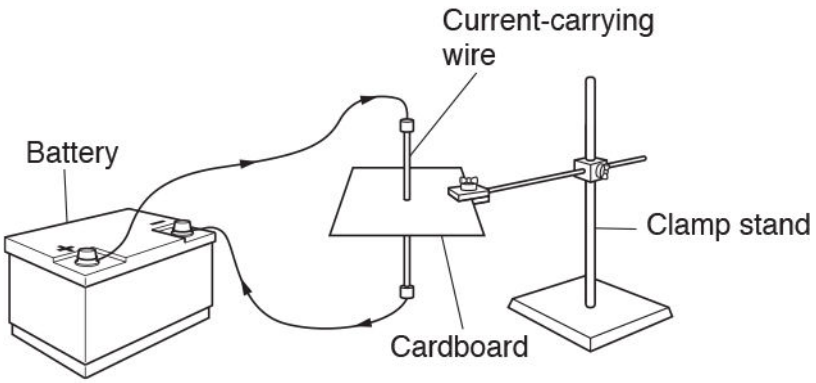
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[3]

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8 A student sets up an experiment to investigate the magnetic field around a current-carrying wire.



(i) Describe how the student could use this experiment and a compass to investigate the magnetic field produced by the wire.

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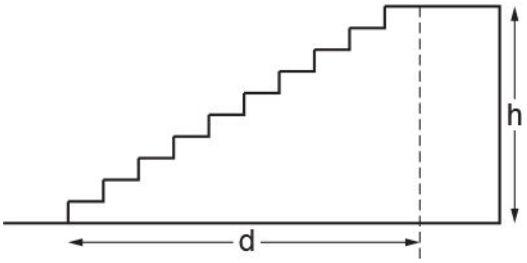
[3]

(ii) Draw the shape of the field which would be found around this wire.

[2]

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9 A student of weight W runs up a flight of stairs.



She moves a distance d metres horizontally and h metres vertically.

What is the work done against gravity running up the stairs?

A W × d

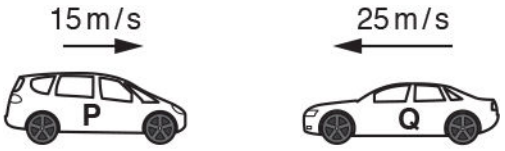
B W × h

C (W × d) + (W × h)

D $W \times \frac{h}{d}$

Your answer ☐ **[1]**

10 Two cars head towards each other on a road.



What velocity does the driver of car **Q** see car **P** travelling towards him at?

A 10 m/s

B 15 m/s

C 25 m/s

D 40 m/s

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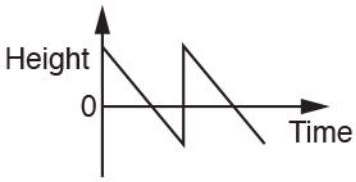
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Your answer  [1]

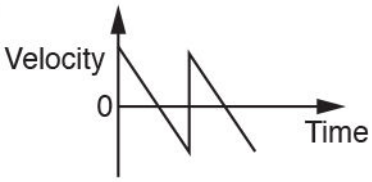
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11 Which graph shows a bouncing ball?

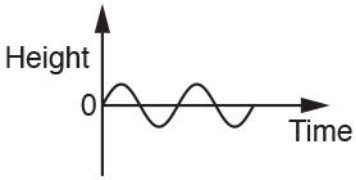
A



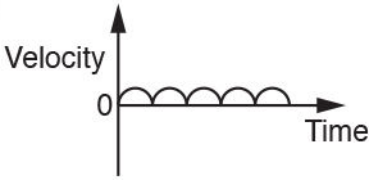
B



C



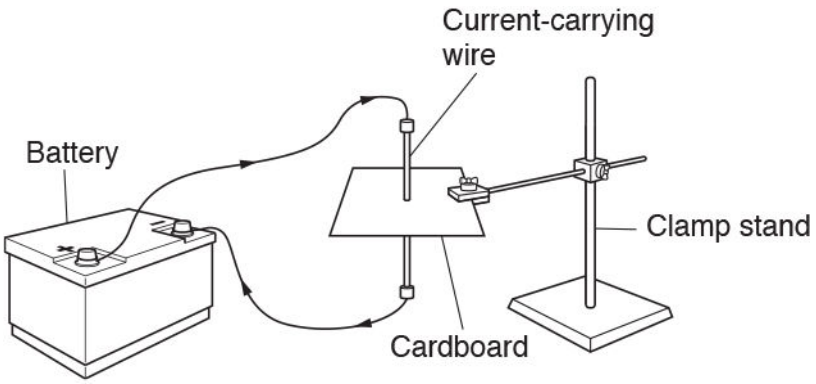
D



Your answer ☐ **[1]**

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12 A student sets up an experiment to investigate the magnetic field around a current-carrying wire.



(i) Describe how the student could use this experiment and a compass to investigate the magnetic field produced by the wire.

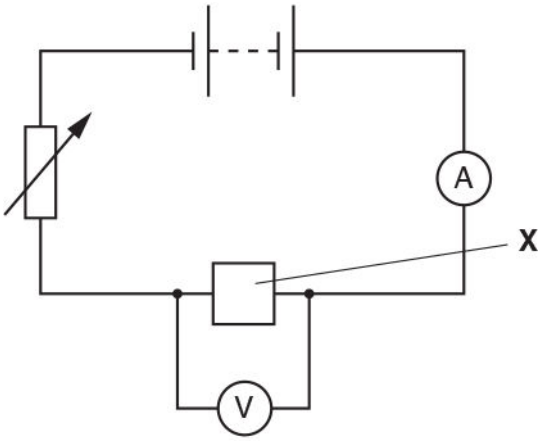
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[3]

(ii) Draw the shape of the field which would be found around this wire.

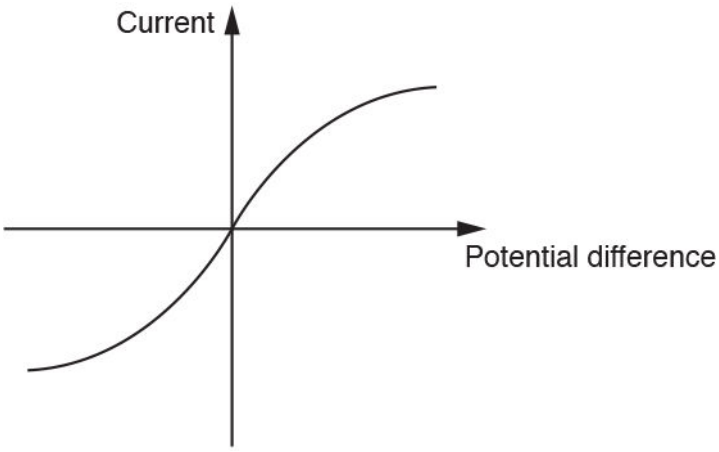
[2]

13 A student builds a circuit to investigate the resistance of component **X**.



The student uses the circuit to take current and potential difference readings.

The student plots a graph of her results.



(i) Look at the graph. What is component **X** in the circuit?

---

[1]

(ii) The resistance of component **X** varies as the potential difference changes.

Describe how the graph shows this and explain why this happens.

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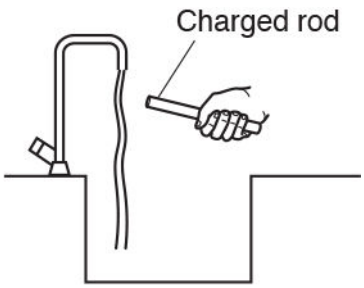
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[3]

14 This question is about electrostatic charges.

A charged rod is brought towards a gentle stream of water from a tap.



Explain how the charged rod affects the stream of water.

---

[3]

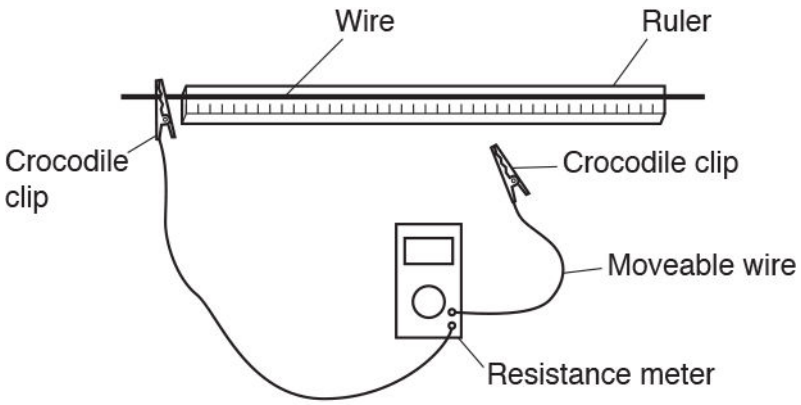
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15(a) Two students investigate the resistance of a wire.

They tape a length of wire to a metre ruler and connect it to a resistance meter using crocodile clips.



Look at their results.

Length of wire (cm)	Resistance (Ω)			
	Attempt 1	Attempt 2	Attempt 3	Mean
25	8.8	8.3	8.5	8.533
50	16.2	16.1	16.4	16.4
75	23.5	23.8	18.7	23.7
100	30.8	31.1	31.0	31.0

(i) Describe the pattern shown by these results.

Use data in your answer.

--- [2]

(ii) The students made **two** mistakes when they recorded their results and completed the table.

Identify the mistakes **and** explain what they should have done.

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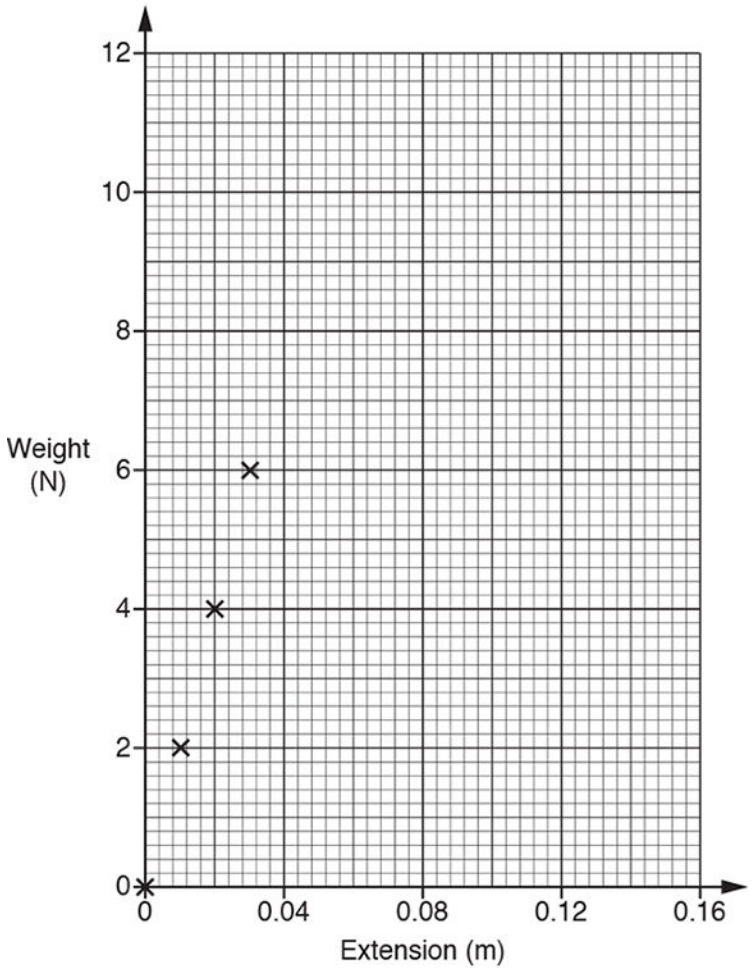
16(a) A student hangs a length of copper wire from the ceiling.

She adds weights to the bottom of the wire and measures the extension of the wire.

Look at a table of some of her results.

Weight (N)	Extension (m)
0	0
2	0.01
4	0.02
6	0.03
8	0.04
10	0.08
12	0.16

(i) Plot the values on the graph. Some have been done for you.



[2]

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(ii) Draw a line of best-fit on the graph.

[1]

(iii) Describe **and** explain the shape of the graph.

---

[3]

(b) Calculate the spring constant for the 0 – 6 N part of the graph.

Use the equation: Force = Spring constant × Extension

Answer = ... N/m **[3]**

(c) Calculate the work done in stretching the wire to 0.04 m.

Answer = ... J **[2]**

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17 A student wants to find out the depth of a well.

She thinks that she can calculate this by dropping a stone into the well and timing how long it takes to hear the stone splash at the bottom.

(i) Explain how she could use this measurement to find the depth of the well.

---

[3]

(ii) It takes 2.2 seconds for the stone to drop from rest and splash into the water at the bottom.

What is the speed of the stone when it hits the water?

Answer = ... m/s **[2]**

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18 A student measures the time it takes for the sound from a firework to reach the observer.

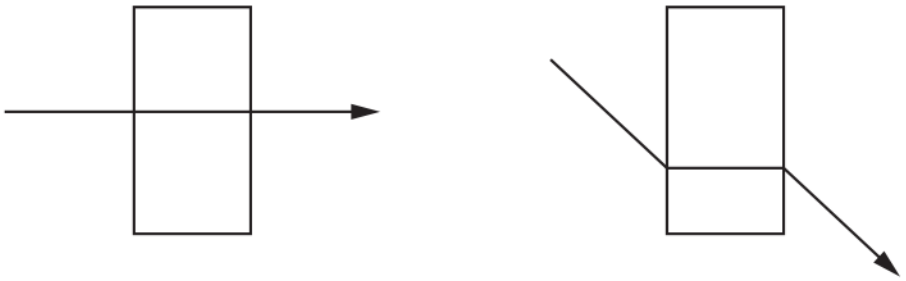
She takes 3 measurements of the time taken for four different distances, **A**, **B**, **C** and **D**.

Distance	Time taken (s)		
	1st measurement	2nd measurement	3rd measurement
A	2.16	2.19	2.17
B	1.99	2.02	1.97
C	1.80	1.81	1.89
D	1.69	1.68	1.71

Which distance **A**, **B**, **C** or **D**, has the largest range of values?

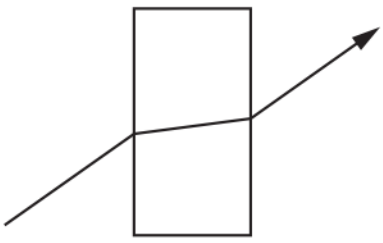
Your answer [1]

19 Look at the diagrams of a light ray as it passes from air through a glass block.

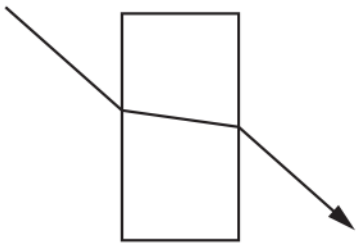


A

B



C



D

Which diagram shows an **incorrect** refraction?

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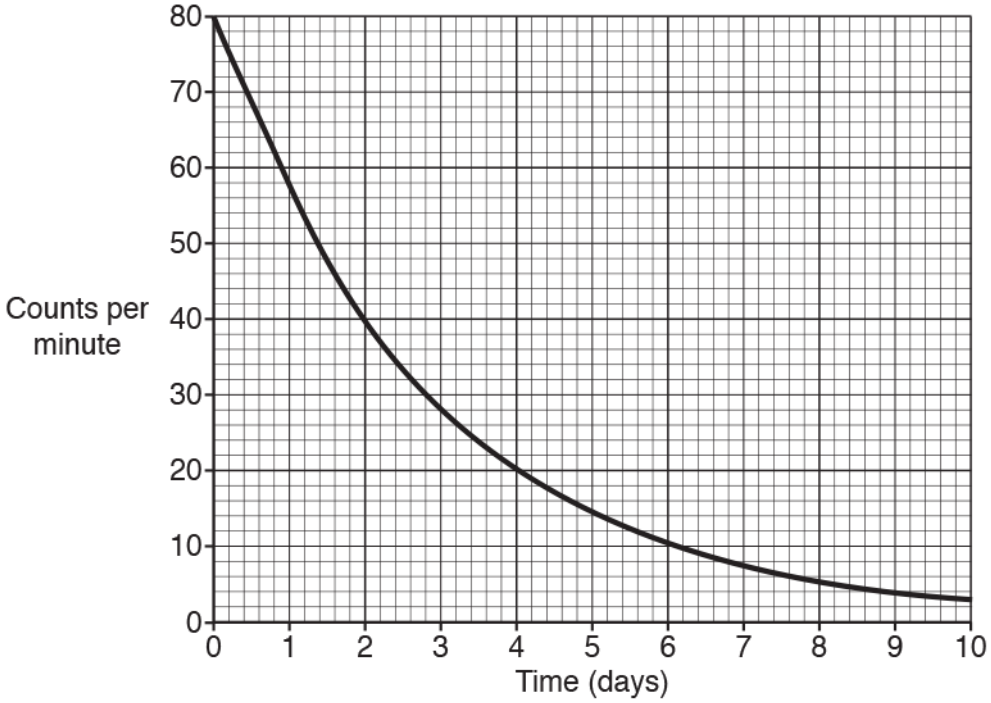
Your answer  [1]

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20 A teacher measures the radiation from a radioactive source for 10 days.



What is the half-life of this radioactive source?

A 1 day

B 2 days

C 4 days

D 5 days

Your answer [1]

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21 A student measures the time it takes for a bicycle to stop in an emergency.

She repeats the measurement to get three results.

The average time for her results is 2.72 s.

The first two results are 2.66 s and 2.60 s.

What is the value of her third result?

A 2.63 s

B 2.66 s

C 2.72 s

D 2.90 s

Your answer [1]

22 An artificial satellite is kept in its low polar orbit by a gravity force from a planet.

The satellite is moved to a higher orbit above the planet.

Which statement is correct about the satellite in this higher orbit?

A The force of gravity is greater and its speed decreases.

B The force of gravity is greater and its speed increases.

C The force of gravity is less and its speed decreases.

D The force of gravity is less and its speed increases.

Your answer [1]

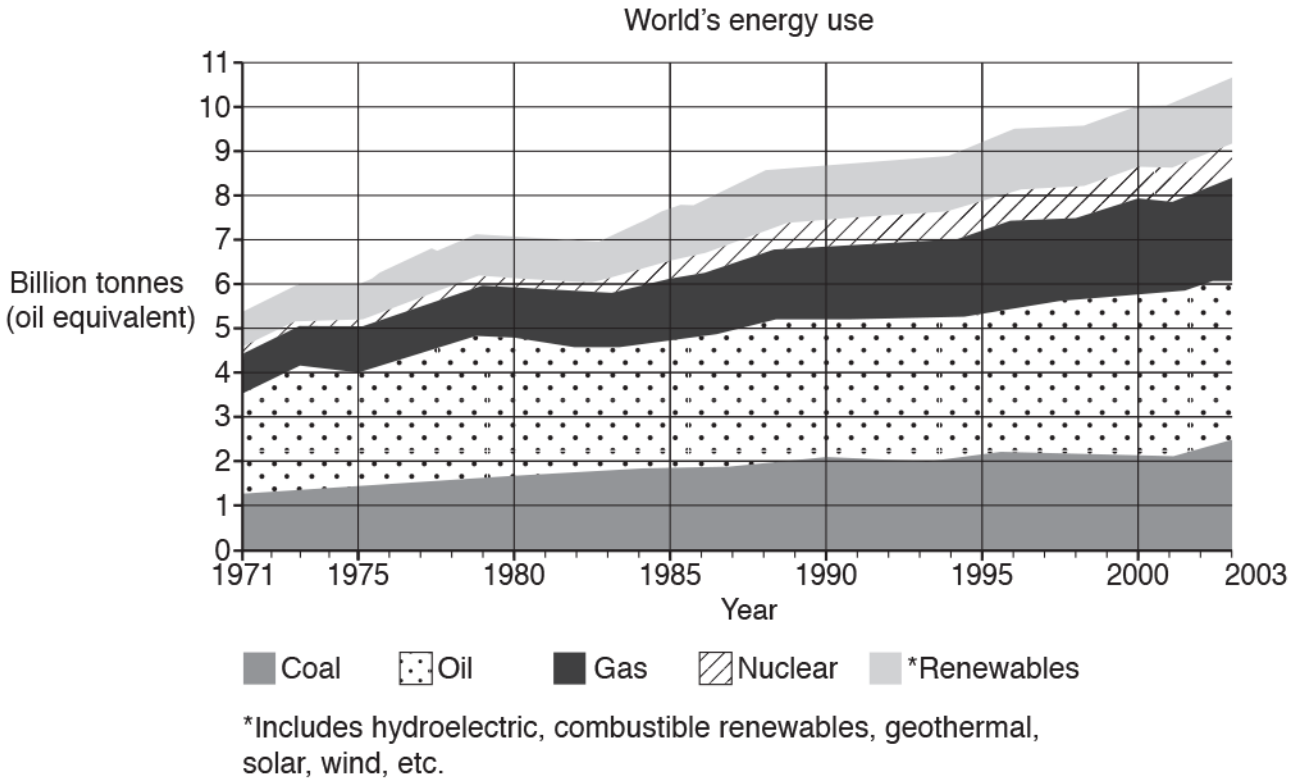
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23(a) The graph shows how the World's energy use has changed from the year 1971 to the year 2003.

It also shows the amount of different energy sources used.



(i) Approximately how much did the total World's energy use increase from the year 1971 to the year 2003?

Answer = ---------- billion tonnes (oil equivalent) **[1]**

(ii) Which energy source had the **greatest** use in the year 2003?

---------- **[1]**

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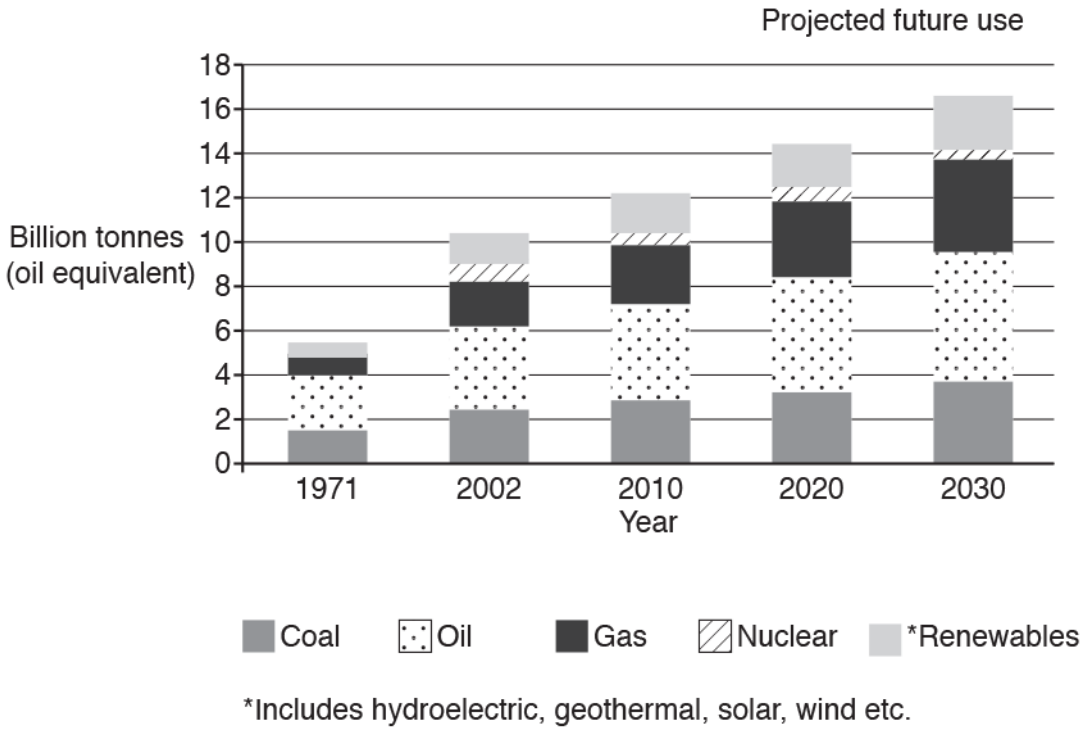
(iii) The total energy use in the year 2003 was 10.6 billion tonnes (oil equivalent).

Approximately what percentage of this amount was due to fossil fuel use?

Answer = ---------- % **[2]**

(b) Scientists are researching the World's energy use for the future.

The graph shows some of their research.



(i) The future demand for fossil fuels is expected to increase.

Give two reasons why scientists are worried about this increase in demand.

1 ----------

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2 ----------

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[2]

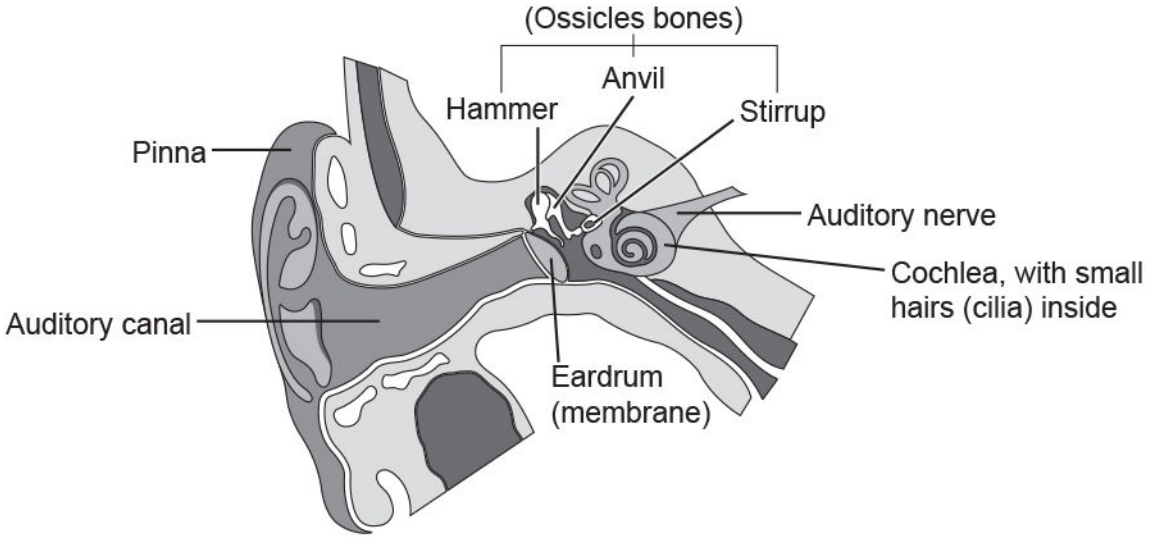
(ii) In the UK the government is closing coal fired power stations and planning for new nuclear power stations to be built.

Suggest why the government wants more nuclear power stations.

---

[2]

24 Look at the diagram of a human ear.



Sound wave disturbances, outside the ear, transfer energy to the small hairs (cilia) inside the cochlea.

The cochlea then sends nerve impulses along the auditory nerve to the brain.

Explain how sound wave disturbances in the air outside the ear transfer to the small hairs (cilia) inside the cochlea.

---

[3]

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25 Sun cream can be used to protect skin from ultra-violet waves. Sun creams have different sun protection factors (SPF).

Look at the information about a bottle of sun cream.

This sun cream has a SPF of 10. If used sensibly it can allow you up to 10 × longer in the Sun without increasing the risk from ultra-violet waves.

(i) A doctor says 'adults should not sunbathe for more than 20 minutes in the midday sunshine when **not** using sun cream'.

If an adult used sun cream with SPF 6, how long could they safely sunbathe for?

Answer = ---------- minutes **[1]**

(ii) The doctor says that children should always use at least SPF 50 sun cream.

Suggest reasons why.

---

[2]

26(a) Nuclear radiation, such as gamma, is used to irradiate some fresh food to increase its 'shelf-life' and make it last longer.

Fresh herbs and spices are dried and irradiated with gamma rays.

Explain the difference between nuclear **irradiation** and nuclear **contamination**.

---

[2]

(b) Explain how the gamma rays can increase the 'shelf-life' of herbs and spices to make them last longer.

---

[2]

(c) Some people are worried about eating irradiated food.

Write down two **concerns** they may have about irradiated food.

1. ---

---

2. ---

---

[2]

27(a) 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

Most of the drivers tested the car on a dry day, on a level road.

Which driver tested the car on an **icy** road?

Driver ..... tested the car on an **icy** road. **[1]**

(b) Which driver has the **quickest** reaction time?

Driver ..... has the **quickest** reaction time.

Calculate their reaction time.

Answer = ---------- s **[3]**

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(c) Give two drivers that have the **same** reaction time.

Drivers ..... have the **same** reaction time.

Explain your answer.

---

[2]

(d) Driver **B** travels at 16 m/s on the road. The thinking distance is 13 m and the braking distance is 24 m.

Driver **B** now drives the car **uphill** at the same speed on the same road.

How will driving the car **uphill** affect thinking, braking and stopping distances?

The reaction time will stay the same.

Complete the sentences.

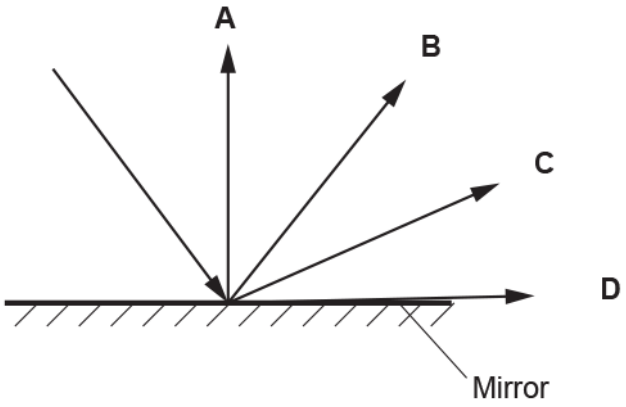
The **thinking distance** will ---

The **braking distance** will ---

The **stopping distance** will ---

[2]

28 Which light ray shows the correct reflection from the plane (flat) mirror?



Your answer ☐ [1]

29 A student experiments with a model parachute and collects some results.

She drops the parachute from a height of 4 m three times and takes three results of the time taken.

The three results are:

3.25 s
3.00 s
3.08 s

What is the mean of the three results?

A 3.00 s

B 3.08 s

C 3.11 s

D 3.25 s

Your answer ☐ [1]

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30 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]

31 A student measures the time it takes for the sound from a firework to reach the observer.

She takes 3 measurements of the time taken for four different distances, **A**, **B**, **C** and **D**.

Distance	Time taken (s)		
	1st measurement	2nd measurement	3rd measurement
A	2.16	2.19	2.17
B	1.99	2.02	1.97
C	1.80	1.81	1.89
B	1.69	1.68	1.71

Which distance **A**, **B**, **C** or **D**, has the largest range of values?

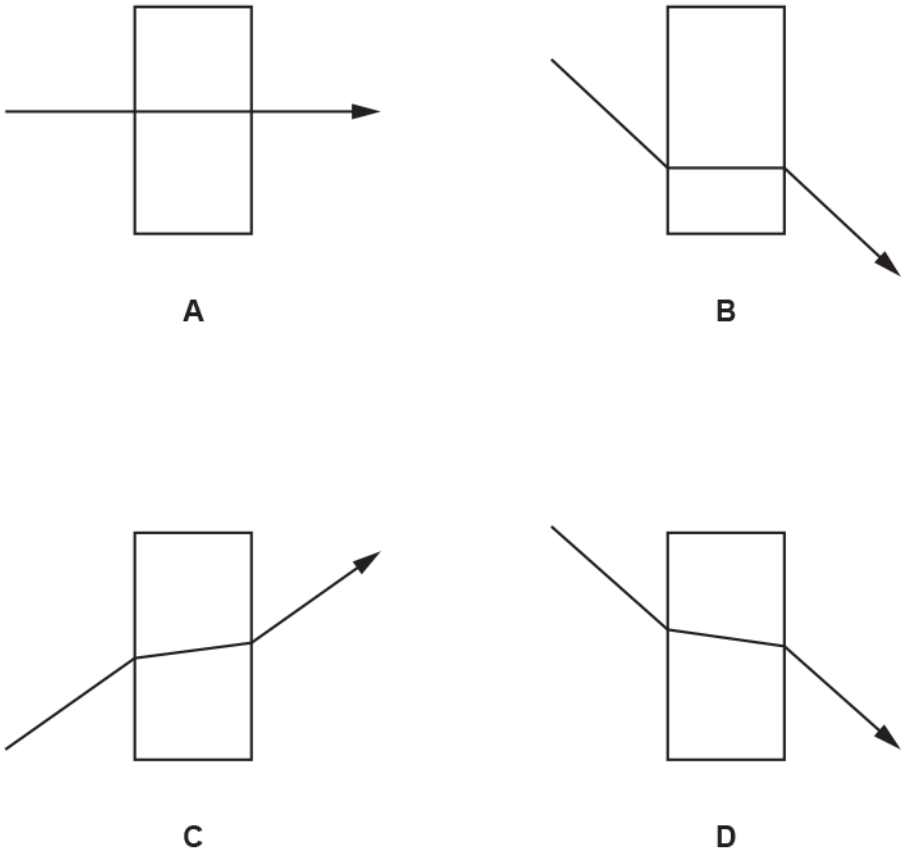
Your answer [1]

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32 Look at the diagrams of a light ray as it passes from air through a glass block.



Which diagram shows an **incorrect** refraction?

Your answer ☐ [1]

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33 A radio wave has a wavelength of 100 m. It has a speed of 3×10^8 m/s.

Use the equation: Wave speed = Frequency × Wavelength

Calculate the frequency of the wave.

A 3 MHz

B 30 MHz

C 300 MHz

D 3000 MHz

Your answer ☐ [1]

34 Look at the diagram of the electromagnetic spectrum.

Radio	Microwave	Infra-red	Visible light	Ultra-violet	X-rays	Gamma-rays

(i) Name a wave that has a longer wavelength than red light.

---

[1]

(ii) Name a wave that has a higher frequency than violet light.

---

[1]

(iii) State two **uses** of gamma-rays.

1. ---

2. ---

[2]

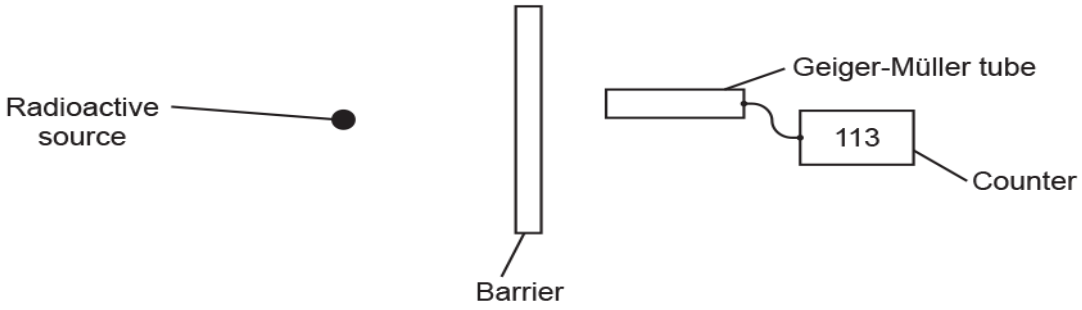
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35(a) A teacher demonstrates an experiment about radioactivity. He demonstrates how different types of radiation can be absorbed.

He puts different barriers between the source and the Geiger-Müller tube. He uses four different radioactive sources **A**, **B**, **C** and **D**.



The teacher chooses source **A** and uses the Geiger-Müller tube to measure the count rate (counts per minute) for different barriers. He repeats the experiment with source **B**, source **C** and then source **D**.

Look at his results.

Source	Count rate using different barriers			
	Paper	Aluminium	Lead	No barrier
A	113	112	22	112
B	20	21	20	182
C	162	23	21	164
D	282	78	24	280

He also finds that the **average count rate** with no sources and no barriers is 20.

(i) Which source **A**, **B**, **C** or **D** emits **gamma** radiation only?

Explain your answer.

Source ---------- because ----------

---

[2]

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(ii) Which source **A**, **B**, **C** or **D** emits **alpha** radiation only?

Explain your answer.

Source ---------- because ----------

---

[2]

(iii) Which source **A**, **B**, **C** or **D** could emit both **beta and gamma** radiation?

Explain your answer.

Source ---------- because ----------

---

[2]

(b) The teacher notices that the count rate behind the lead barrier ranges from 20 to 24.

Give **two** reasons why there are a wide range of results around 22 counts per minute.

1. ----------

---

2. ----------

---

[2]

(c) The teacher decides to repeat the experiment.

This time he records the number of counts for a much longer time interval for each source.

Explain why this is an improvement to the experiment.

---

[2]

36 Look at the information about different electric motors.

Electric motor	Energy input per hour (J)	Useful energy output per hour (J)	Energy 'wasted' per hour (J)
A	72 000	60 000	
B	54 000	36 000	
C	18 000		3 000
D		48 000	12 000
E	54 000	48 000	

(i) Calculate the energy input per hour in J for electric motor **D**.

Answer = ---------- J **[2]**

(ii) Which electric motor has the **lowest** 'wasted' energy in one hour?

---

[1]

(iii) Which electric motor has the **highest** 'wasted' energy in one hour?

---

[1]

(iv) Describe how energy is 'wasted' in an electric motor.

---

[1]

(v) Suggest how this 'wasted' energy can be reduced in an electric motor.

---

[1]

37(a) **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

Describe how the **thinking distance** changes when the speed doubles.

Use data from the table in your answer.

---

[1]

(b) Calculate the reaction time of the person driving the car.

Answer = _____ s **[3]**

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

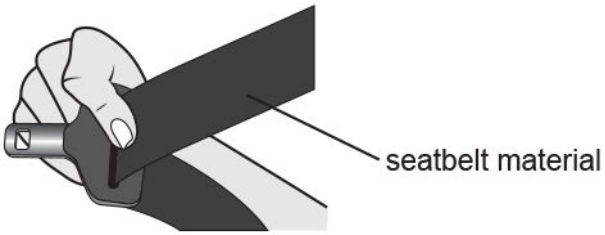
_____

_____

_____ **[6]**

38(a)

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]

(b) Children in cars use special seats with their own seatbelts.



The seatbelts for children are narrower than adult seatbelts.

Why is it safe for children's seatbelts to be **narrower** than adult seatbelts?

---

[2]

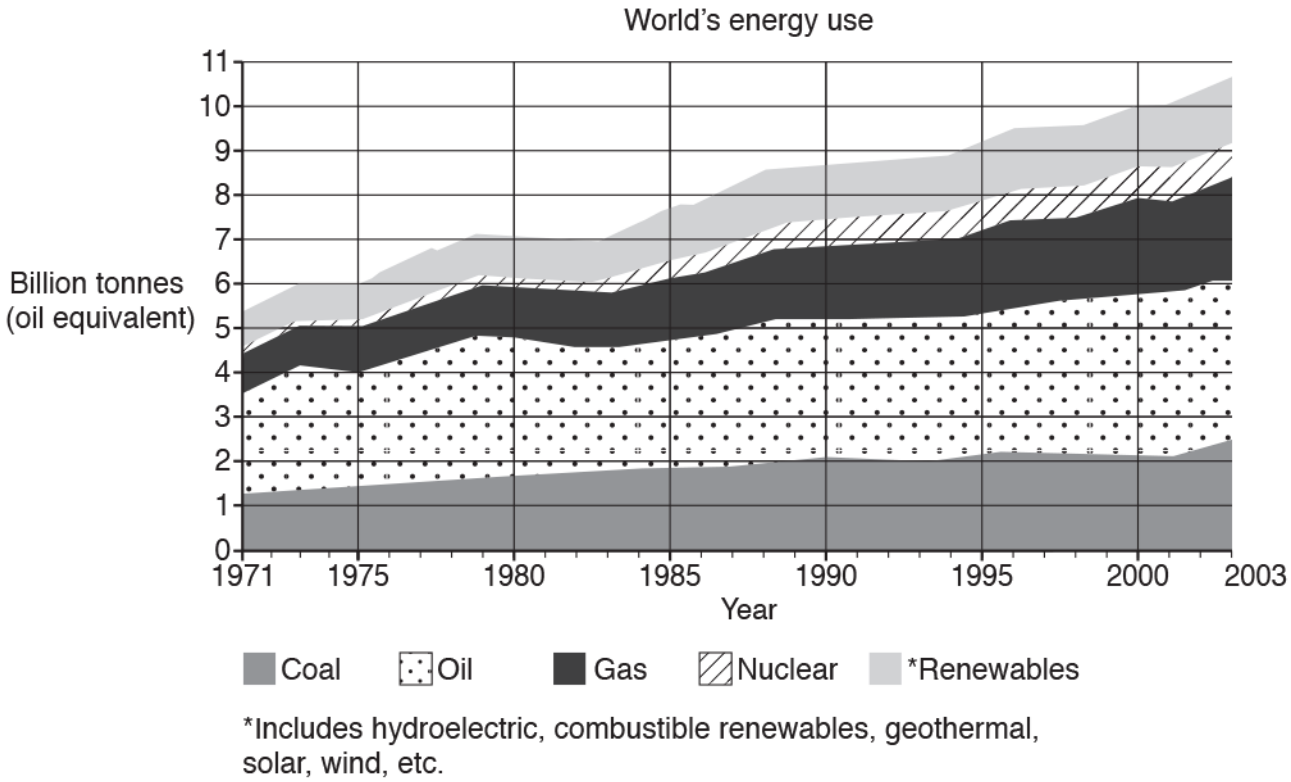
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39(a) The graph shows how the World's energy use has changed from the year 1971 to the year 2003.

It also shows the amount of different energy sources used.



(i) Approximately how much did the total World's energy use increase from the year 1971 to the year 2003?

Answer = _____ billion tonnes (oil equivalent) **[1]**

(ii) Which energy source had the **greatest** use in the year 2003?

_____ **[1]**

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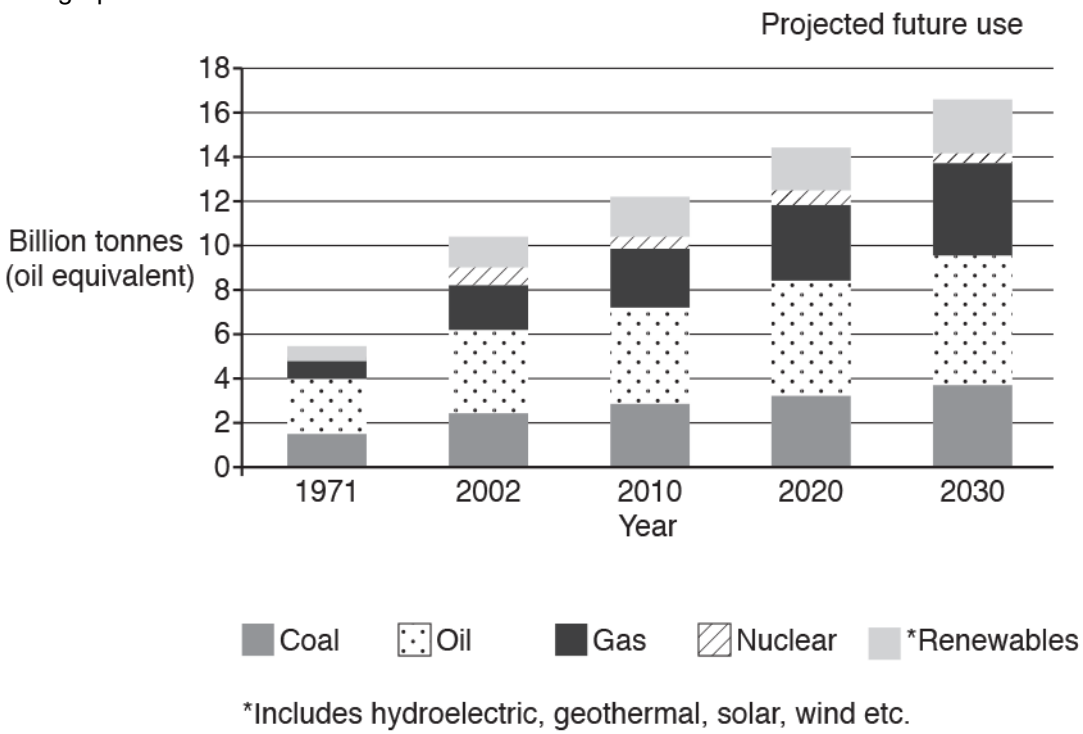
(iii) The total energy use in the year 2003 was 10.6 billion tonnes (oil equivalent).

Approximately what percentage of this amount was due to fossil fuel use?

Answer = ---------- % **[2]**

(b) Scientists are researching the World's energy use for the future.

The graph shows some of their research.



(i) The future demand for fossil fuels is expected to increase.

Give two reasons why scientists are worried about this increase in demand.

1. ----------

---

2. ---

Answer = ... J/kg °C **[1]**

(ii) Describe the conclusions that can be drawn from the data.

---**[3]**

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(b) The actual value for the specific heat capacity of water is 4200 J/kg °C.

(i) Explain why the mean specific heat capacity calculated in **(a)(i)** is higher than the actual value.

---

[2]

(ii) Write down **two** problems with this experiment **and** suggest how they could be solved.

Use the diagram and results table to help you.

Problem 1 ---

Solution ---

Problem 2 ---

Solution ---

---

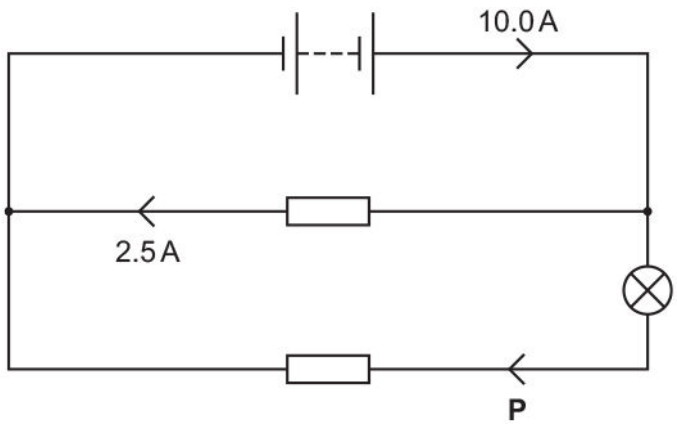
[4]

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41 Look at the circuit diagram.



What is the current at point **P** in the circuit?

A 2.5 A

B 5.0 A

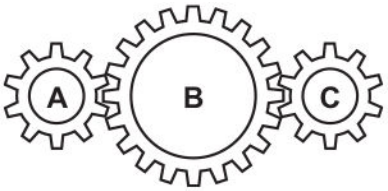
C 7.5 A

D 10.0 A

Your answer [1]

42 A student investigates cogs and gears.

Cogs **A** and **C** have 10 teeth. Cog **B** has 20 teeth.



Cog **A** is turned 5 times.

How many times does cog **C** turn?

A 5 times

B 10 times

C 20 times

D 50 times

Your answer ☐ **[1]**

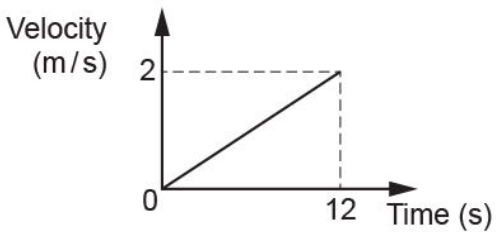
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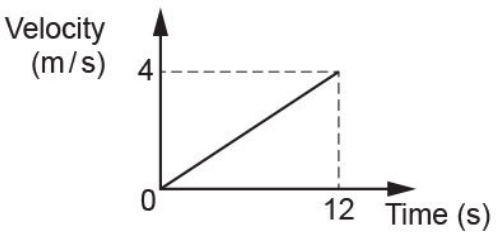
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43 Look at the motion graphs.

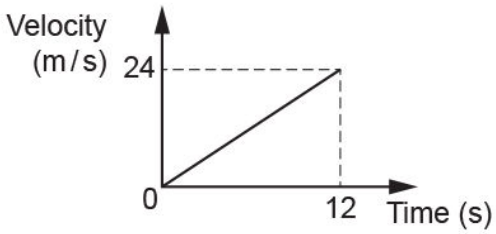
A



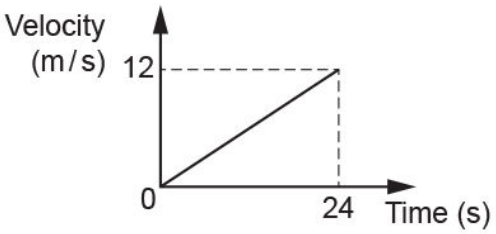
B



C



D



Which graph shows a journey with a distance of 24 m?

Your answer ☐ **[1]**

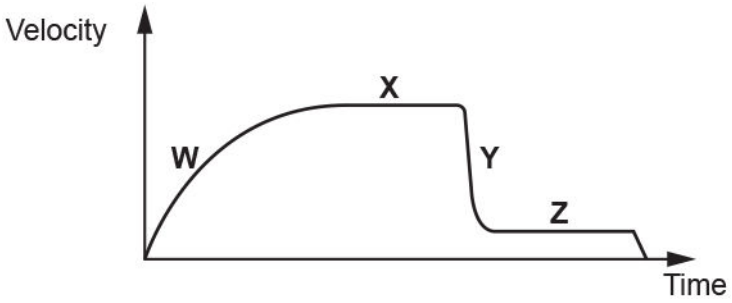
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44 A skydiver falls from a plane. His parachute opens and he lands safely.

Look at the velocity-time graph of his journey.



Which parts of the graph show balanced forces on the skydiver?

A X only

B Y and Z

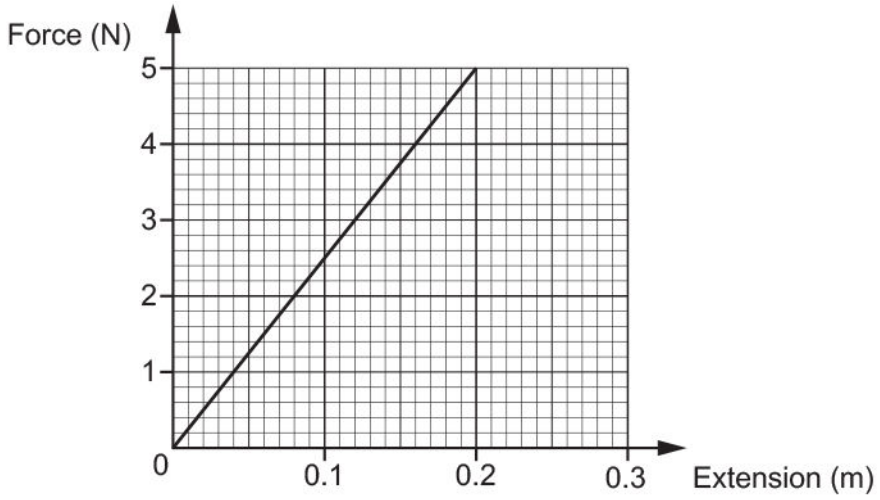
C X and Z

D Y only

Your answer [1]

45 A student investigates how a spring stretches when a force is added.

Look at a graph of his results.



Calculate the spring constant of the spring.

Spring constant = ... N / m **[3]**

46(a) A student investigates how the angle of a ramp affects the final speed of a trolley.

He uses light gates to record the speed of the trolley at the bottom of the ramp.

The student releases the trolley from rest at the same point on the ramp each time.

Look at his results.

Angle of ramp (°)	Final speed (m / s)			
	Attempt 1	Attempt 2	Attempt 3	Mean
10	1.81	1.80	1.81	1.81
20	2.58	2.56	2.57	2.57
30	3.1	3.11	3.11	3.11

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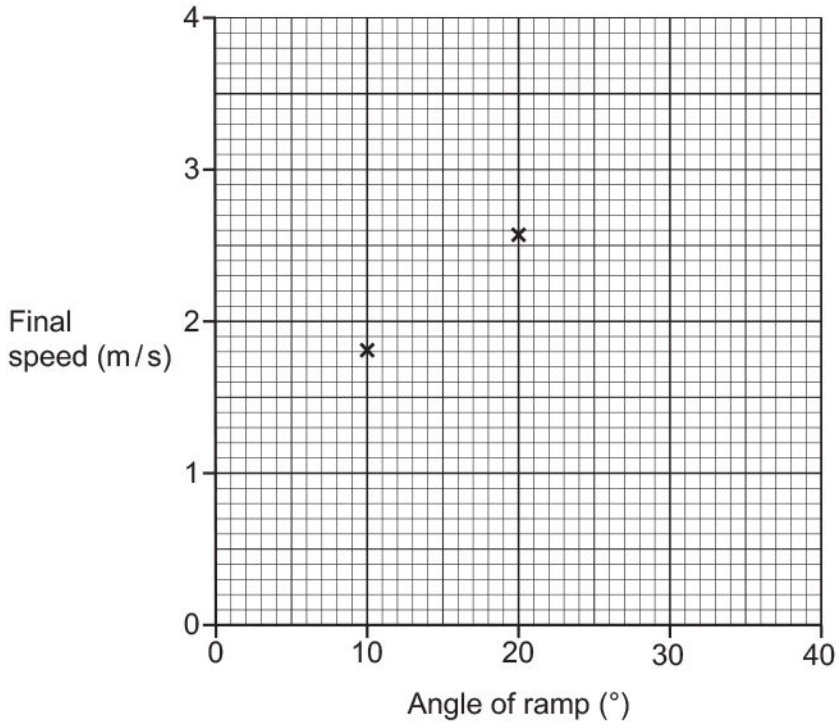
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40	3.52	3.51	3.50	3.51

(i) Plot the results on the graph and draw a line of best fit.

Two results have been plotted for you.



[2]

(ii) Describe the pattern shown by the results.

Use data from the table or graph in your answer.

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[3]

(iii) Explain why the final speed changes when the angle of the ramp increases.

In your answer use ideas about energy.

[2]

(iv) The student made a mistake when recording one of his results.

Identify the mistake **and** explain what he should have done.

[2]

(v) The student thinks this data shows that his results are **reproducible**.

He is **not** correct.

Explain why.

[2]

(b)

(i) The mean final velocity for the ramp at a 40° angle is 3.51 m / s. The distance from the top of the ramp to the light gate at the bottom is 1.0 m.

Calculate the acceleration of the trolley when the ramp is at a 40° angle.

Give your answer to decimal places.

Acceleration = ... m / s^2 **[5]**

(ii) The trolley has a mass of 2.0 kg.

Calculate the kinetic energy of the trolley at a speed of 3.0 m / s.

Kinetic energy = ... J **[3]**

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47 A student investigates four gases.

Look at her data.

Gas	Pressure (Pa)	Volume (m^3)
A	5	0.5
B	10	0.4
C	20	0.2
D	40	0.2

Two readings are for the same mass of the same gas at a constant temperature.

Which two readings are for the **same mass** of the **same gas** at a constant temperature?

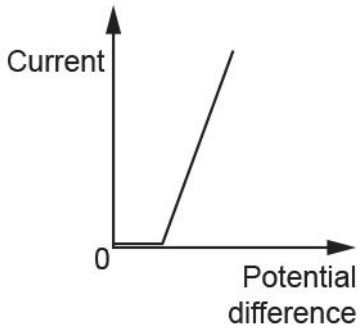
Use calculations in your answer.

[3]

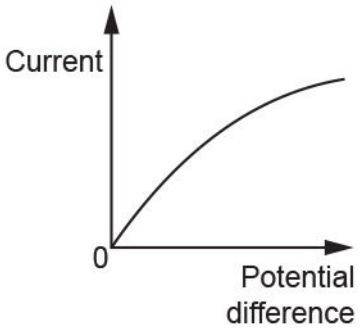
48 A student investigates how current and potential difference vary in different components.

Look at the graphs of her results.

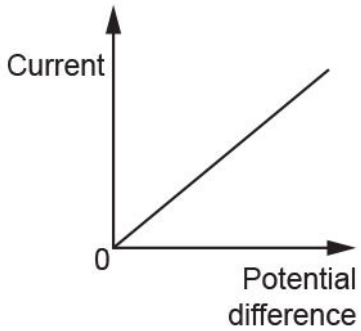
A



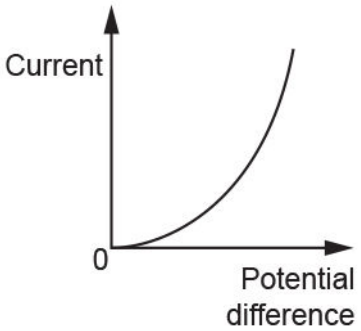
B



C



D



Which graph shows a filament lamp?

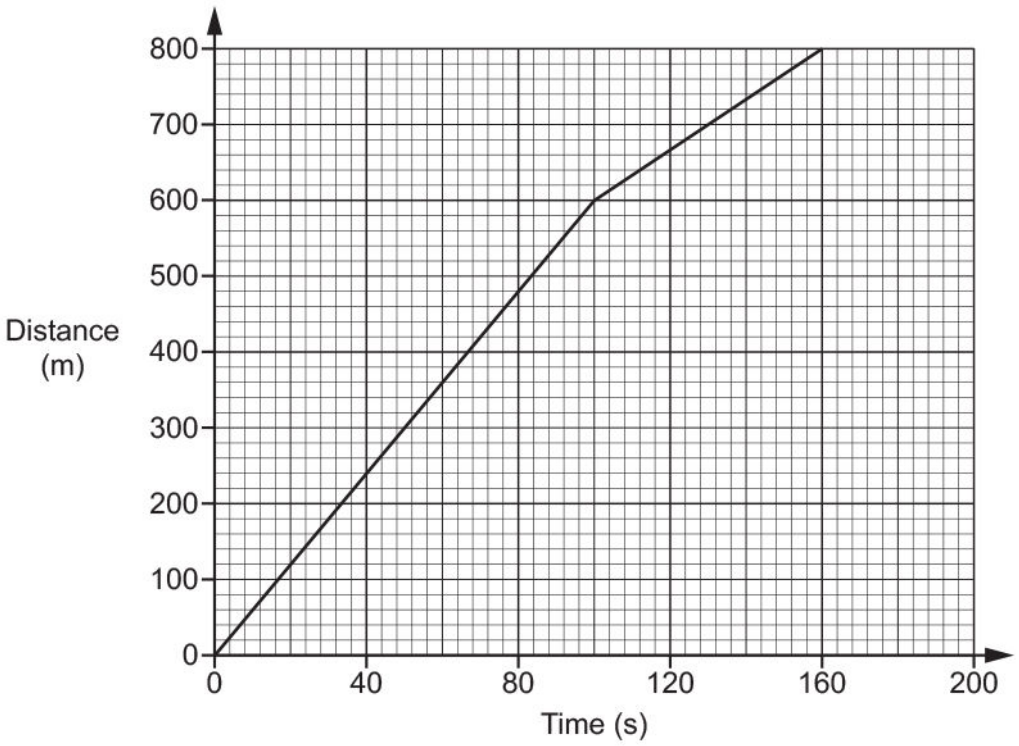
Your answer [ ] [1]

49 Look at the distance-time graph for a journey to school.

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What is the average speed for the journey?

Use the equation: average speed = distance travelled ÷ time

A 0.2 m/s

B 5.0 m/s

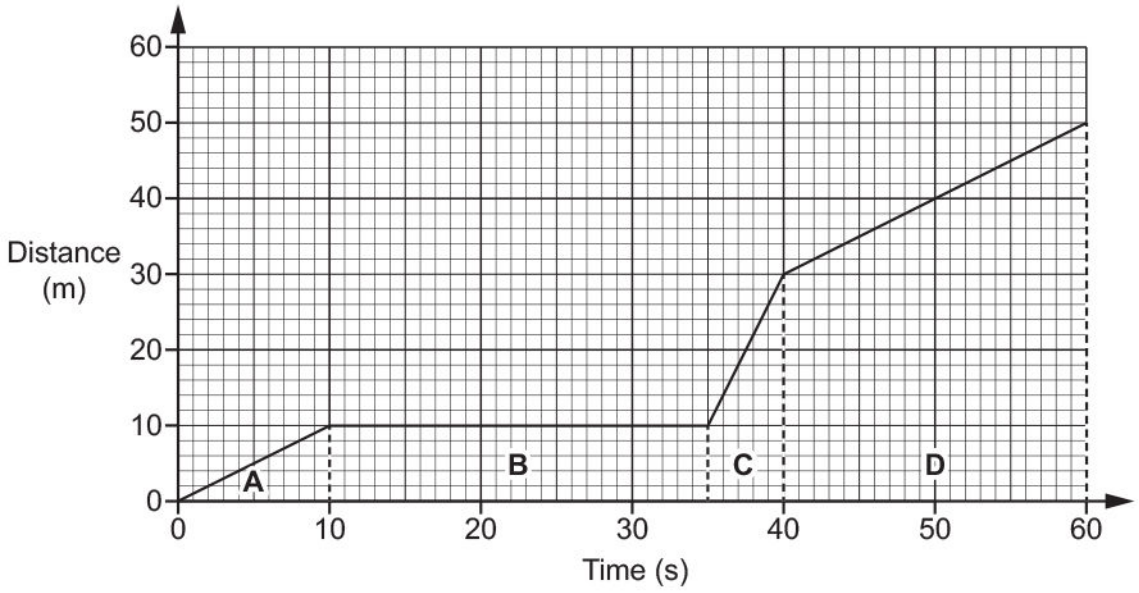
C 6.0 m/s

D 50 m/s

Your answer ☐ **[1]**

50(a) A student investigates motion graphs.

Look at a distance-time graph for the movement of a dog in a park.



(i) How far did the dog move in the park?

Distance = ... m **[1]**

(ii) How long was the dog in the park?

Time = ... s **[1]**

(iii) Name a piece of apparatus the student could use to accurately measure the distance the dog moved.

[1]

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(b) The distance-time graph has four sections: **A**, **B**, **C** and **D**.

(i) Which section of the graph shows the **greatest** speed?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

D ☐

Explain your answer.

---

[2]

(ii) Which section of the graph shows **zero** speed?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

D ☐

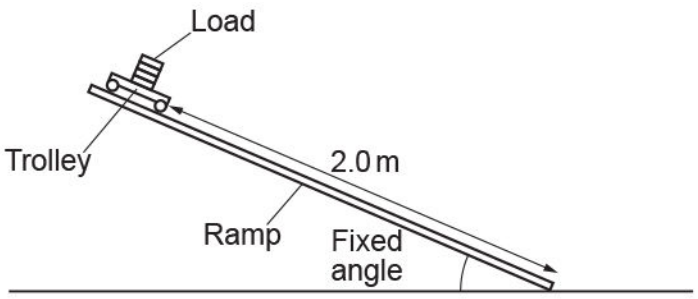
Explain your answer.

---

[2]

51 A student investigates the average speed at which a trolley with different loads travels down a ramp.

Look at the diagram of her experiment.



She releases the trolley from a distance of 2.0 m from the bottom of the ramp.

The student uses a stop-clock to measure the time it takes to reach the bottom of the ramp.

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She calculates the average speed. Look at her results.

Load (N)	Time taken (s)	Average speed (m / s)
20	2.3	0.87
40	2.4	0.83
60	2.3	0.87
80	2.4	0.83

* Describe the trend shown by the results, identify problems with the experiment and describe any improvements that you would make to the experiment.

[6]

52 Four students measure the time it takes a wave to travel the length of a ripple tank.

Each student collects three measurements of the time.

Student	Time taken (s)		
	1st measurement	2nd measurement	3rd measurement
A	2	2	1
B	2.1	2.1	2.4
C	2.1	2.0	2.2
D	2.11	2.49	2.23

Which student collected the **most** precise data?

Your answer [ ] **[1]**

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53 Ripples are made on the surface of the water. The ripples can be used to model waves.

Student **A** and student **B** drop stones into a pond.

(i) Student **A** measures the frequency and wavelength of the water ripples. **Table 17.1** shows his results:

Frequency (Hz) of ripples	0.6
Wavelength (m) of ripples	0.1

Table 17.1

Calculate the wave speed of the ripples.

Use the equation: wave speed = frequency × wavelength

Wave speed = ...m / s **[2]**

(ii) Student **B** measures the same ripples as student **A**.

She measures:

- The distance one ripple travels.
- The time it takes the ripple to travel this distance.

Table 17.2 shows student **B**'s results:

Distance ripple travels (m)	2.40
Time taken (s)	30.0

Table 17.2

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Name the equipment student **B** uses to measure the distance and time.

Distance .....

Time .....

[2]

(iii) Use results in **Table 17.2** to calculate the wave speed of the ripples.

Wave speed = ...m / s **[1]**

(iv) Student **A** and student **B** obtained different answers for the wave speed of the ripples.

Suggest why.

.....

.....

.....

[1]

54

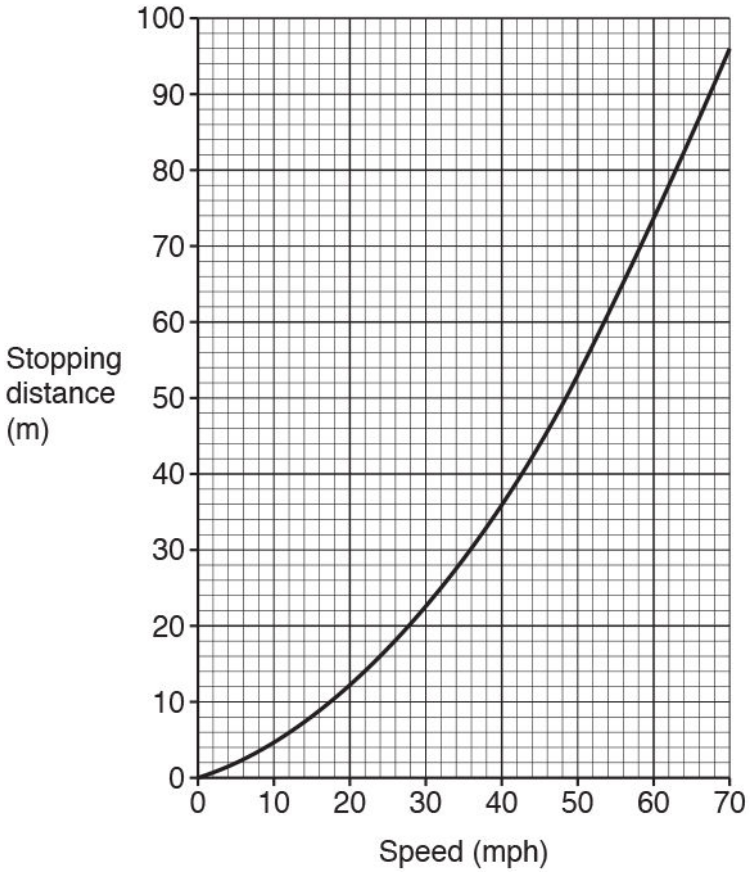
The driver of a car makes an emergency stop.

The thinking distance is 9 m. The braking distance is 14 m.

(i) Calculate the total stopping distance of the car.

Stopping distance = ... m **[1]**

(ii) This graph shows how this driver's stopping distance changes with speed.



- A car is travelling at 50 mph.
- There is a barrier in the road 40 m in front of the car.

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- The driver makes an emergency stop.

Use the graph to work out if the car hits the barrier.
Explain how you obtained your answer.

[2]

(iii) State one factor, other than speed, that affects braking distance.

Explain how this factor changes braking distance.

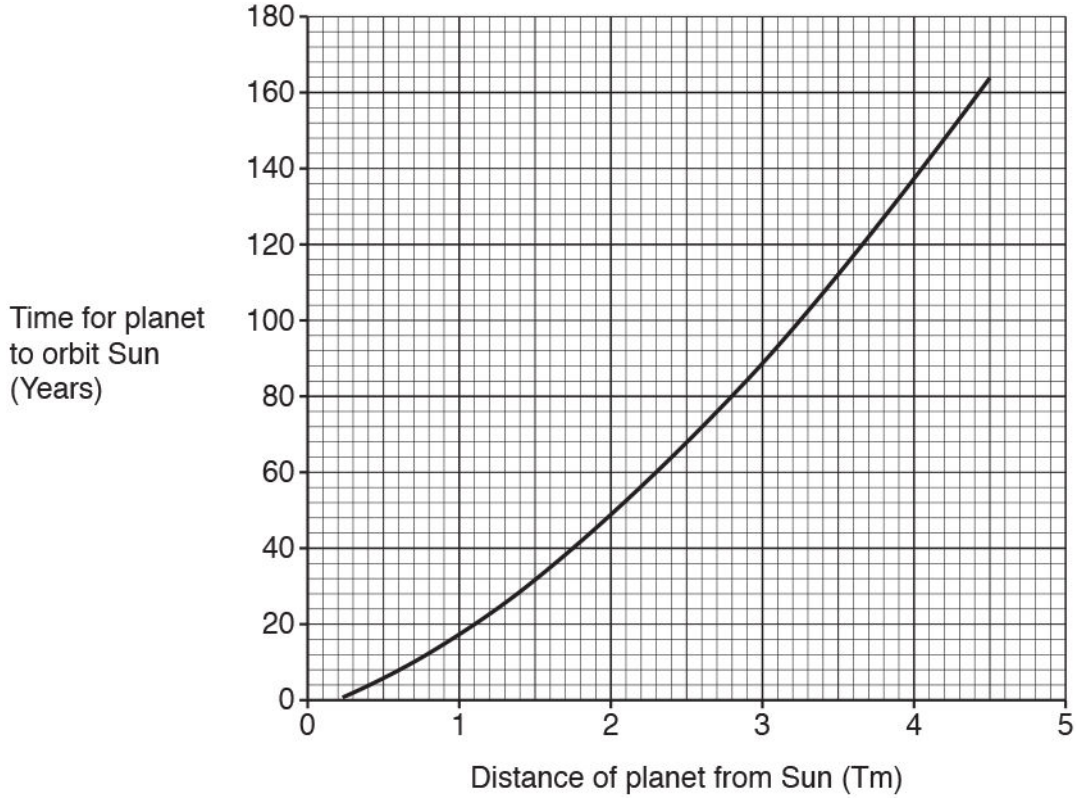
Factor

Explanation

[3]

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55 * This graph shows how a planet's orbit time changes with distance from the Sun in our solar system.



Describe and explain the relationship shown by the graph.

Use data from the graph and ideas about our solar system in your answer.

[6]

56 A student drops a paper ball from a balcony 4.00 m high. Her friend measures the time taken for the paper ball to reach the ground.

They record their results in a table.

Attempt	1	2	3	4	5
Time taken (s)	1.84	2.08	2.02	2.08	1.98

(i) Use the data in the table to calculate the mean, median and mode of their results.

Mean = ...

Median = ...

Mode = ...

[3]

(ii) The results are not very precise. Explain how you can tell from the data in the table.

[1]

(iii) Suggest a possible source of error in the experimental method **and** how it could be improved.

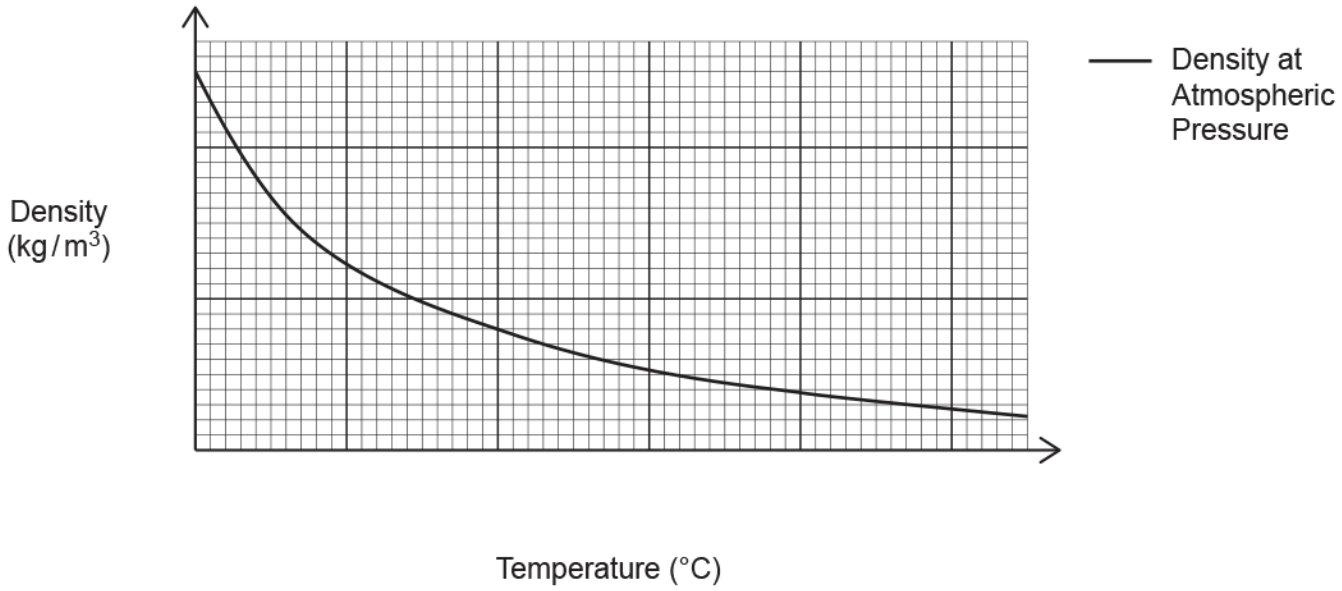
Source of error _____

Improvement _____

_____

[2]

57 A student researches how the density of air varies with the temperature of the air. Look at the graph of her findings.



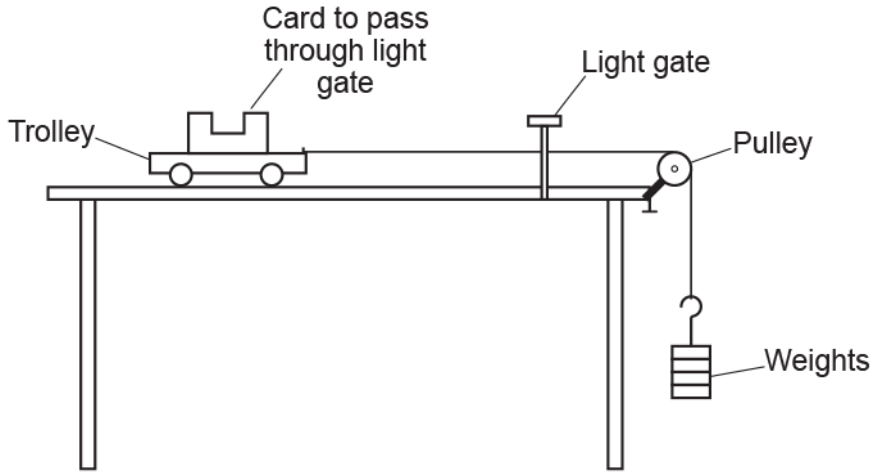
Describe the relationship between the temperature and density of air shown in the graph.

_____

[1]

58(a) A student investigates the acceleration of a trolley.

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The trolley is released from a fixed position and accelerates.

The accelerating force is provided by the weights attached to the trolley with string.

Acceleration is measured using a light gate and data logging equipment.

Look at the results from the experiment.

Force (N)	Acceleration
1.0	1.3
2.0	2.9
3.0	4
4.0	5.7
5.0	6.0

The student has made **two** mistakes in their results table. Identify the two mistakes and suggest corrections to them.

Mistake 1: _____

Correction 1: _____

Mistake 2: _____

Correction 2: _____

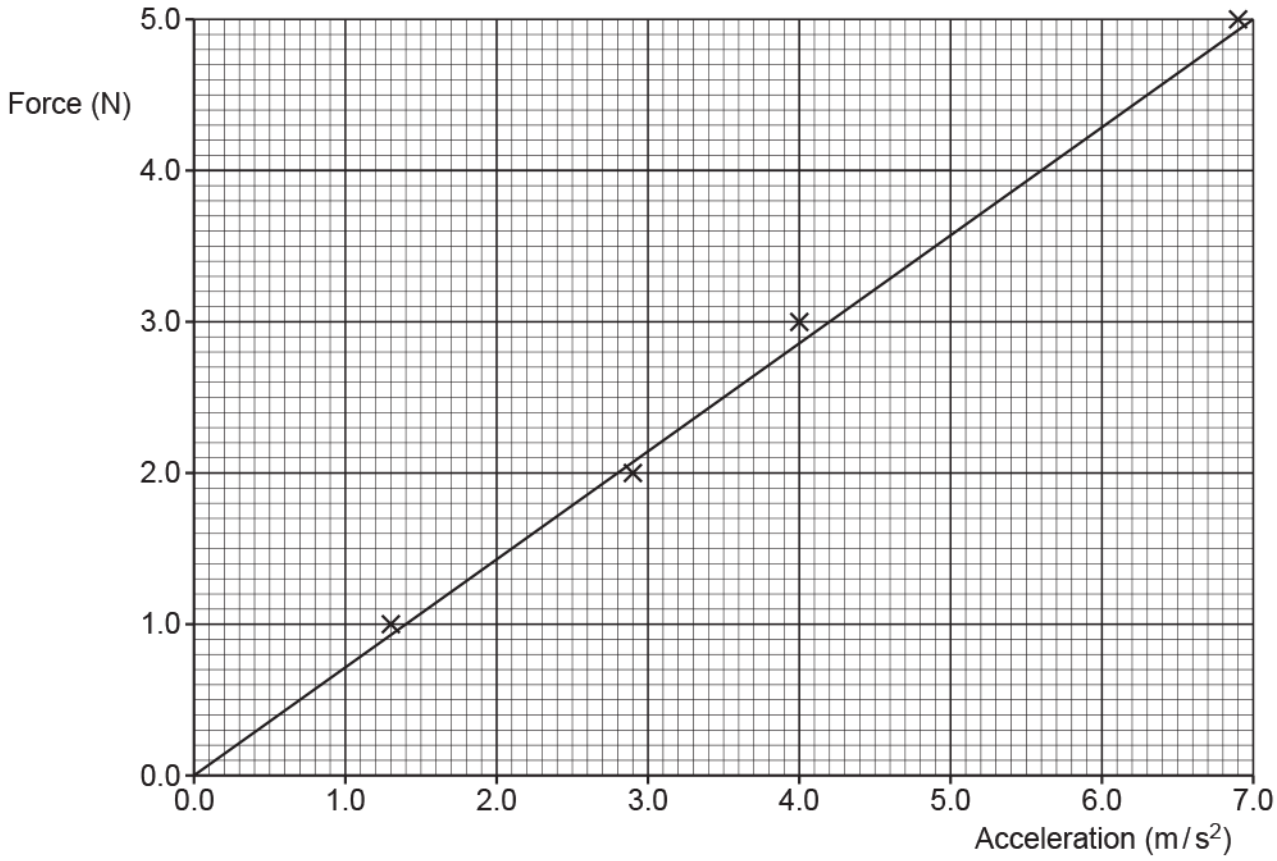
[4]

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(b) The student plots the results on a graph.



(i) One point has not been plotted on the graph. Plot the missing point on the graph.

[1]

(ii) Describe the relationship between the two variables on the graph.

---

[2]

(iii) Calculate the gradient of the graph and use this to determine the mass of the trolley.

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Mass = ... kg **[2]**

(iv) The actual mass of the trolley is lower than that found in the experiment. Suggest two reasons why.

Use ideas about forces and energy in your answer.

1 _____

_____

2 _____

_____

[2]

(v) Suggest **two** ways the experiment could be improved.

1 _____

_____

2 _____

_____

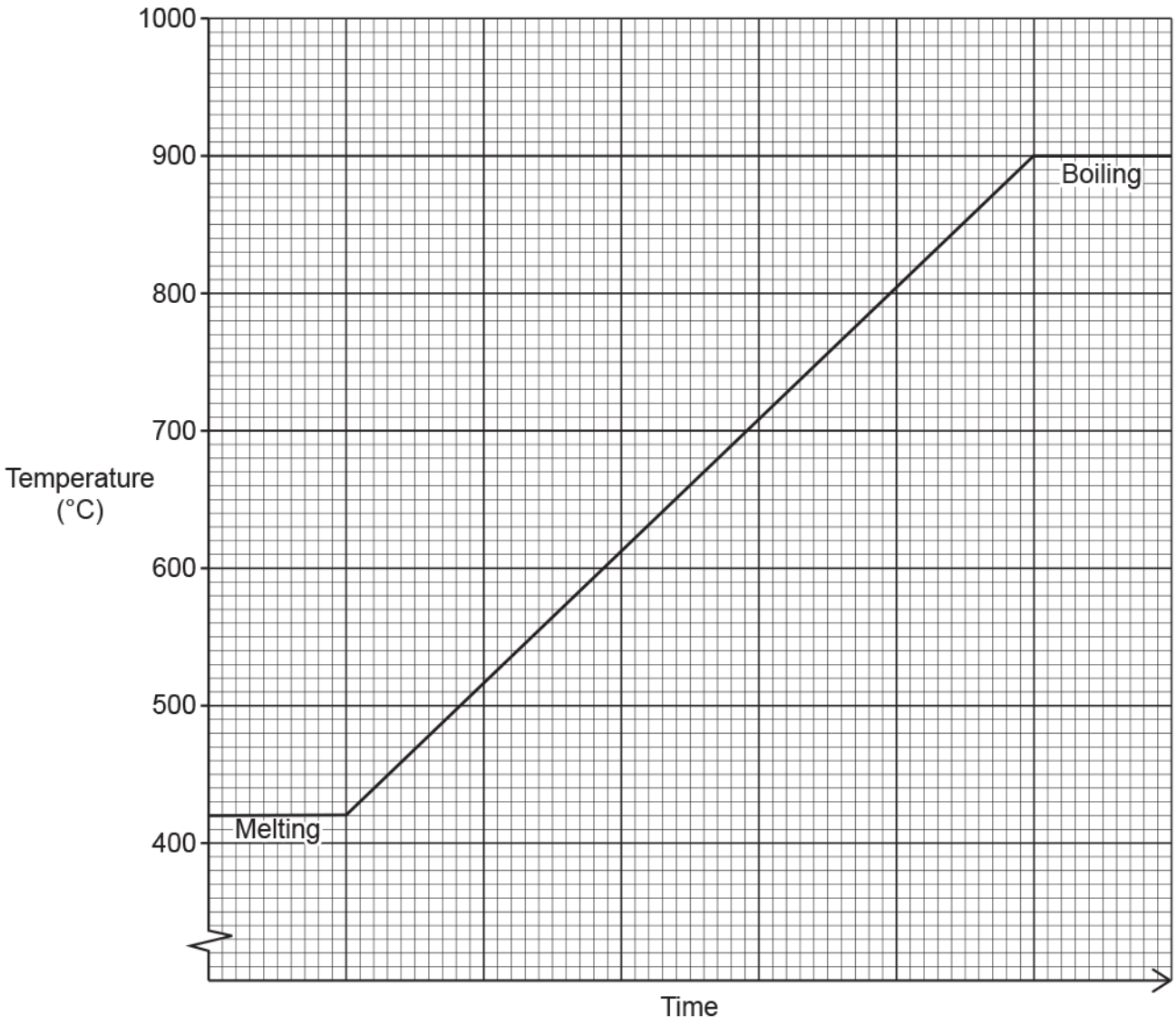
[2]

59(a) The table shows the specific heat capacities of different materials.

Material	Specific heat capacity (J / kg °C)
Copper	330
Brass	380
Zinc	385
Nickel	440
Concrete	880
Concrete	913

A scientist heats an unknown substance from a solid to a liquid.

The graph shows how the temperature of the substance varies with time.



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The scientist has 2.5 kg of the substance and records that it takes 462 kJ of energy to increase it from the lowest to the highest temperature in the liquid state.

Use the graph to calculate the specific heat capacity of the substance.

Suggest what material it could be from the table.

Specific heat capacity = ... J / kg °C

Material = ...

[5]

(b) Suggest **two** reasons why the scientist cannot be certain that the substance has been identified correctly.

1 ----------

---

2 ----------

---

[2]

60 Four students measure the time it takes for a wave to travel the length of a ripple tank.

Each student collects three measurements of the time.

Student	Time taken (s)		
	1st measurement	2nd measurement	3rd measurement
A	2	2	1
B	2.1	2.1	2.4
C	2.1	2.0	2.2
D	2.11	2.49	2.23

Which student collected the **most** precise data?

Your answer [ ] **[1]**

61 A student investigates the rate of cooling using a cardboard box to model the walls of a building.

She puts a beaker of hot water into the cardboard box. She measures the temperature of the water every two minutes.

She investigates how the rate of cooling changes with the thickness of the walls.

Here are the results of one of her experiments.

Time (minutes)	Temperature of water (°C)
0	90
2	75
4	63
6	54
8	47
10	41
12	37

(i) Plot the results on the grid in **Fig. 17.1**.

Two of the points have been plotted for you.

[2]

(ii) Draw a line of best fit on your graph.

[1]

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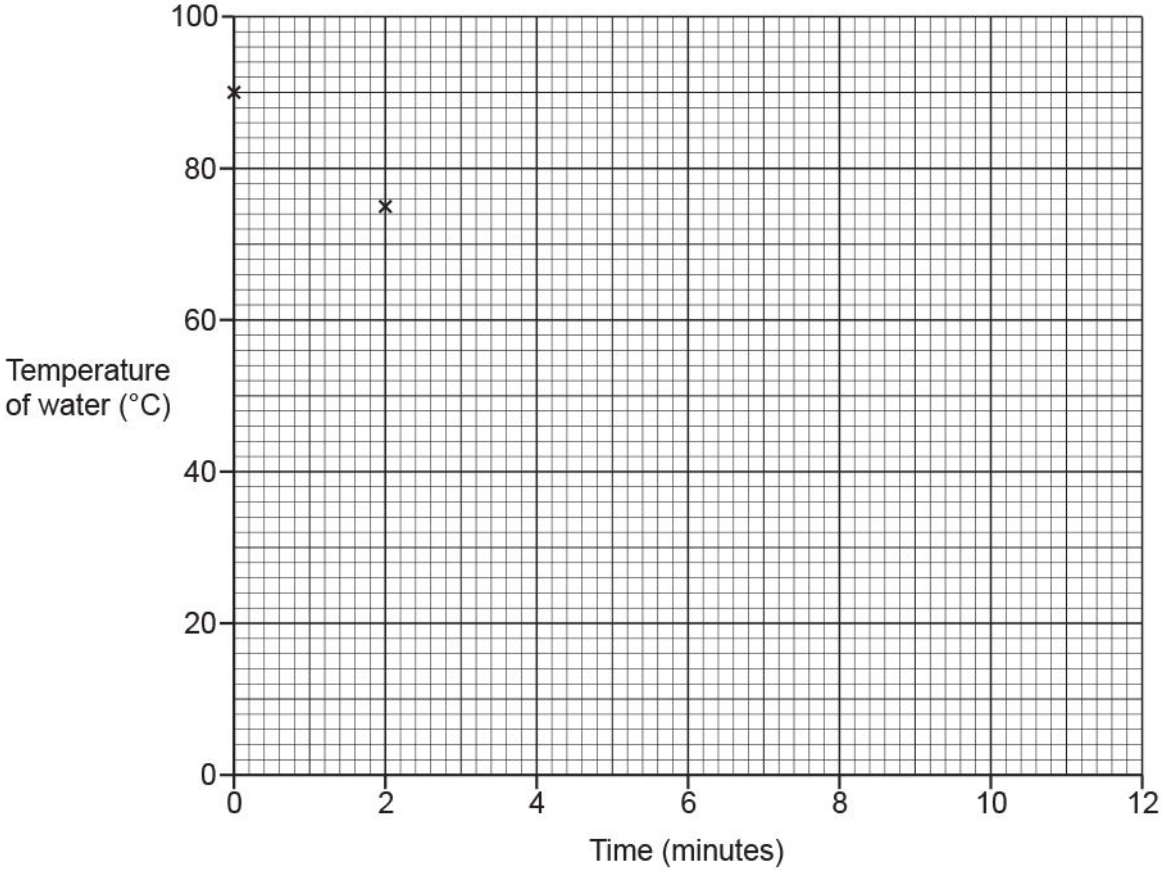


Fig. 17.1

(iii) Describe how the temperature of the water changes with time.
Use data from the graph **Fig. 17.1** in your answer.

---

[2]

(iv) The thickness of the cardboard box is doubled. Everything else stays the same.

Sketch a line on the graph in **Fig. 17.1** to suggest what these new results may look like.
Label your line **Z**.

[1]

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(v) Suggest **one** way to improve the investigation.

---

[1]

62 * The UK generates some of its electrical power from wind turbines.

Fig. 18.1 shows the total electrical power generated by wind turbines in the UK.

The graph is for a single day in December which had very strong winds.

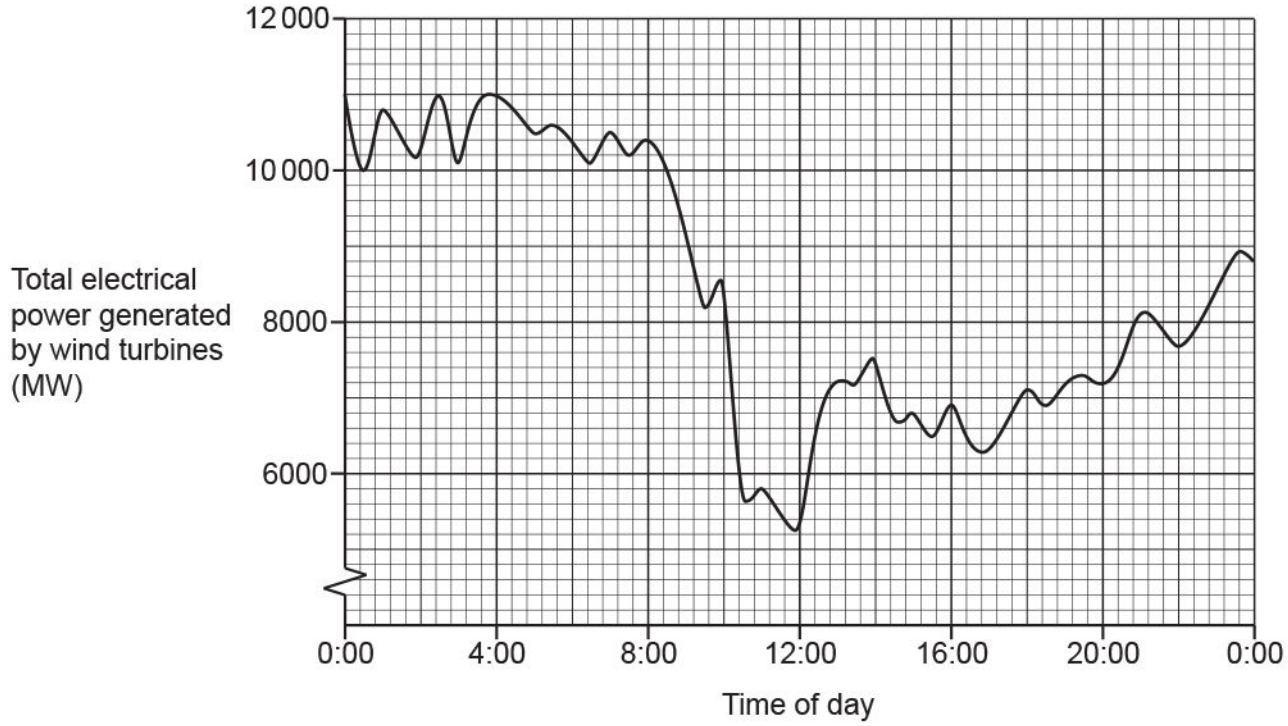


Fig. 18.1

Fig. 18.2 shows the total demand for electrical power in the UK on the same day.

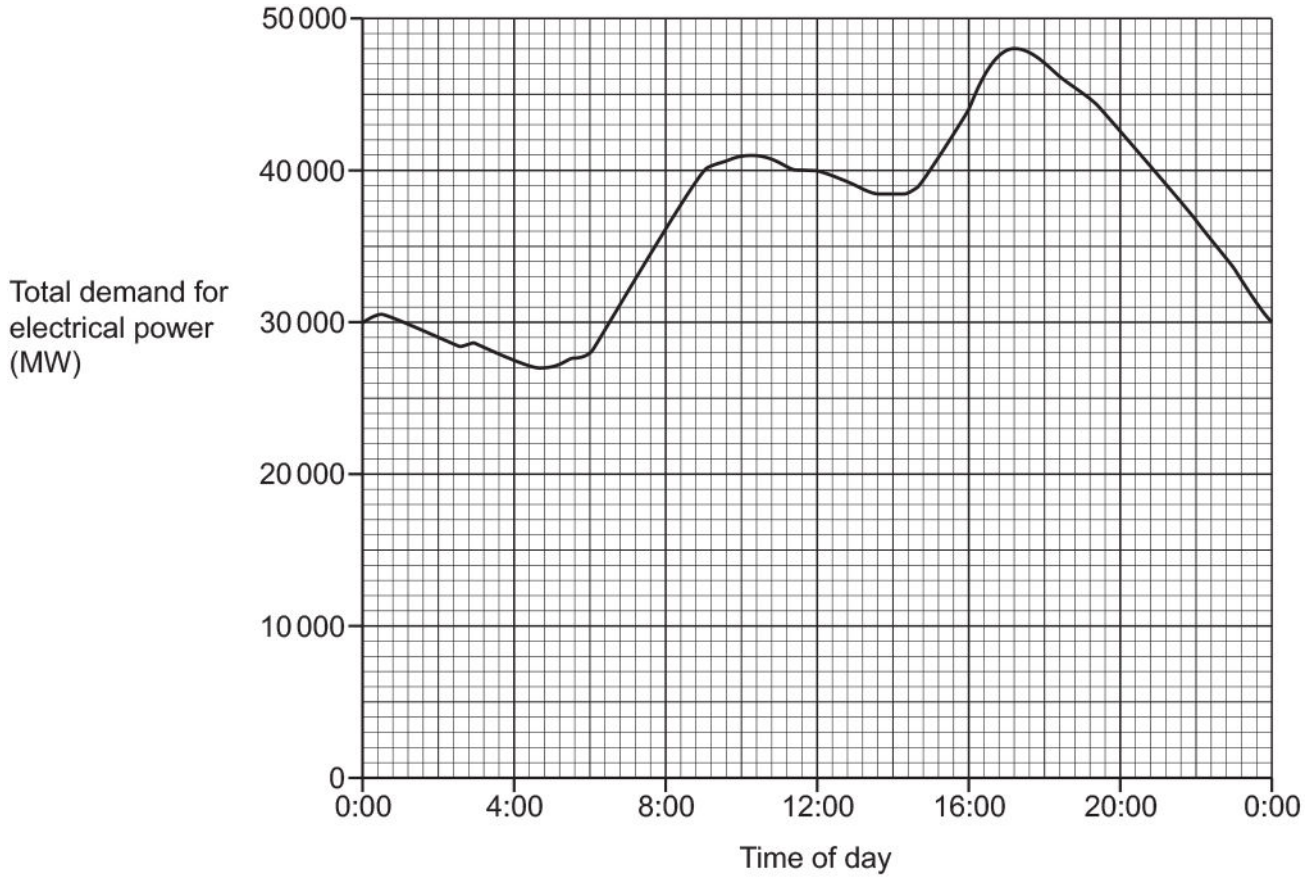


Fig. 18.2

Some experts believe the UK should generate most of its electrical power from wind.

Evaluate the advantages and disadvantages of this idea.

Use the graphs in Fig. 18.1 and Fig. 18.2 and your own ideas about wind turbines to support your answer.

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[6]

END OF QUESTION PAPER