Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2020–2021

Single Award Science: Physics

Unit 3
Foundation Tier

ML

[GSA31]

WEDNESDAY 25 NOVEMBER 2020, MORNING

TIME

1 hour, plus your additional time allowance.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 60.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **9(a)**.

1 **(a)** Answer the questions about four of the planets in our Solar System.

Neptune **Mars** **Uranus** **Saturn**

(i) Which of these is a rocky planet?

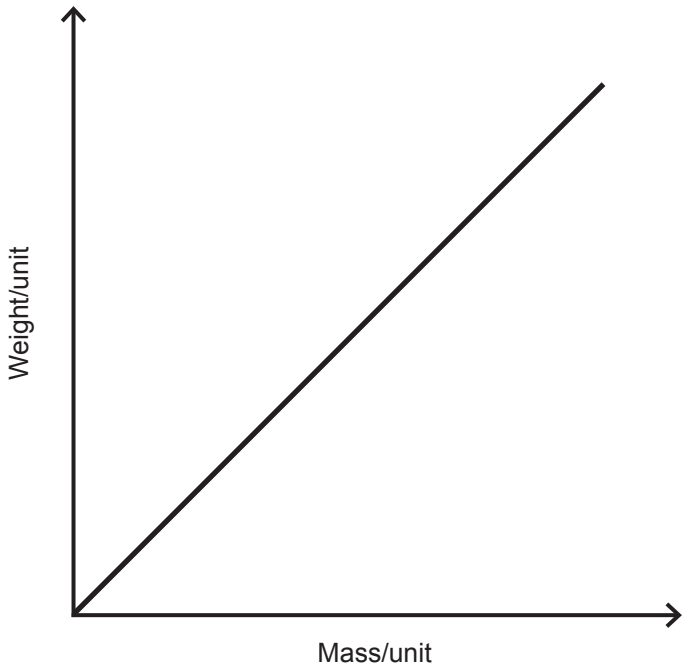
_____ [1]

(ii) Which of these planets is the most far away from the Sun?

_____ [1]

(b) Look at the graph below.

It shows the relationship between mass and weight for objects on Earth.



(i) What is the trend you can see from the graph?

_____

_____ [1]

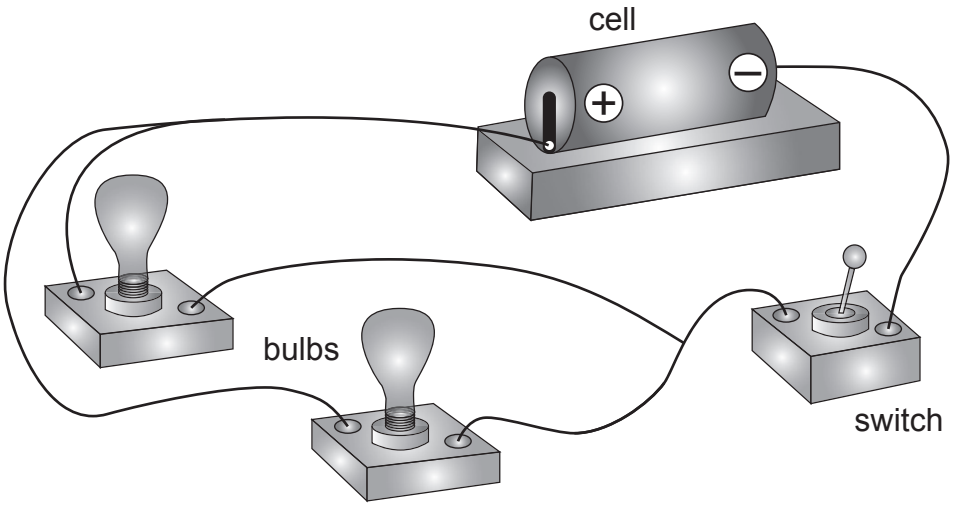
(ii) Use lines to match each measurement with its unit.

Measurement	Unit
weight	kilogram
mass	metre
	newton

[2]

[Turn over

2 **(a)** The diagram below shows a simple electric circuit.



Source: Principal Examiner

(i) How are the bulbs connected in this circuit?

Circle your answer.

series **short** **parallel** [1]

(ii) How should a voltmeter be connected to measure the voltage of the cell?

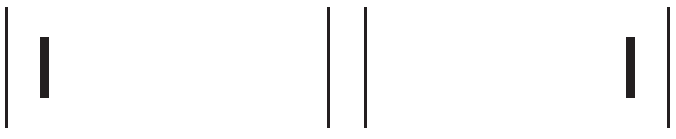
Circle your answer.

series **short** **parallel** [1]

(iii) When the switch is closed how many bulbs, if any, will light up?

_____ [1]

(iv) Look at the circuit above. Which symbol represents the cell being used?



A **B** **C**

_____ [1]

(b) In a circuit a cell provides 1.5 V and a current of 0.5 A flows.

Use the equation:

$$\textbf{resistance} = \frac{\textbf{voltage}}{\textbf{current}}$$

to calculate the resistance of the circuit.

(Show your working out.)

_____ Ω [2]

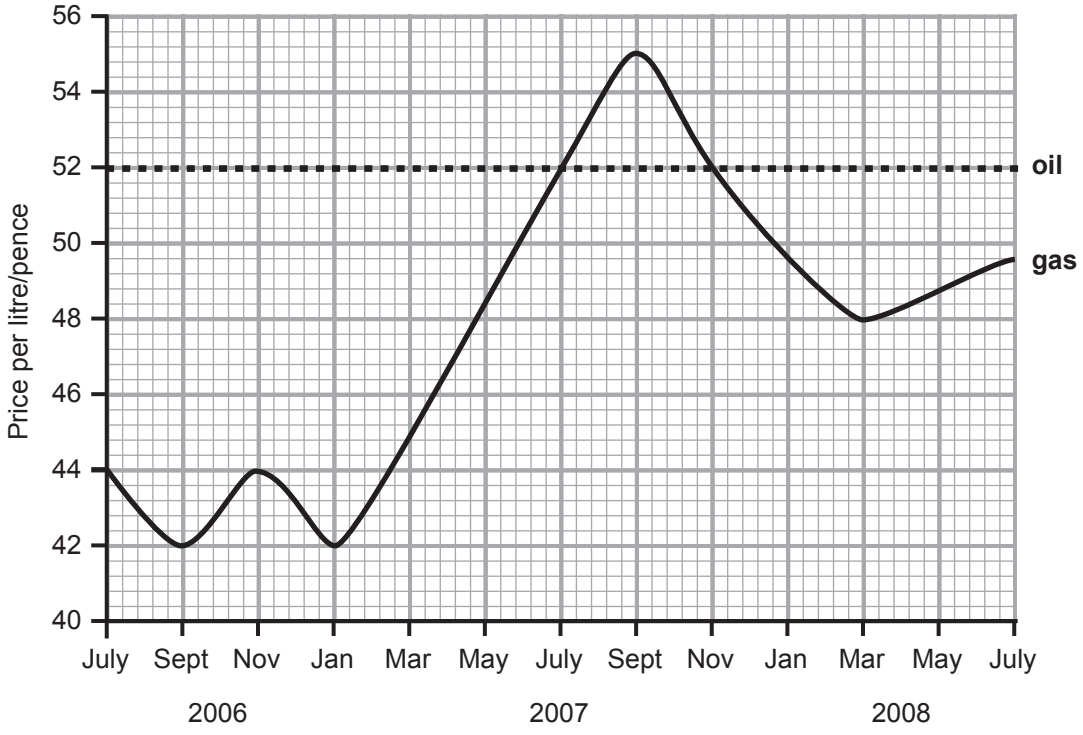
(c) Another cell is added to increase the voltage in the circuit.
Complete each row of the table using a tick (✓) to show the effect, if any, of adding this extra cell.

	increased	**decreased**	**no effect**
bulb brightness			
current			
bulb temperature			

[2]

[Turn over

3 **(a)** Kilroot power station can use either oil or gas to generate electricity. The graph below shows the price of both oil and gas over a two year period.



Source: Principal Examiner

(i) What would have been the best two months in 2007 for the power station to have used oil?

_____ to _____ [1]

(ii) Look at the graph above. Calculate the maximum difference in the price of **gas**.

(Show your working out.)

_____ pence [2]

(iii) Oil and gas are both non-renewable energy sources.
What does **non-renewable** mean?

_____

_____ [1]

(b) Look at the photograph below.

The wind turbines use a renewable source of energy.

Source: Principal Examiner

(i) Write down **one** disadvantage of using wind turbines.

_____

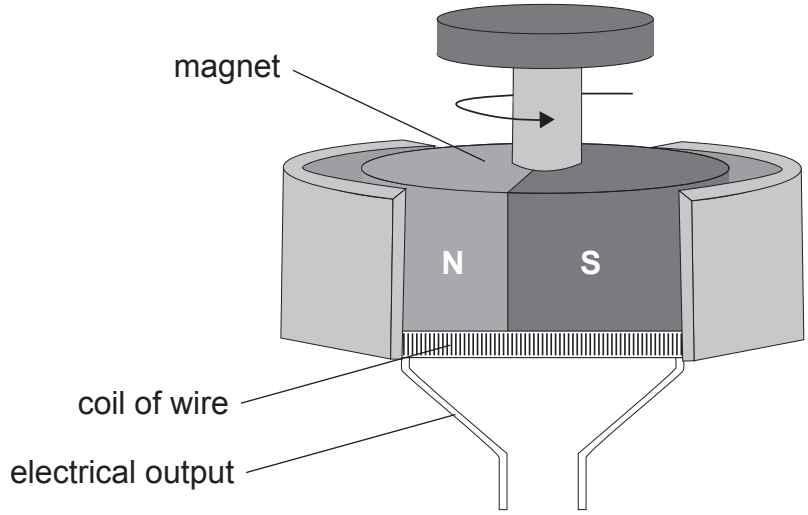
_____ [1]

(ii) Name **one** other renewable energy source

_____ [1]

[Turn over

(c) The diagram below shows a generator.



Source: Principal Examiner

(i) Use the diagram to show how a generator produces electricity.

_____

_____ [1]

(ii) You want to increase the amount of electricity generated. Write down **one** way you could do this.

_____ [1]

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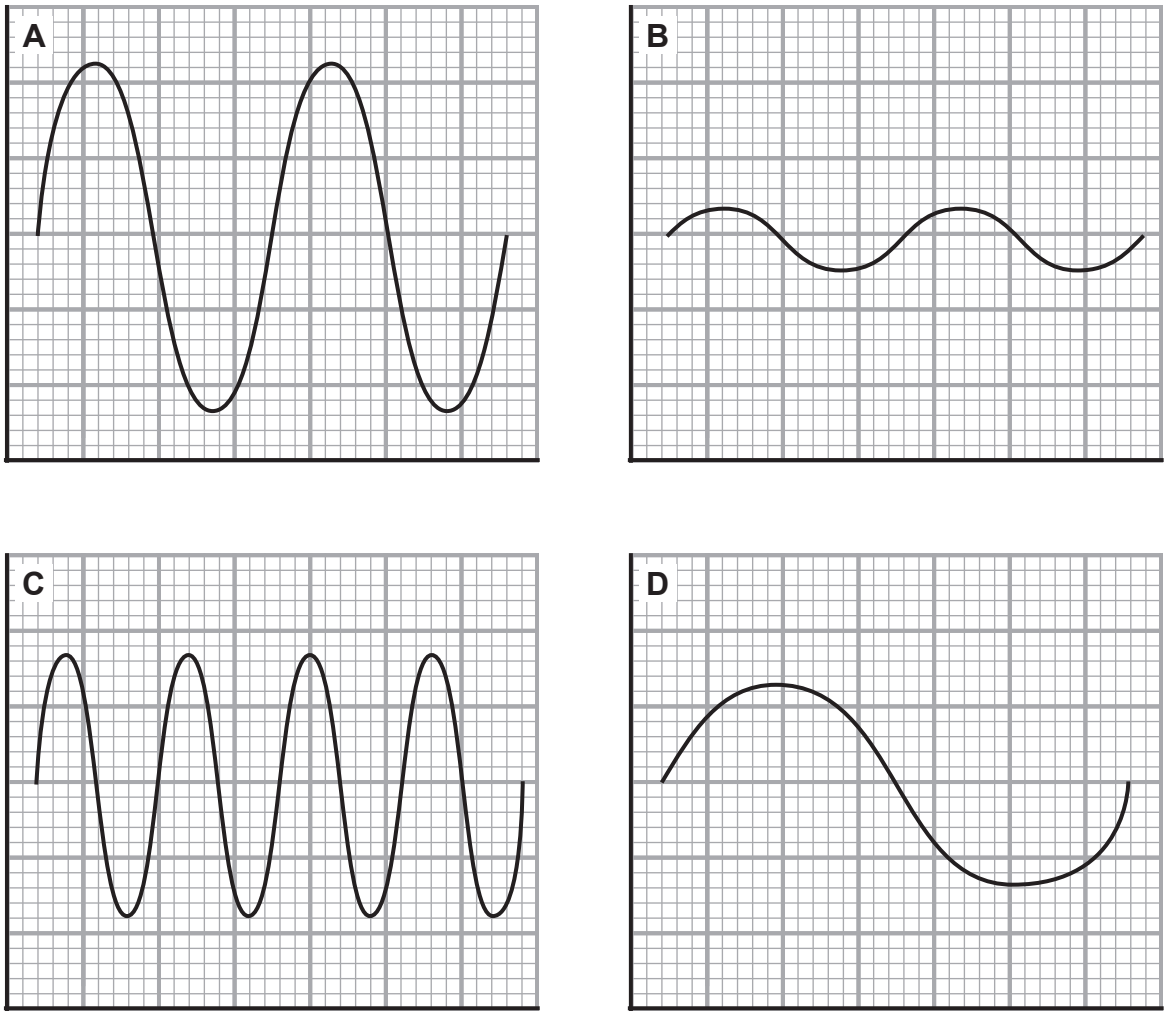
[Turn over

4 **(a)** Look at the diagrams below. They show four waves over the same length of time.



Source: Principal Examiner

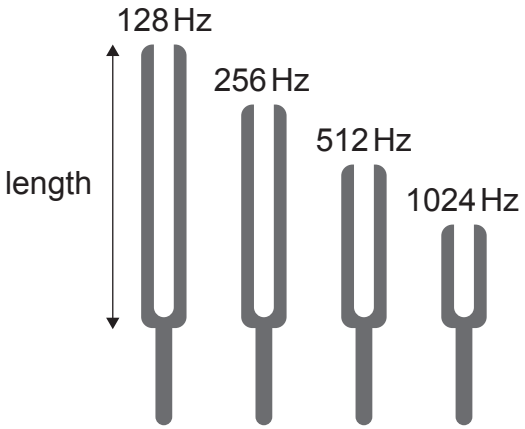
(i) Which wave (**A**, **B**, **C** or **D**) has the lowest amplitude?

_____ [1]

(ii) Which **two** waves (**A**, **B**, **C**, **D**) have the same wavelength?

_____ and _____ [1]

(b) Look at the diagram below. It shows how the length of a tuning fork changes the frequency of the sound it makes.



Source: Principal Examiner

(i) What does this information tell us?

_____

_____ [1]

(ii) Another tuning fork vibrates at a frequency of 136 Hz.

Use the equation:

$$\textbf{wavelength} = \frac{\textbf{speed}}{\textbf{frequency}}$$

to calculate the wavelength of the sound produced.
The speed of sound is 340 m/s.

(Show your working out.)

_____ m [2]

[Turn over

(c) The table below gives the audible range for five animals.

Animal	Audible range
elephant	16 Hz – 12 kHz
cat	45 Hz – 64 kHz
dog	67 Hz – 45 kHz
whale	1 kHz – 123 kHz
chicken	125 Hz – 2 kHz

(i) Which of these animals can hear the **lowest** frequency?

_____ [1]

(ii) How many of these animals can hear sounds above 20 000 Hz?

_____ [1]

(iii) What name is given to sounds above 20 000 Hz?

_____ [1]

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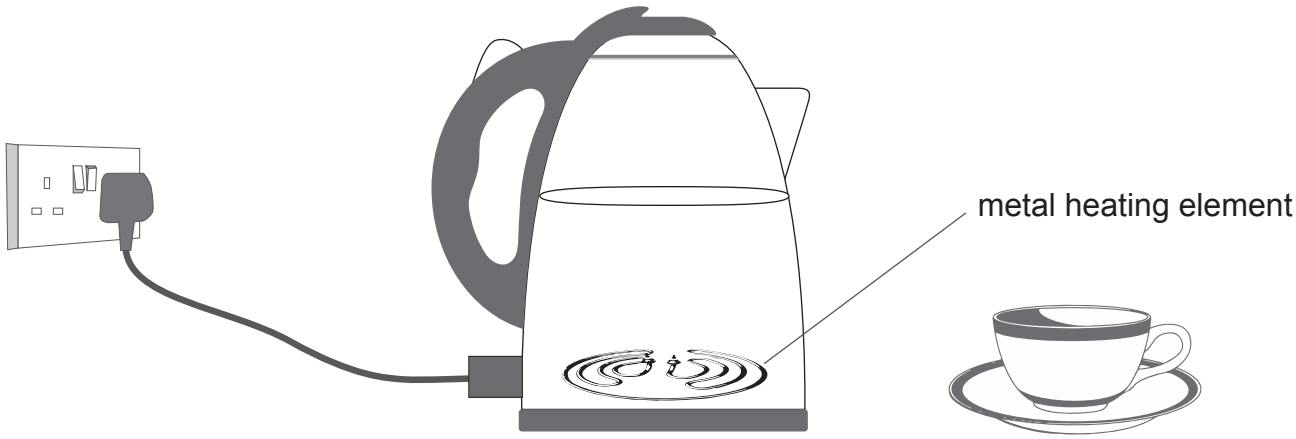
[Turn over

5 The diagram below shows a kettle heating water to make a cup of tea.



Source: Principal Examiner

(a) Name the heat transfer methods in the sentences below.

Heat is transferred through the heating element by _____.

Heat is transferred through the water by _____. [2]

(b) Look at the table below.
It shows the thermal (heat) conductivity of four metals at different temperatures.

Metal	Thermal Conductivity/W/m °C		
	25 °C	**125 °C**	**225 °C**
iron	80	68	60
copper	401	400	398
gold	310	310	310
steel	54	51	47

A student thinks:

*'As temperature increases, the thermal conductivity of **all** metals decreases.'*

(i) Was the student correct? Use information from the table to explain your answer.

_____

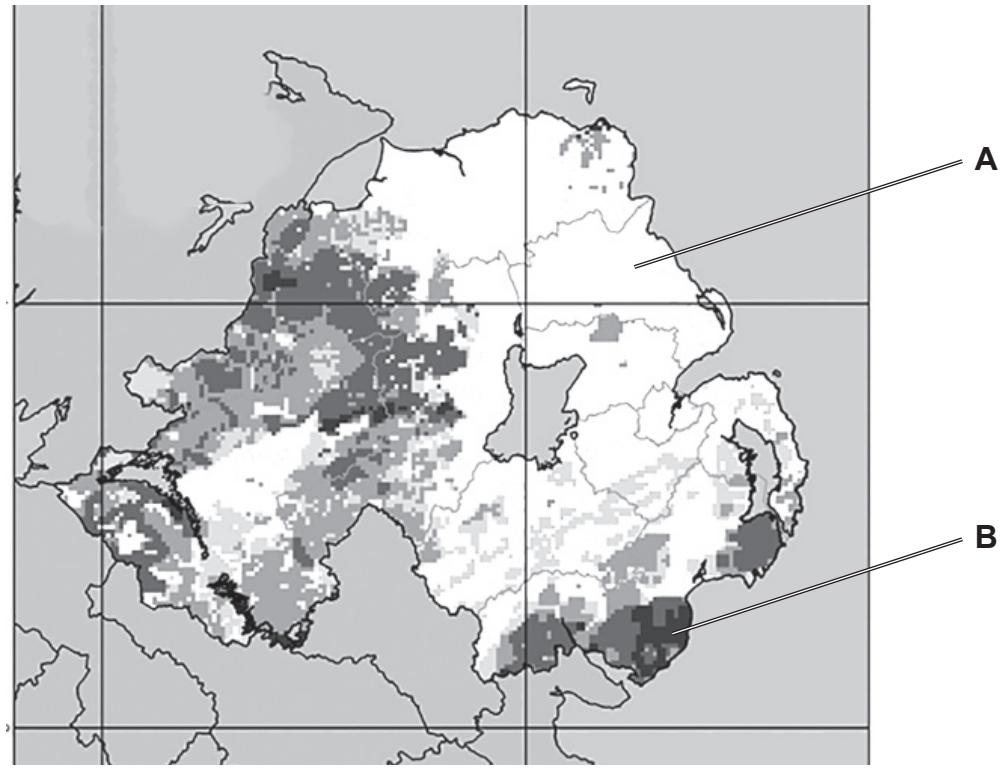
_____ [1]

(ii) Which of these metals would be **best** to use as the heating element in the kettle?

_____ [1]

[Turn over

6 Radon gas is a source of background radiation. The map below shows how radon levels are different across Northern Ireland.
The darker the area, the higher the level of radon.



(a) Why could there be more of a risk to health if you live in area **B** instead of **A**? Explain your answer fully.

_____

_____

_____

_____ [2]

(b) **(i)** What does **background radiation** mean?

_____

_____ [1]

(ii) Radon gas is a natural source of background radiation. Name **one** man-made source of background radiation.

_____ [1]

(c) Bananas grown in Africa can be treated with radiation before they are transported to Northern Ireland.

(i) Name the type of radiation used to treat the bananas.

_____ [1]

(ii) Why are bananas treated with radiation before being transported long distances? Explain your answer fully.

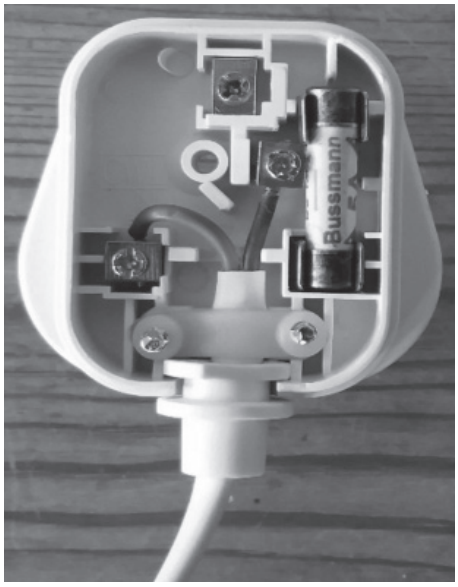
_____

_____

_____ [2]

[Turn over

7 **(a)** The photograph below shows a 3-pin plug used to connect a fan to the mains. The fan has double insulation.



Source: Principal Examiner

(i) Explain what **double insulation** means.

_____

_____

_____ [2]

(ii) Name the wire that is **not** needed because the fan is double insulated.

_____ [1]

(b) (i) The fan uses 2.3 kW of power and is connected to the 230 V mains electricity supply.

Use the equation:

$$\textbf{current} = \frac{\textbf{power}}{\textbf{voltage}}$$

to calculate the current being used by the fan.

(Show your working out.)

_____ A [2]

(ii) Which fuse should be used in the plug of this fan?

Circle your answer.

1 A **3 A** **5 A** **13 A** **30 A**

[1]

(iii) Name the wire connected to the fuse in a plug.

_____ [1]

[Turn over

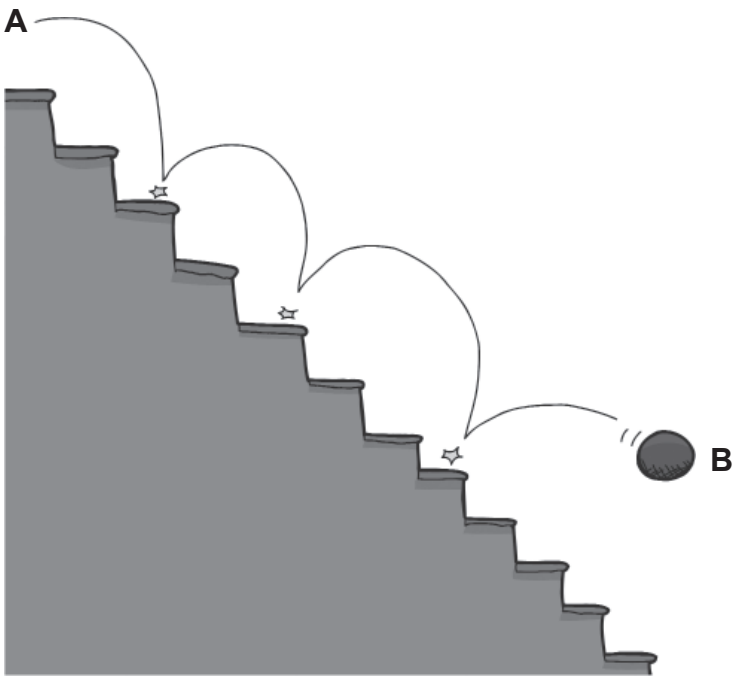
8 **(a)** State the Principle of Conservation of Energy.

_____

_____

_____ [2]

(b) The diagram below shows a ball bouncing down a staircase. It started from rest at position **A**.



(i) Complete the table below by adding ticks (□) to show the form(s) of energy at positions **A** and **B**.

	Potential energy	Kinetic energy
A		
B		

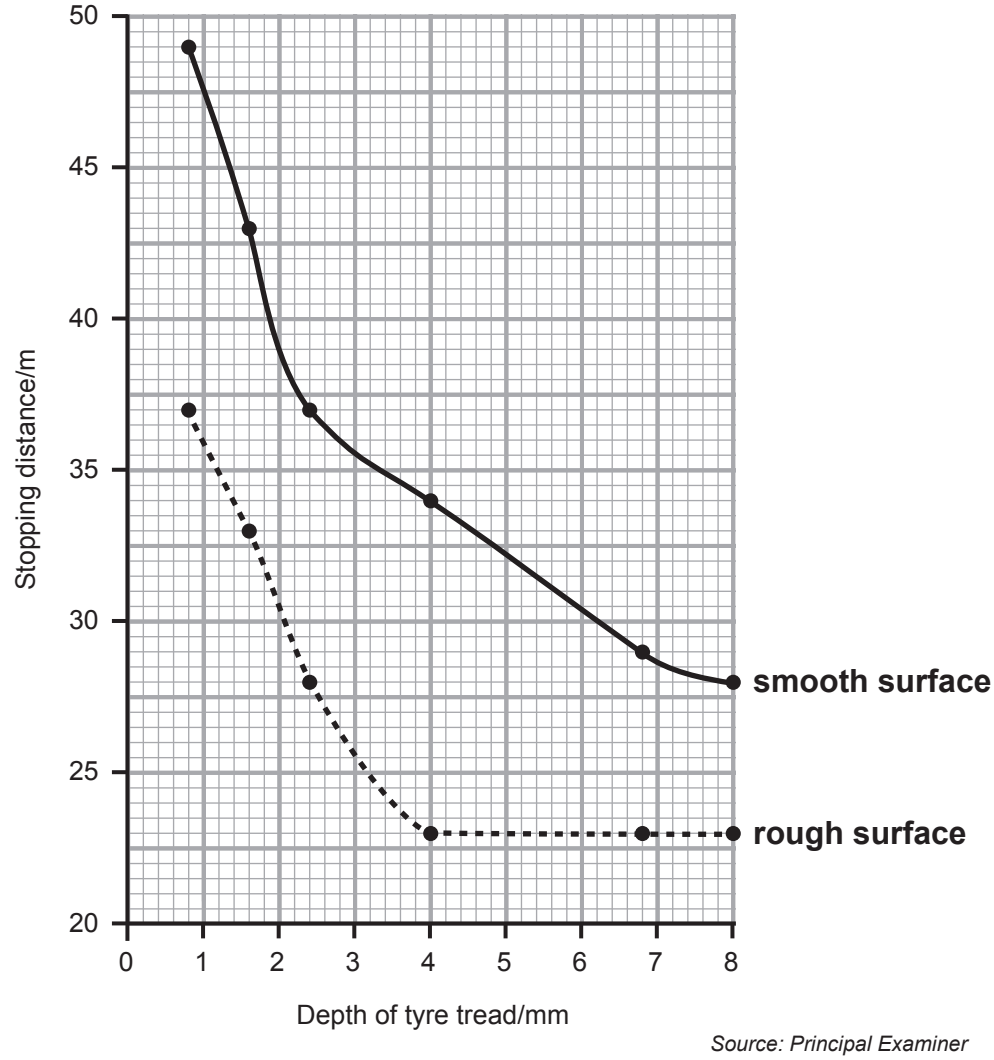
[2]

(ii) Name **one** form of energy that is wasted as the ball bounces down the staircase.

_____ [1]

[Turn over

9 Look at the graph below. It shows how stopping distance for a car is affected by the depth of the tyre tread. There are two different road surfaces.



Source: Principal Examiner

(a) Describe and explain how the depth of tyre tread and road surface affect stopping distance. How is this important for road safety?

Your answer should include:

- conclusions that can be made from this graph;
- a definition of friction;
- a link between friction and stopping distance; and
- a link between stopping distance and road safety.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[6]

(b) Complete the sentences below to show the difference, if any, of driving on a wet road compared to a dry road.

On a wet road the thinking distance will be _____,

the braking distance will be _____ and the overall

stopping distance will be _____. [2]

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For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

Examiner Number