AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

Level 3 Certificate/Extended Certificate

APPLIED SCIENCE

Unit 1 Key Concepts in Science
Section C – Physics

ASC1/P

Tuesday 11 June 2019   Afternoon

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

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

For this paper you must have:
- a calculator
- Formulae Sheet.

INSTRUCTIONS

- Use black ink or black ball-point pen.

- Answer ALL questions in each section.

- You must answer the questions in the spaces provided. Do not write 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.

DO NOT TURN OVER UNTIL TOLD TO DO SO

SECTION C – PHYSICS
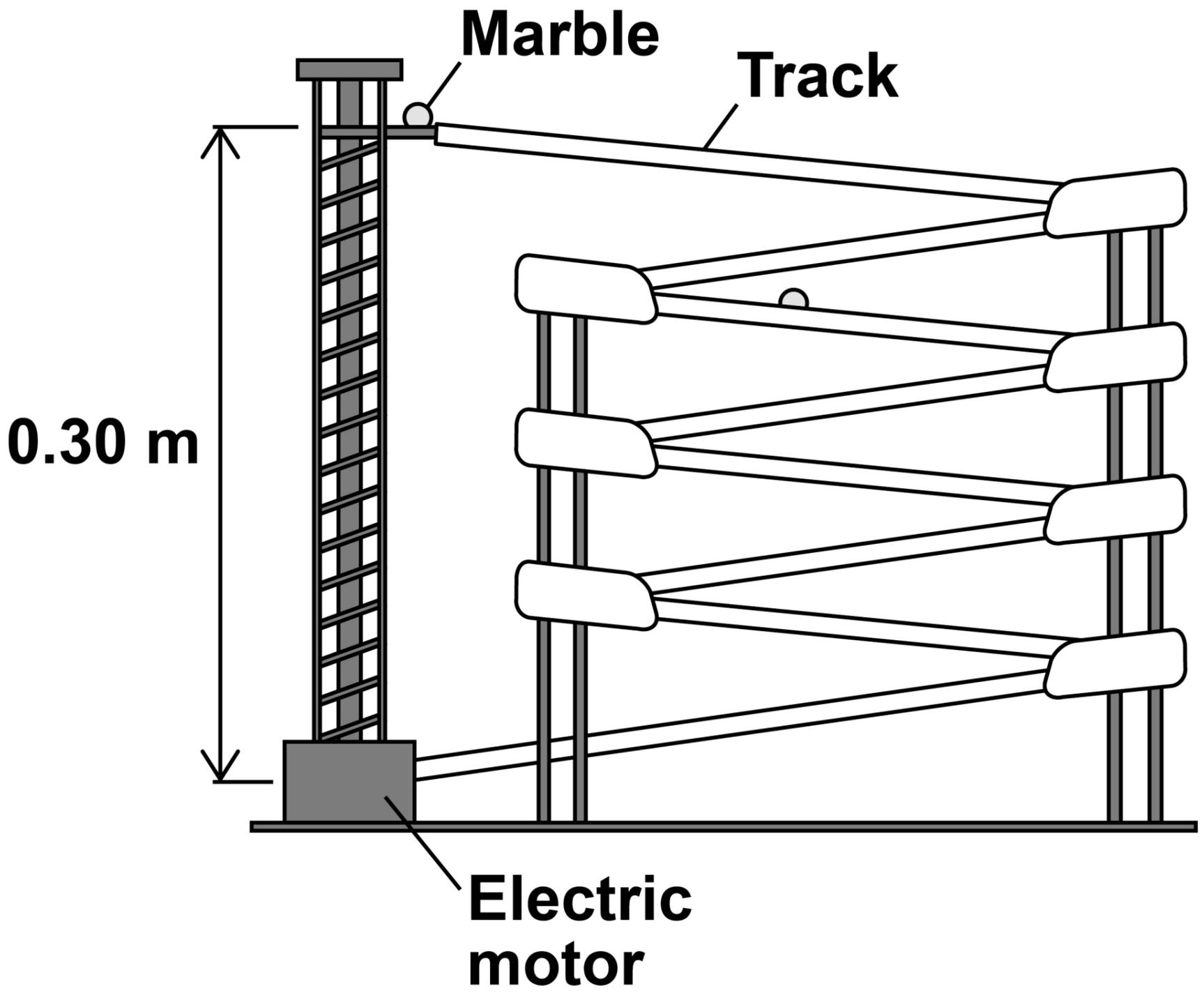
Answer ALL questions in this section.

| 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, on the opposite page, shows the toy design.

FIGURE 1

Marble

Track

0.30 m

Electric motor

[Turn over]

BLANK PAGE

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]

_____

_____

_____

_____

_____

_____

_____

[Turn over]

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

[Turn over]

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 m s^{-1}

Use information from FIGURE 1, on page 5. [2 marks]

Change in gravitational potential energy

= _____ J

0 1 . 5

Calculate the efficiency of the electric motor. [2 marks]

Efficiency = _____

[Turn over]

0 1 . 6

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

_____

_____

_____

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**

[Turn over]

11

0 2

FIGURE 2 shows an offshore wind turbine.

FIGURE 2

Length of turbine blade
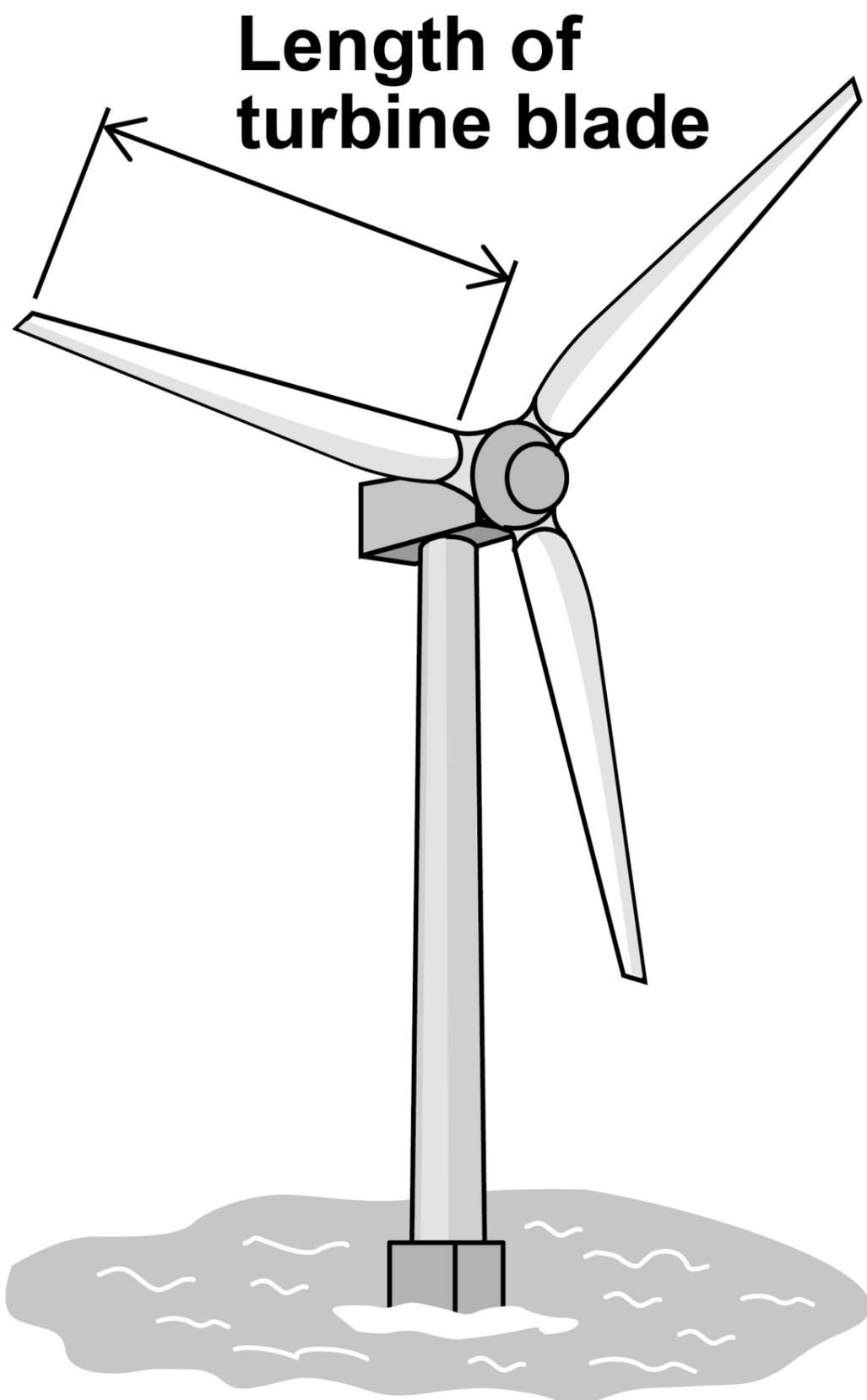
0 2 . 1

At a wind speed of 12 m s⁻¹ the mass of air passing through the turbine blades each second is 3.0 × 10⁵ kg.

Calculate the kinetic energy of the air passing through the turbine blades each second. [2 marks]

Kinetic energy of the air =

_____ **J**

[Turn over]

BLANK PAGE

0 2 . 2

Give ONE advantage and ONE disadvantage of using wind power compared with fossil fuels. [2 marks]

Advantage _____

_____

_____

Disadvantage _____

_____

_____

[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

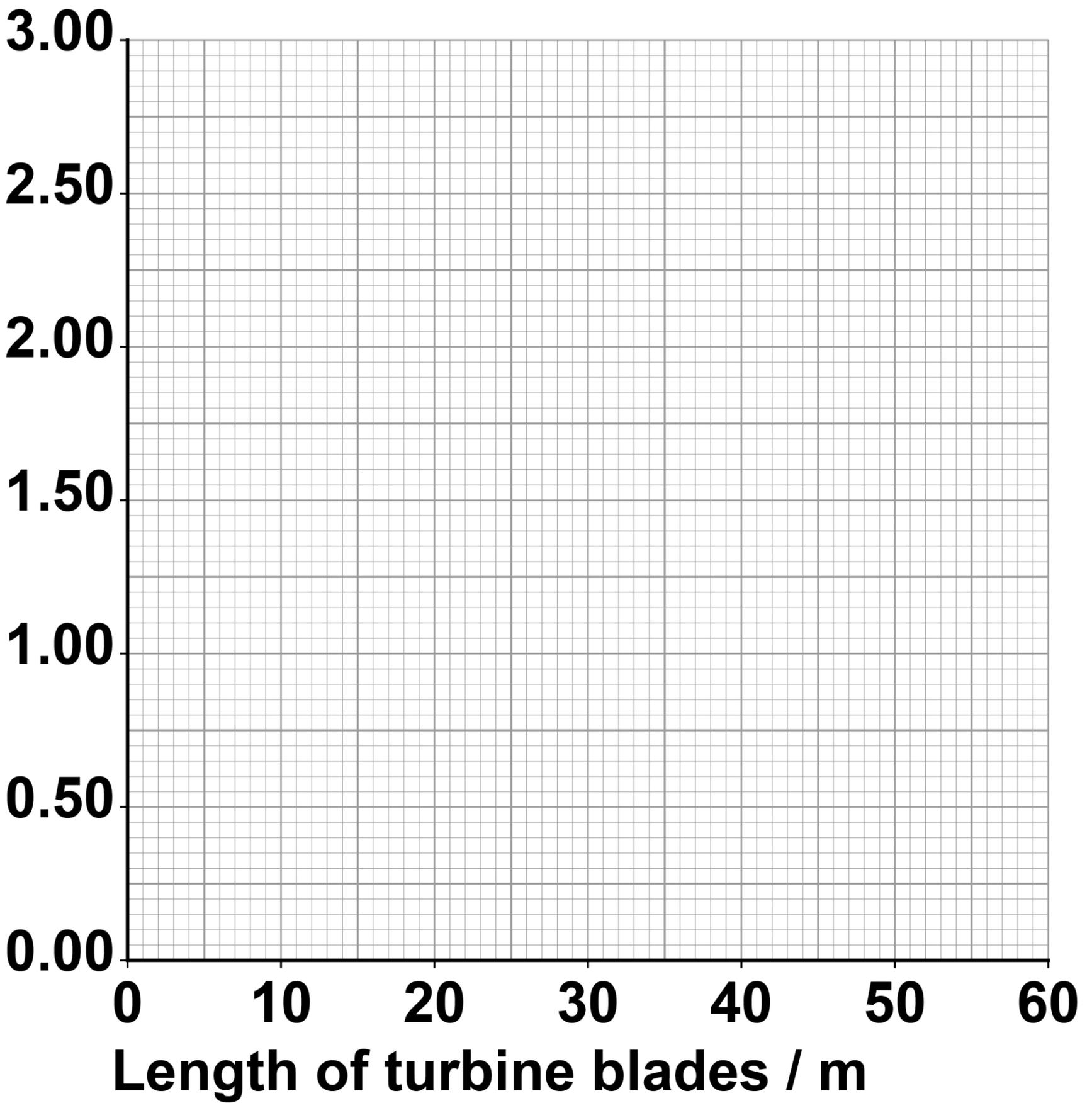| Length of turbine blades / m	Power output of wind turbine / MW
10	0.08
20	0.32
30	0.72
40	1.28
50	2.00
60	2.88

Plot the data from TABLE 1 on FIGURE 3, on the opposite page.

Draw a line of best fit. [2 marks]

FIGURE 3

Power output of wind turbine / MW

Length of turbine blades / m

Repeat of TABLE 1

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

0 2 . 4

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

Use FIGURE 3, on page 19, and data from TABLE 1 in your answer. [3 marks]

_____

_____

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_____

_____

END OF QUESTIONS

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22

Additional page, if required.

Write the question numbers in the left-hand margin.

23

Additional page, if required.

Write the question numbers in the left-hand margin.

24

Additional page, if required.

Write the question numbers in the left-hand margin.

25

Additional page, if required.

Write the question numbers in the left-hand margin.

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