

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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# Level 3 Certificate/Extended Certificate

## APPLIED SCIENCE

Unit 1 Key Concepts in Science  
Section C – Physics

Tuesday 11 June 2019

Afternoon

Time allowed: 1 hour 30 minutes.  
You are advised to spend  
approximately 30 minutes on this  
section.

### Materials

For this paper you must have:

- a calculator
- Formulae Sheet.

### Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in each section.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

### Information

- You will be provided with a copy of the Formulae Sheet.
- There are three sections in this paper:  
**Section A** – Biology      **Section B** – Chemistry      **Section C** – Physics.
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60 and the maximum mark for this section is 20.

### Advice

Read each question carefully.

For Examiner's Use	
Question	Mark
1	
2	
<b>TOTAL</b>	



## Section C – Physics

Answer **all** questions in this section.

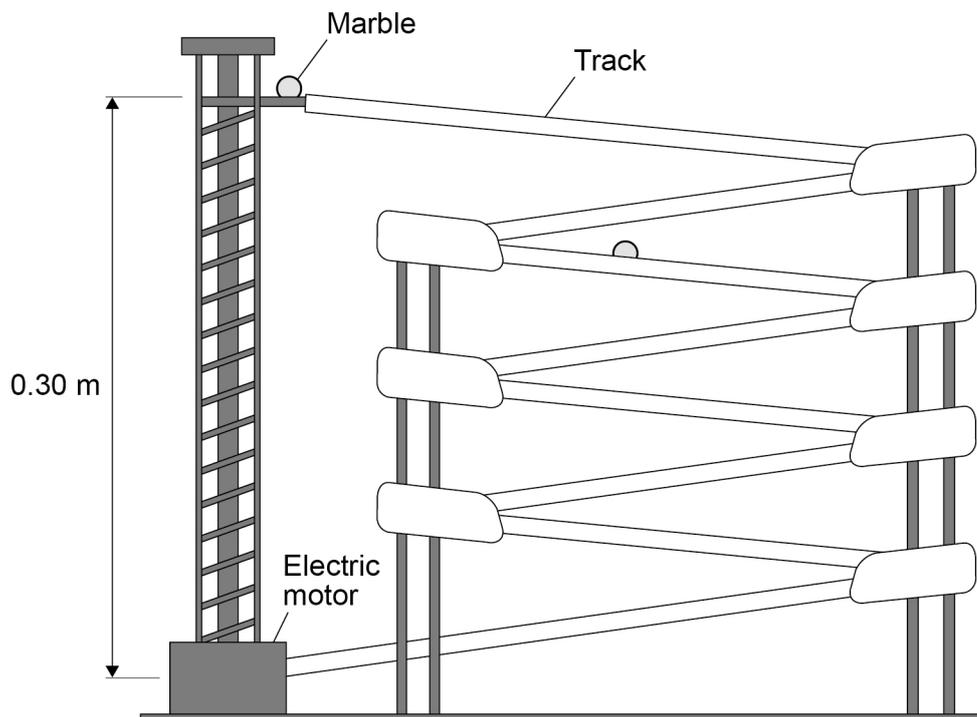
0 1

A product designer has designed a toy ‘roller coaster’.

An electric motor lifts marbles up to the top of the ‘roller coaster’.  
The marbles are released at the top and travel back down to the bottom along a track.

**Figure 1** shows the toy design.

**Figure 1**



0 1 . 1

The electric motor is powered by a battery.

Describe how energy is transferred usefully by the battery and electric motor.

**[3 marks]**

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**0 1 . 2** The voltage across the electric motor is 1.50 V. The current in the electric motor is 0.20 A.

Calculate the power of the electric motor.

[1 mark]

Power of the electric motor = \_\_\_\_\_ W

**0 1 . 3** It takes 4.50 s for a marble to be lifted from the bottom of the 'roller coaster' to the top.

Calculate the energy transferred by the electric motor.

[1 mark]

Energy transferred = \_\_\_\_\_ J

**0 1 . 4** The mass of a marble is 0.015 kg.

Calculate the change in gravitational potential energy of the marble as it is lifted from the bottom of the 'roller coaster' to the top.

Use  $g = 9.8 \text{ m s}^{-1}$

Use information from **Figure 1**.

[2 marks]

Change in gravitational potential energy = \_\_\_\_\_ J

**0 1 . 5** Calculate the efficiency of the electric motor.

[2 marks]

Efficiency = \_\_\_\_\_

**Question 1 continues on the next page**

Turn over ►



0 1 . 6

Give **one** reason why it is important for the efficiency of a system to be maximised.**[1 mark]**

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0 1 . 7

When a marble approaches the bottom of the roller coaster, it is moving at a constant speed.

Name the property of the marble which means it has a tendency to continue in its state of uniform motion.

**[1 mark]**Tick (✓) **one** box.

Action and reaction

Inertia

Momentum

Resistance

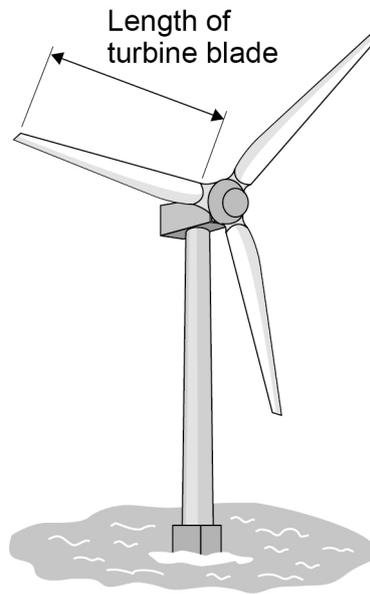
11



0 2

Figure 2 shows an offshore wind turbine.

Figure 2



0 2 . 1

At a wind speed of  $12 \text{ m s}^{-1}$  the mass of air passing through the turbine blades each second is  $3.0 \times 10^5 \text{ kg}$ .

Calculate the kinetic energy of the air passing through the turbine blades each second.

[2 marks]

Kinetic energy of the air = \_\_\_\_\_ J

0 2 . 2

Give **one** advantage and **one** disadvantage of using wind power compared with fossil fuels.

[2 marks]

Advantage \_\_\_\_\_

\_\_\_\_\_

Disadvantage \_\_\_\_\_

\_\_\_\_\_

Question 2 continues on the next page

Turn over ►



**0 2 . 3** **Table 1** shows how the power output of a wind turbine changes with the length of the turbine blades.

**Table 1**

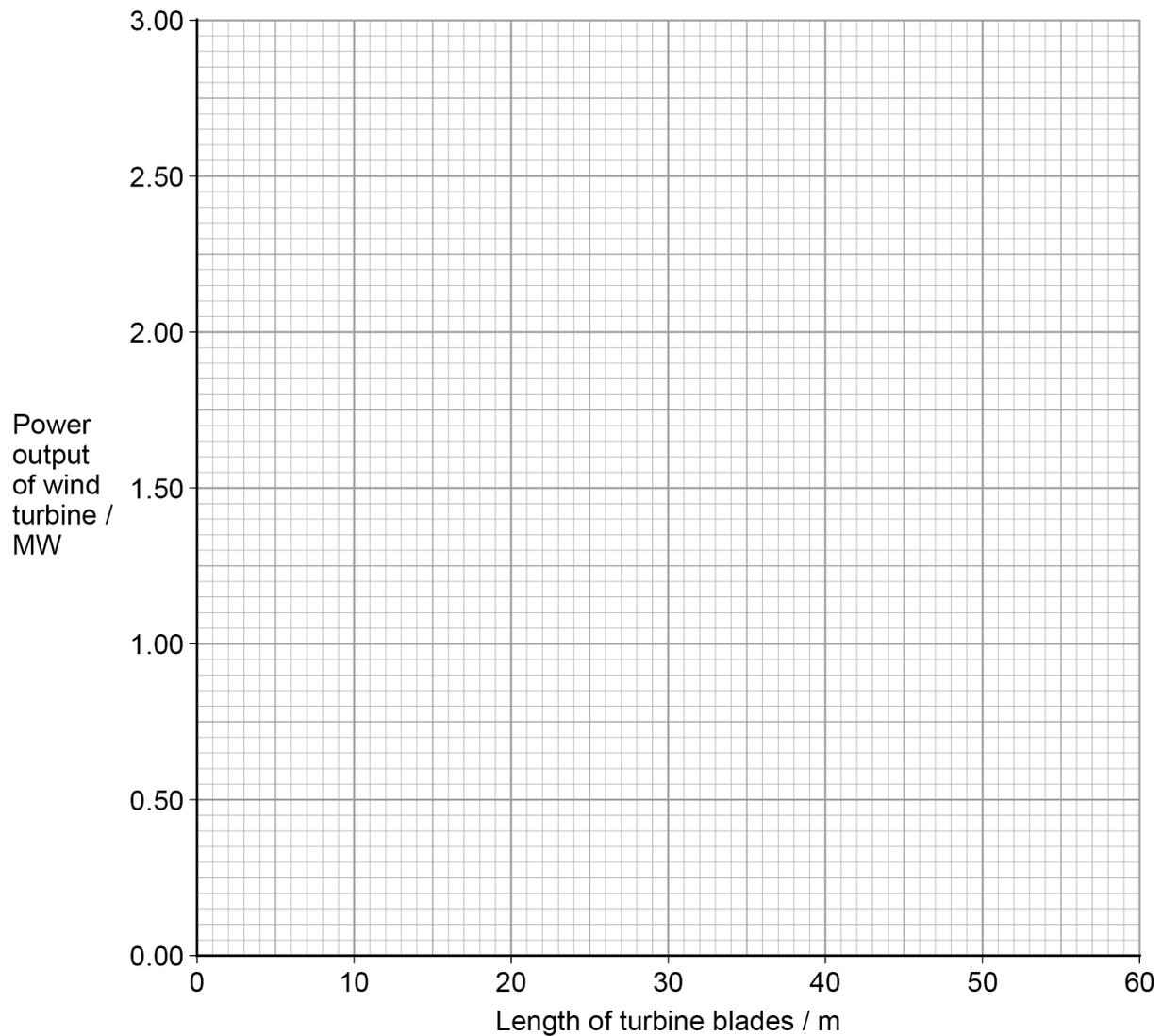
<b>Length of turbine blades / m</b>	10	20	30	40	50	60
<b>Power output of wind turbine / MW</b>	0.08	0.32	0.72	1.28	2.00	2.88

Plot the data from **Table 1** on **Figure 3**.

Draw a line of best fit.

**[2 marks]**

**Figure 3**



0 2 . 4

Describe the relationship between the power output of the wind turbine and the length of the turbine blades.

Use **Figure 3** and data from **Table 1** in your answer.

[3 marks]

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**END OF QUESTIONS**



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outside the  
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ANSWER IN THE SPACES PROVIDED**









