General Certificate of Secondary Education
2015–2016

Double Award Science:
Physics

Unit P1

Foundation Tier

[GSD31]

GSD31

WEDNESDAY 25 MAY 2016, AFTERNOON

TIME

1 hour.

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 blue or black ink only. **Do not write with a gel pen.**
Answer **all eleven** questions.

**INFORMATION FOR CANDIDATES**

The total mark for this paper is 70.
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 **10**.

1 A microphone is **designed** to change sound energy into electrical energy, as shown below.
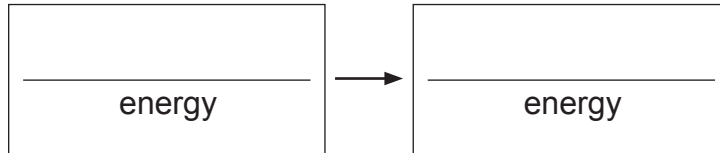
Microphone

Sound		Electrical
energy	→	energy
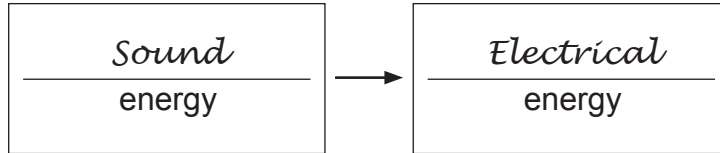
Fill in the spaces below to show the main types of energy change each device is designed to bring about.

(i) Room heater

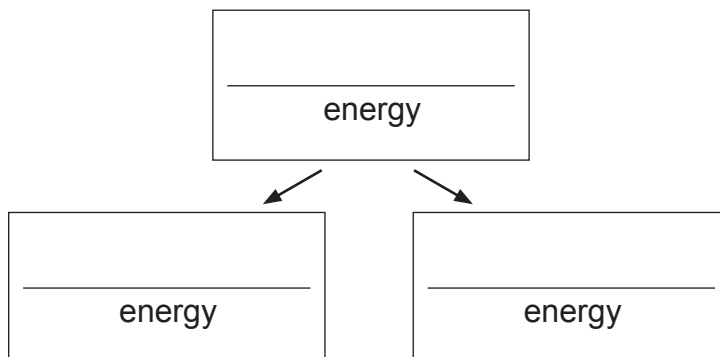| _____		_____
energy	→	energy

[2]

(ii) Match

_____		_____
energy	→	energy

[2]

(iii) Television

_____
energy

_____		_____
energy		energy

[3]

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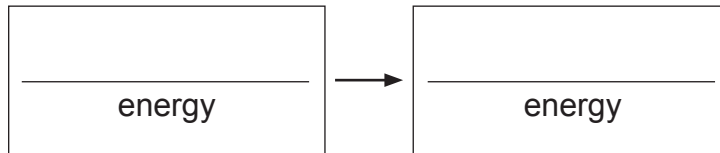
2 The chart below shows the sources of energy used to produce electricity in the U.K.

Source of energy used to produce electricity

14%
35%
26%

■ Gas
☐ Coal
■ Other sources
☐ Nuclear
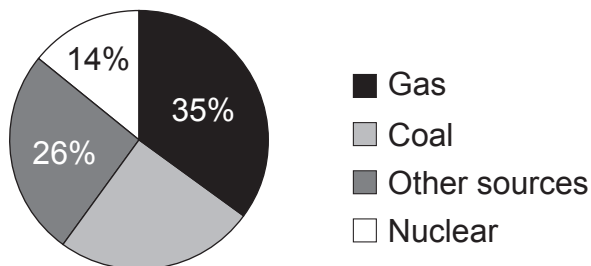
Source: Chief Examiner

(a) Calculate the percentage of the electricity produced from coal.

_____ %   [1]

(b) State one disadvantage, other than cost, of producing electricity from coal.

Disadvantage _____ [1]

Electricity can also be produced from wind energy.

(c) State one advantage and one disadvantage, other than cost, of producing electricity from wind energy.

Advantage: _____ [1]

Disadvantage: _____ [1]

(d) The engine of a crane consumes 5000 J of chemical energy to produce 3000 J of useful output energy. Calculate the efficiency of the engine of the crane.
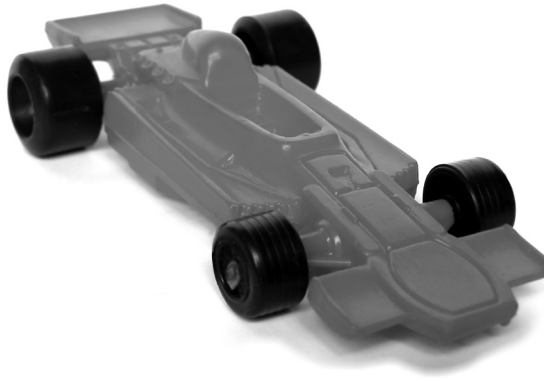
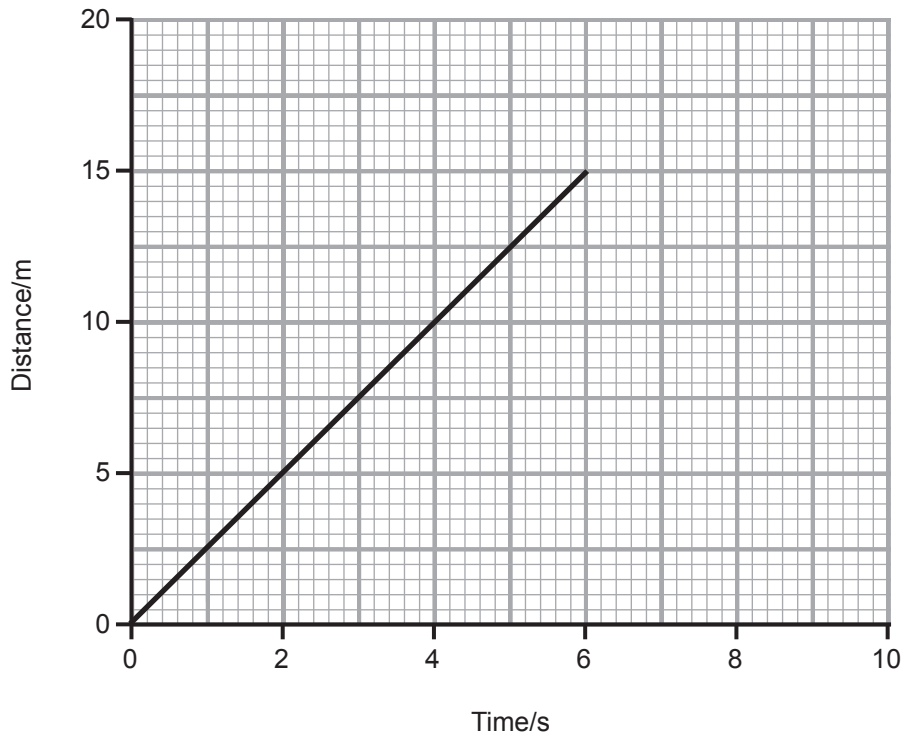**You are advised to show your working out.**

Efficiency = _____   [3]

[Turn over

10179

3 The graph of distance against time for a toy car is shown below.

(a) Use the graph to calculate the speed of the toy car.

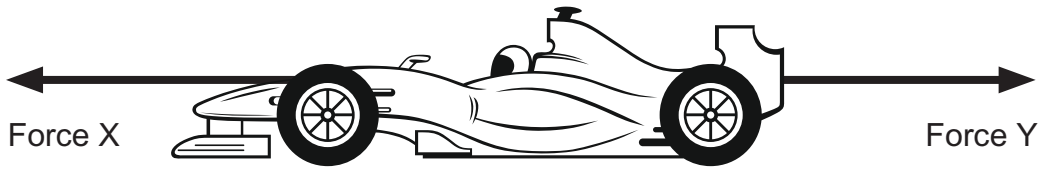**You are advised to show your working out.**

Speed = _____ m/s [3]

(b) The car stops after 6 seconds.
Continue the graph for a further 4 seconds. [1]

[Turn over

4 A racing car travels along a straight racetrack.

Force X ←——————————————————————→ Force Y

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gravity	weight	reaction force
driving force	mass	friction

(a) Select from the box the names of the forces X and Y.

Force X ————————————— Force Y ————————————— [2]

(b) If force X is equal to force Y, what can you say about the speed of the racing car?
Remember the racing car is moving.

————————————————————————————————————— [1]
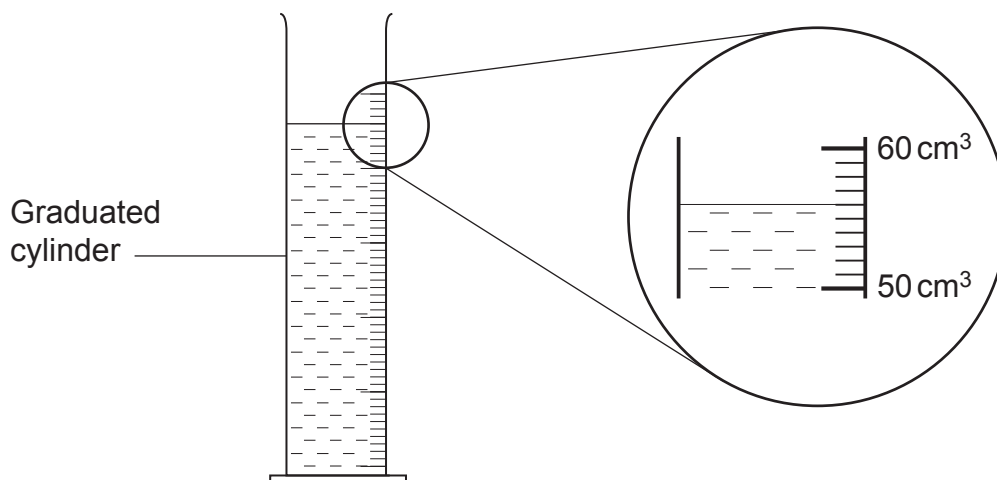
(c) The driver takes his foot off the accelerator pedal and the racing car begins to slow down.
How do the forces X and Y now compare?

————————————————————————————————————— [1]

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5 A student pours 42 g of a liquid into a graduated cylinder and measures its volume.

Graduated
cylinder

60 cm³

50 cm³

Source: Principal Examiner

Use the information given above to calculate the density of the liquid.
Give your answer to 2 decimal places.

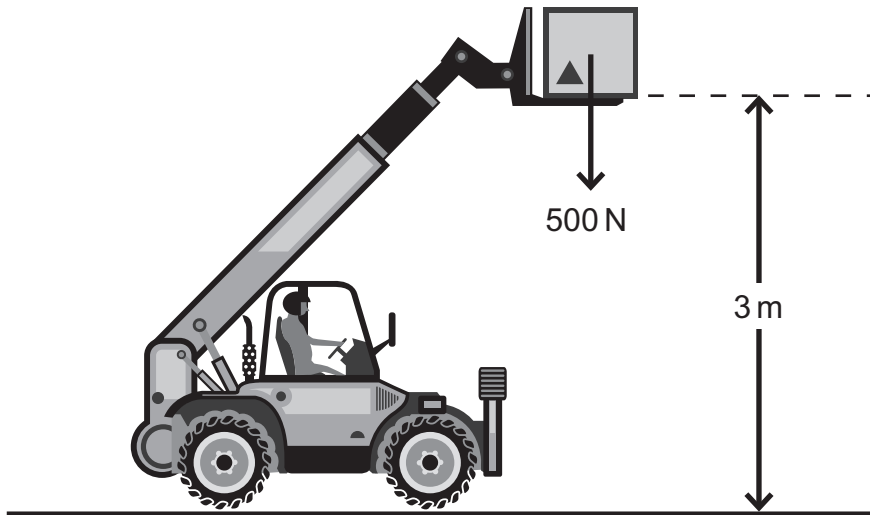Remember to include the unit.

You are advised to show your working out.

Density of liquid = _____ [5]

[Turn over

6 A forklift truck raises a load of 500 N to a height of 3 m above the ground.

© *anton_novik / iStock / Thinkstock*

(a) Calculate the work done lifting the load.

You are advised to show your working out.
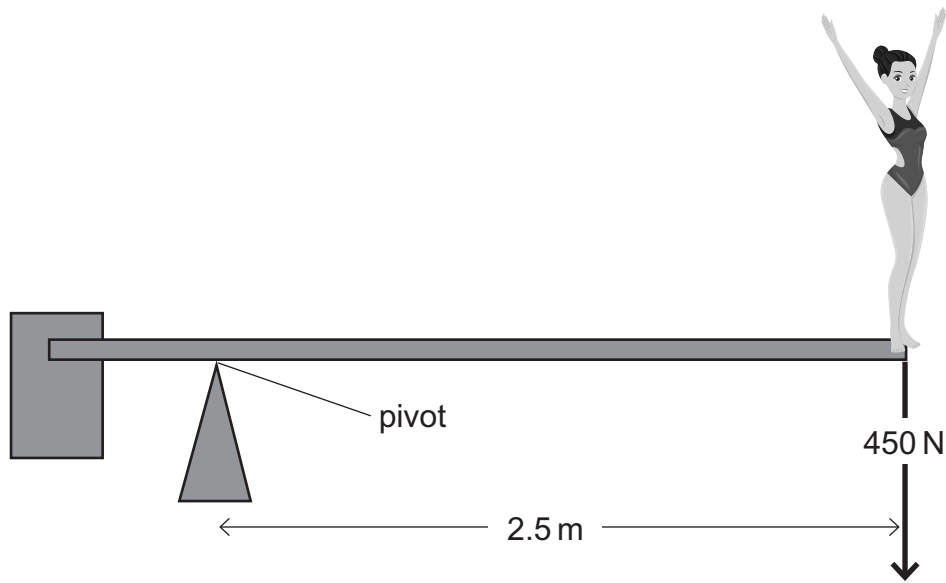
Work = _____ J   [3]

(b) On another occasion, the engine of the forklift truck uses 5000 J of energy in a time of 20 s.

Calculate the power of the engine of the forklift truck.

Give your answer in kilowatts.

You are advised to show your working out.

Power = _____ kW   [4]

7 Deirdre, who has a weight of 450 N, stands at the end of a diving board.

pivot

450 N

2.5 m

(a) Calculate the moment of Deirdre's weight about the pivot when she stands at the end of the diving board.

You are advised to show your working out.

Moment = _____ Nm   [3]

(b) What is Deirdre's mass?

You are advised to show your working out.

Mass = _____ kg   [2]

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(Questions continue overleaf)

8 **(a)** This part of the question is about how mass, speed and radius affect the centripetal force acting on a stone whirled in a horizontal circular plane.

(i) How does the centripetal force depend on the mass of the stone?
Tick (✓) the correct box.

Increases with mass ☐

Remains constant with mass ☐

Decreases with mass ☐ [1]

(ii) How does the centripetal force depend on the speed of the stone?
Tick (✓) the correct box.

Increases with speed ☐

Remains constant with speed ☐

Decreases with speed ☐ [1]

(iii) How does the centripetal force depend on the radius of the circular path?
Tick (✓) the correct box.

Increases with radius ☐

Remains constant with radius ☐

Decreases with radius ☐ [1]

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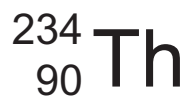**(b)** Calculate the kinetic energy of a snowboarder who has a mass of 50 kg and a speed of 3 m/s.

You are advised to show your working out.

Kinetic energy = _____ J   [3]

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9 **(a)** The symbol for Thorium-234 is

$$^{234}_{90}\text{Th}$$

(i) State the total number of protons and neutrons in a nucleus of Thorium-234.

_____ [1]

(ii) How many protons does a nucleus of Thorium-234 contain?

_____ [1]

(iii) What name is given to the total number of protons and neutrons in the nucleus of Thorium-234?

_____ [1]

(iv) How many neutrons does a nucleus of Thorium-234 contain?

_____ [1]

(b) A radioactive isotope has a half-life of 30 days. Initially there are 64 000 undecayed nuclei. How many undecayed nuclei will remain after 90 days?

You are advised to show your working out.

Number of undecayed nuclei = _____ [3]

10 The modern theory for the structure of the atom is quite different from the earlier theory which it replaced.

Write a brief account of both theories.

Your account should include:

- the name of each theory;
- a description of the structure of the atom in each theory.

You will be assessed on your written communication skills including the use of specialist scientific terms.

_____

_____

_____

_____

_____

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_____

_____

_____

_____

_____

_____ [6]

[Turn over

11 Theory shows that the gravitational potential energy (G.P.E.) of a body depends on its height (h) above the Earth's surface, according to the formula:

**G.P.E. = k h   Equation 11.1**

where k is a constant.

The following table shows the results for the gravitational potential energy (G.P.E.) of an object at different heights above the Earth's surface.

Height/m	0	10	20	30	40	50
G.P.E./J	0	50	100	150	200	250

You are asked to plot a graph of gravitational potential energy against height.

(a) Choose a suitable vertical scale and label its axis.   [2]

(b) Plot the points on the grid of G.P.E. against height above the Earth's surface.   [2]

(c) Draw a line of best fit.   [1]
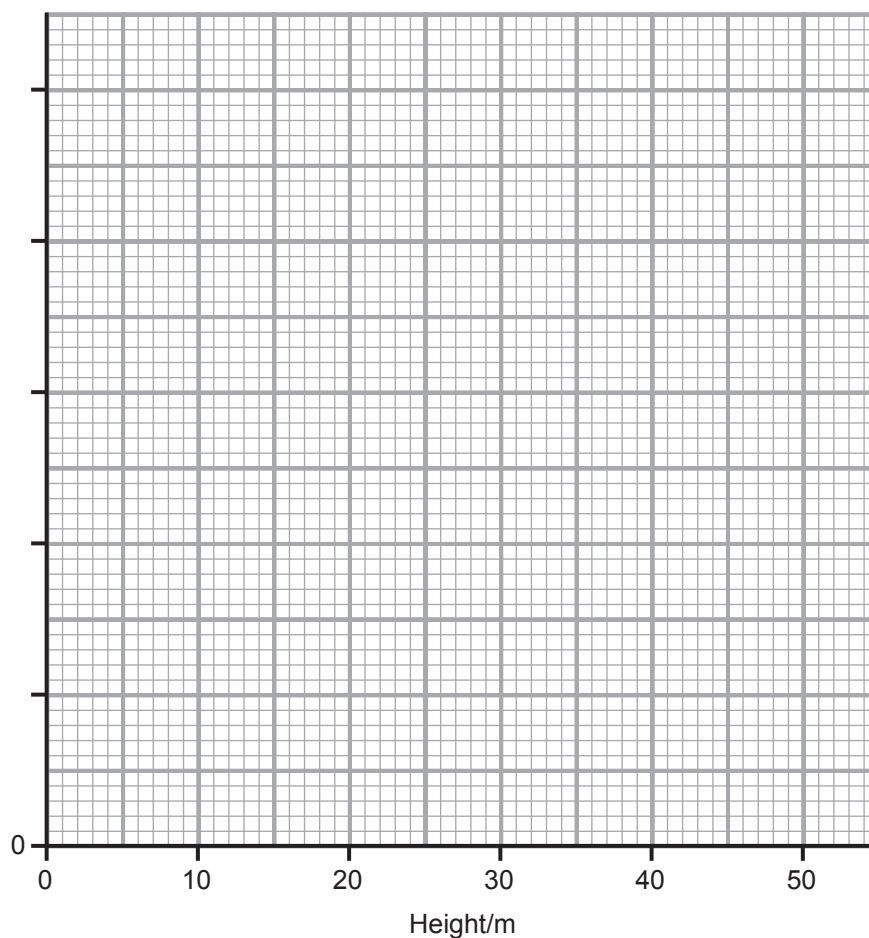
Height/m

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(d) (i) From your graph state the relationship between G.P.E. and height above the Earth's surface.

_____

_____ [1]

(ii) Explain fully how the graph shows this.

_____

_____

_____ [1]

(e) From your graph find the gravitational potential energy when the height is 45 m.

_____ [1]

(f) Use your graph to determine the constant k, in **Equation 11.1**.
Remember to include the units for k.

You are advised to show your working out.

k = _____   Units = _____ [4]

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
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6	
7	
8	
9	
10	
11	
Total Marks	

Examiner Number

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