Write your name here

Surname	Other names

Pearson Edexcel Certificate
Pearson Edexcel
International GCSE

Centre Number	Candidate Number

Physics

Unit: KPH0/4PH0
Science (Double Award) KSC0/4SC0
Paper: 1P

Wednesday 25 May 2016 – Afternoon
Time: 2 hours

Paper Reference
KPH0/1P 4PH0/1P
KSC0/1P 4SC0/1P

You must have:
Ruler, calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

PEARSON

EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time	$E = I \times V \times t$
pressure × volume = constant	$p_1 \times V_1 = p_2 \times V_2$
$\text{frequency} = \dfrac{1}{\text{time period}}$	$f = \dfrac{1}{T}$
$\text{power} = \dfrac{\text{work done}}{\text{time taken}}$	$P = \dfrac{W}{t}$
$\text{power} = \dfrac{\text{energy transferred}}{\text{time taken}}$	$P = \dfrac{W}{t}$
$\text{orbital speed} = \dfrac{2\pi \times \text{orbital radius}}{\text{time period}}$	$v = \dfrac{2 \times \pi \times r}{T}$

Where necessary, assume the acceleration of free fall, $g = 10\ \text{m/s}^2$.

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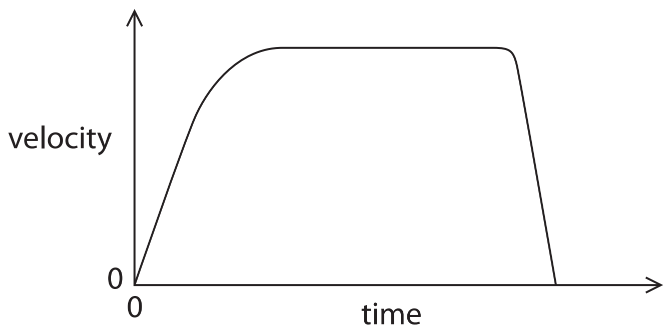
Answer ALL questions.

1 A toy car rolls down a ramp and hits a cushion.

The graph shows how its velocity changes with time.



(a) Constant velocity on the graph is shown by

(1)

☒ **A** the area under the line

☒ **B** the horizontal part of the line

☒ **C** the sloping line at the end

☒ **D** the sloping line at the start

(b) The distance travelled is shown by

(1)

☒ **A** the area under the line

☒ **B** the horizontal part of the line

☒ **C** the sloping line at the end

☒ **D** the sloping line at the start

(c) The average velocity of the toy car is given by

(1)

☒ **A** the change in velocity divided by the time taken

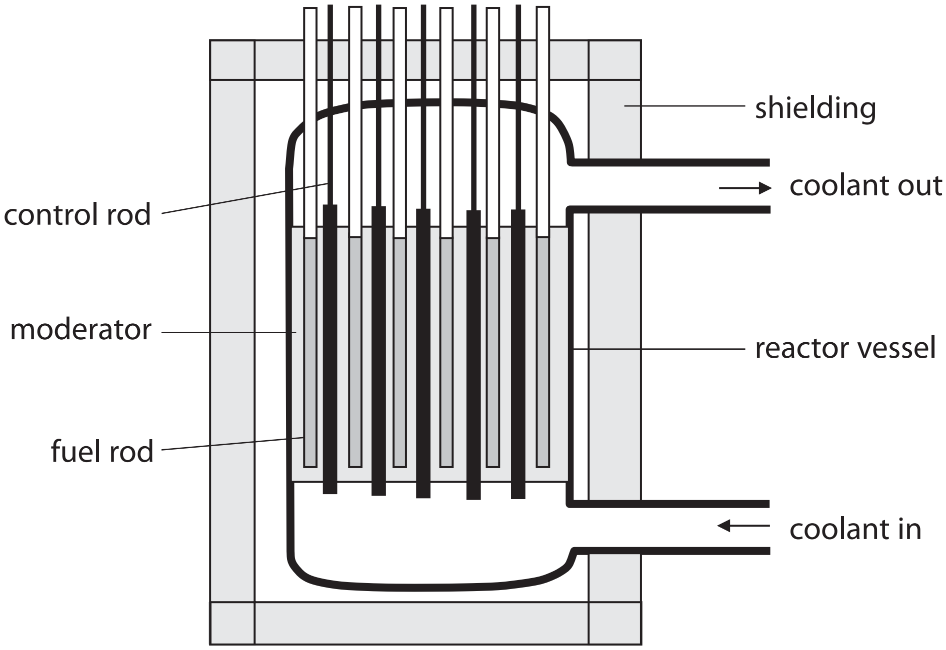
☒ **B** the distance moved divided by the time taken

☒ **C** the time taken divided by the change in velocity

☒ **D** the time taken divided by the distance moved

(Total for Question 1 = 3 marks)

2 The diagram shows the main parts of a nuclear reactor.



(a) Draw a line linking each part of the reactor with its main function.

The first one has been done for you.

(2)

part of reactor	**main function**
control rod ● ——————	● controls the rate of fission
coolant ●	● absorbs dangerous radiation
fuel rod ●	● contains uranium for fission
shielding ●	● removes energy from the reactor

(b) State the type of energy released in a fission reaction.

(1)

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(c) Explain the role of the moderator in a fission reaction.

(2)

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(d) Explain, in terms of neutrons, what is meant by controlled nuclear fission.

(3)

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(Total for Question 2 = 8 marks)

3 Different types of waves are used in hospitals.

(a) Some of the waves used are electromagnetic.

(i) Which of these properties is the same for all electromagnetic waves? **(1)**

☒ **A** amplitude

☒ **B** frequency

☒ **C** speed in free space

☒ **D** wavelength in free space

(ii) Draw a line linking each type of electromagnetic wave with its use. **(2)**

type of electromagnetic wave	**use**
gamma rays	heating food for patients
microwaves	imaging broken bones
x-rays	with medical tracers

(iii) Electromagnetic waves are transverse.

Describe how the vibrations of a transverse wave relate to the direction in which the wave travels.
You may draw a diagram to help your answer. **(1)**

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(b) Another type of wave used in hospitals is ultrasound.

Ultrasound waves are used to make images of internal organs.

A scanner emits an ultrasound wave into the patient and records any reflections.

(i) The frequency of ultrasound waves is outside the range of human hearing.

Which of these could be the frequency of an ultrasound wave?

(1)

☒ **A** 45 Hz

☒ **B** 450 Hz

☒ **C** 4 500 Hz

☒ **D** 45 000 Hz

(ii) The scanner records the time from when a wave is emitted to when its reflection is received.

A technician calculates the depth of the reflection using the equation

$$\text{depth} = \tfrac{1}{2} \times \begin{matrix}\text{speed of ultrasound}\\ \text{in patient}\end{matrix} \times \begin{matrix}\text{time recorded}\\ \text{by scanner}\end{matrix}$$

Explain why the technician uses the value $\frac{1}{2}$ in the equation.

(2)

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(iii) An ultrasound wave travels faster in the patient than it does in air.

Explain how a change in speed affects the wavelength of the ultrasound wave.

(2)

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(Total for Question 3 = 9 marks)

4 A diver works in the sea on a day when the atmospheric pressure is 101 kPa and the density of the seawater is 1028 kg/m^3.

(a) The diver uses compressed air to breathe under water.

1700 litres of air from the atmosphere is compressed into a 12-litre gas cylinder.

The compressed air quickly cools to its original temperature.

Calculate the pressure of the air in the cylinder.

(3)

pressure = ... kPa

(b) (i) State the equation linking pressure difference, depth, density and g.

(1)

(ii) Calculate the increase in pressure when the diver descends from the surface to a depth of 11 m.

(2)

increase in pressure = ... kPa

(iii) Calculate the total pressure on the diver at a depth of 11 m.

Assume that the atmospheric pressure remains at 101 kPa.

(1)

total pressure = ... kPa

(c) As the diver breathes out, bubbles of gas are released and rise to the surface.

The bubbles increase in volume as they rise.

Explain this increase in volume.

(2)

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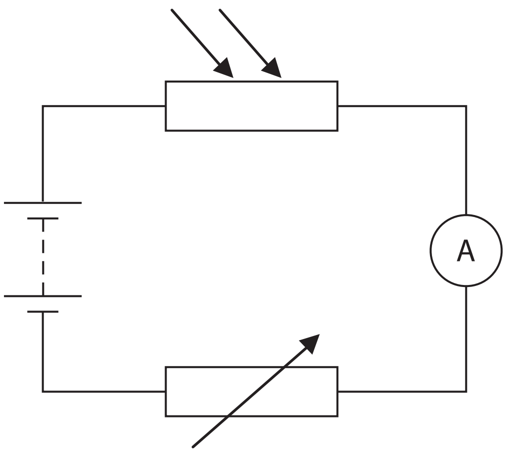
(Total for Question 4 = 9 marks)

5 The resistance of a Light Dependent Resistor (LDR) is affected by the amount of light that shines on it.

A student investigates this relationship using the circuit shown.



(a) (i) The student uses a voltmeter to measure the voltage across the LDR.

Add this voltmeter to the circuit diagram.

(2)

(ii) Explain how the student can work out the resistance of the LDR using this circuit.

(2)

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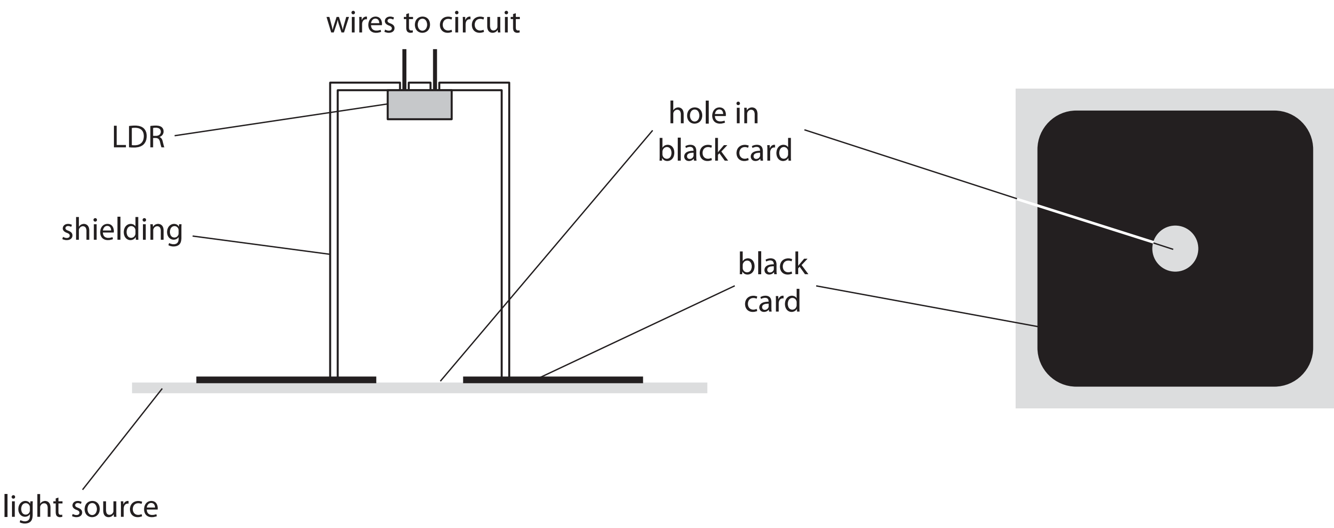
(b) The student shines light on the LDR through a circular hole in a piece of black card, as shown in the diagram.

The student repeats the experiment using cards with holes of different diameter.

The distance from the card to the LDR is always 5 cm.

The student varies the current in the circuit by adjusting the variable resistor.



(i) The independent variable in this experiment is **(1)**

☒ **A** the brightness of the light source

☒ **B** the diameter of the hole

☒ **C** the distance from the card to the LDR

☒ **D** the resistance of the LDR

(ii) A controlled variable in this experiment is **(1)**

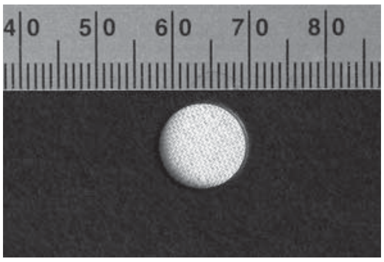
☒ **A** the current in the circuit

☒ **B** the diameter of the hole

☒ **C** the distance from the card to the LDR

☒ **D** the resistance of the LDR

(iii) The photograph shows how the student places a metal ruler to measure the diameter of one of the holes.



Suggest how the student can improve this technique while still using the same ruler.

(1)

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(c) The table shows the student's results.

Diameter of hole in mm	Resistance of LDR in Ω
8	1050
10	890
15	640
20	490
23	430
30	340

(i) Plot the student's results on the grid.

(4)

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

(1)

(iii) Describe the relationship between the resistance of the LDR and the diameter of the hole.

(2)

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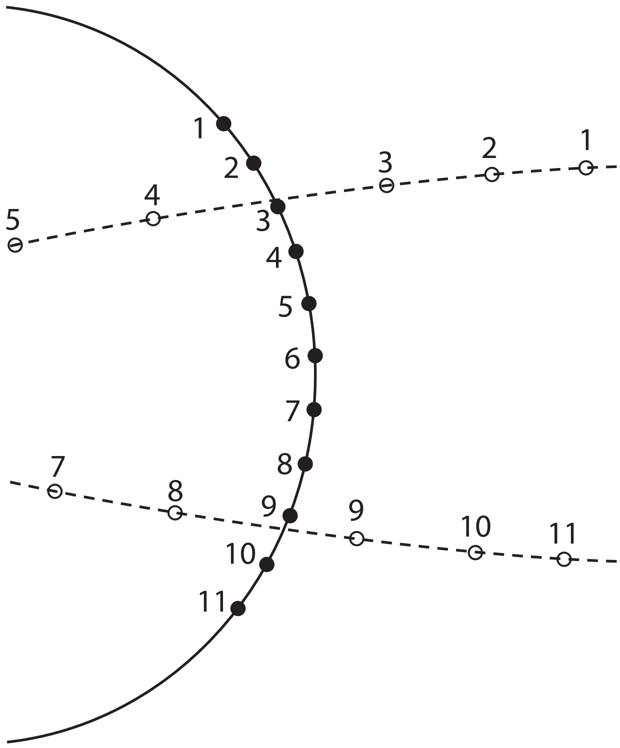
(Total for Question 5 = 14 marks)

6 A comet passes close to the Earth.

An astronomer observes the position of the comet and the Earth on the same day each week for several weeks.

(a) The diagram shows her observations for weeks 1 to 11.



Path of Earth	———————
Path of comet	- - - - - - - - - -
Position of Earth week 1	1●
Position of comet week 1	1○

(i) Complete the path for the comet between week 5 and week 7. **(1)**

(ii) Mark an X on the diagram to show the position of the Sun. **(1)**

(iii) Suggest why the astronomer did not observe the comet during week 6. **(1)**

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(iv) The observation showing the comet nearest to the Earth was made during **(1)**

☒ **A** week 7

☒ **B** week 8

☒ **C** week 9

☒ **D** week 10

(v) Explain how the diagram shows that the speed of the comet changes as it moves from position 1 to position 5. **(2)**

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(vi) Suggest why the speed of the comet changes. **(1)**

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(b) The Earth orbits the Sun once in 365 days.

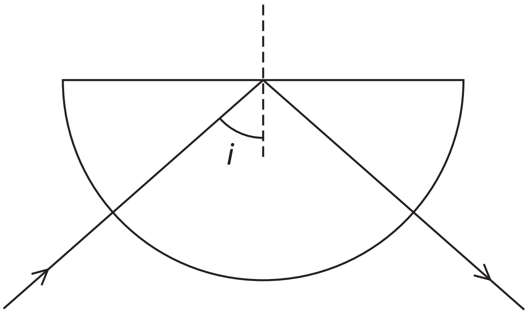
The radius of the Earth's orbit is 150 000 000 km.

Calculate the orbital speed of the Earth in kilometres per hour. **(3)**

orbital speed = ... kilometres per hour

(Total for Question 6 = 10 marks)

7 A student watches a demonstration of the total internal reflection of light in a semicircular glass block.



i = angle of incidence

(a) He takes notes, but some of his notes are wrong.

Place a tick (✓) or a cross (✗) in the table to show which statements are right or wrong.

The first statement is right and has been done for you.

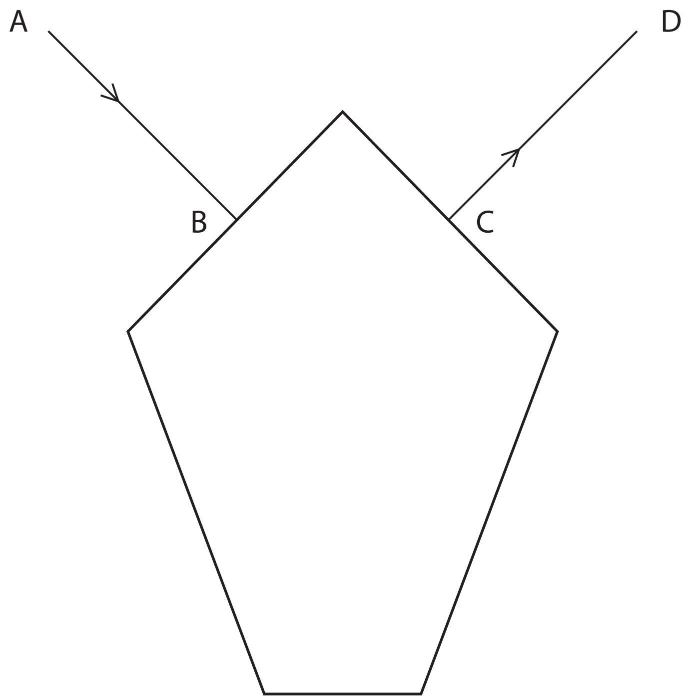
(2)

Notes about the total internal reflection of light	Right or wrong
the angle of incidence equals the angle of reflection	✓
light changes speed when it is internally reflected	
every ray entering the semicircular glass block is reflected by total internal reflection	
if *i* = 0 then the ray does not deviate	
the refractive index of glass is bigger than the refractive index of air	

(b) Jewellers cut jewels so that total internal reflection is more likely.

Light enters a jewel along the normal AB and leaves along the normal CD as shown.

Between B and C there are **two** total internal reflections.



Complete the path of the light through the jewel.

(3)

(c) (i) Show, by calculation, that the critical angle for a refractive index of 1.5 is about 42°.

(3)

(ii) Explain why the quantity called refractive index has no unit.

(2)

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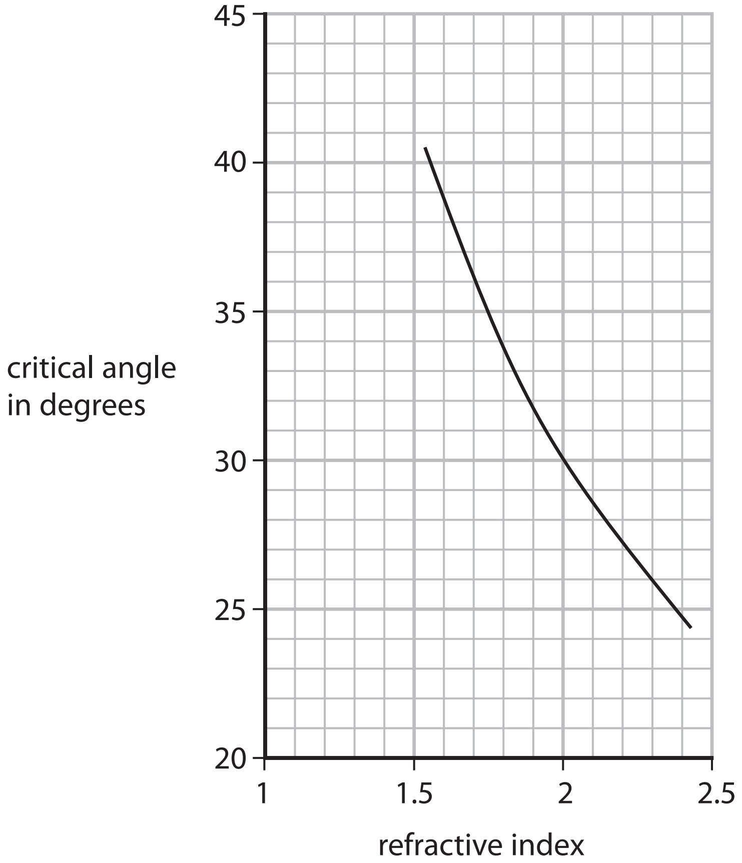
(d) The graph shows how critical angle varies with refractive index.

(i) Add the point (1.5, 42°) to the graph.

(1)



(ii) How can you tell that the point (1.5, 42°) is **not** anomalous?

(1)

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(iii) Suggest two reasons why the axes of the graph do not start from zero.

(2)

1 ....

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2 ....

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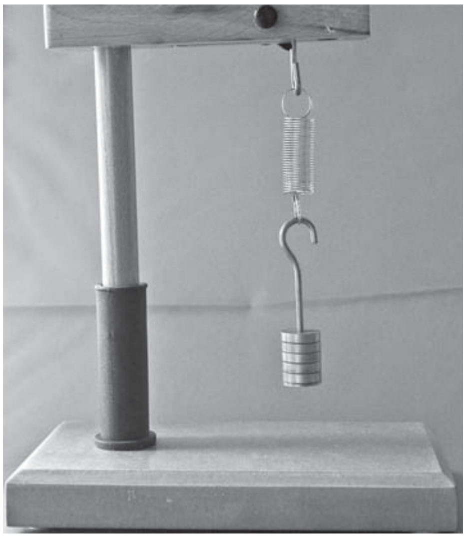
(Total for Question 7 = 14 marks)

8 A student investigates whether a spring obeys Hooke's law.

She uses the apparatus shown in the photograph.



(a) Which additional measuring instrument does the student need for the investigation? **(1)**

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(b) Explain how the student can investigate whether the spring obeys Hooke's law. **(5)**

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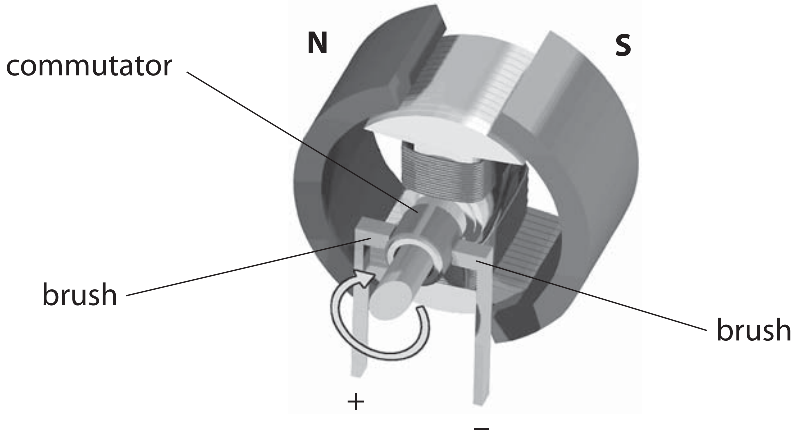
(Total for Question 8 = 6 marks)

9 The diagram shows an electric motor.



(a) This electric motor needs a direct current (d.c).

(i) Explain what is meant by the term direct current.

(1)

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(ii) Explain the purpose of the brushes and the commutator in a d.c. motor.

(3)

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(iii) The motor turns clockwise when the direction of the current goes from + to – .

State what happens to the motor when both the magnetic field and the current are reversed.

(1)

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(b) The photograph shows a machine at a coal mine.

© Andrew Curtis

The machine lifts up containers of coal from the mine and lowers empty containers down.

The machine uses an electric motor connected to a 600 V d.c. supply.

The maximum current in the motor is 4000 A.

(i) State the equation linking power, current and voltage.

(1)

(ii) Calculate the maximum power available from the motor.

(2)

maximum power = ... MW

(c) The machine lifts a load weighing 400 000 N through 190 m.

(i) State the relationship between work done, force and distance moved.

(1)

(ii) Calculate the work done on the load.

(2)

work done on load = ... J

(d) The machine uses an average (mean) power of 1.9 MW to do 67 MJ of work.

(i) Calculate the time needed to do this work.

(3)

time = ... s

(ii) State the effect of using a lower average power to do this work.

(1)

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(Total for Question 9 = 15 marks)

10 A student measures the circumference of a circular pipe.

He wraps a length of string around the pipe five times and marks it with ink, as shown in the photograph.

(a) The student unwraps the string and holds it against a ruler with a centimetre scale. The next photograph shows the first two ink marks on the string.

(i) Estimate the circumference of the pipe, using the photograph of the string and the centimetre scale.

Give your answer to two significant figures.

(2)

estimated circumference = ... cm

(ii) The student finds that the total length of string for 5 turns is 25.6 cm.

Calculate the average (mean) circumference of the pipe using this value.

(1)

average circumference = ... cm

P 4 5 6 9 1 R A 0 2 4 3 6

(iii) The student measures the **diameter** of the pipe using a digital calliper.

The calliper shows that the diameter is 15.10 mm.

Calculate the circumference of the pipe using the formula

$$\text{circumference} = \text{diameter} \times \pi$$

(2)

calculated circumference = ... cm

(b) The student uses two methods to find the circumference

- averaging, using a measured length of string
- calculating, using the digital calliper reading

Explain why the two methods are likely to give different results.

(4)

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(Total for Question 10 = 9 marks)

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11 An underground train enters a station.

© Tom Page

(a) The mass of the train and its passengers is 250 000 kg.

The total kinetic energy is 18 MJ.

(i) State the relationship between kinetic energy (KE), mass and velocity.

(1)

(ii) Calculate the velocity of the train as it enters the station.

(3)

velocity = ... m/s

(iii) The driver applies the brakes to stop the train.

State what happens to the kinetic energy of the train.

(1)

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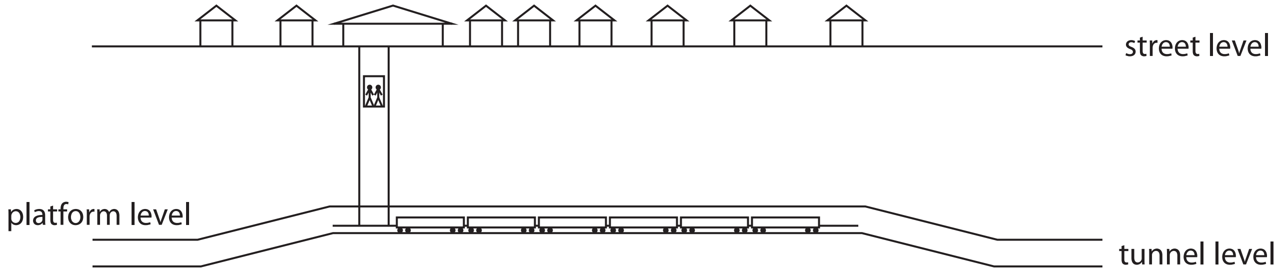
(b) The diagram shows a section through the station.



(i) The passengers who use the station are carried from platform level to street level in a lift.

Explain why these passengers gain gravitational potential energy in the lift, even when they are below ground.

(2)

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(ii) The tunnel is designed so that the trains go up a slope as they enter the station and go down a slope as they leave.

The driver uses brakes to stop the train in the station and a motor to make the train move away.

Explain how the sloping parts of the tunnel affect the amount of work that needs to be done on the train by the brakes and by the motor.

(4)

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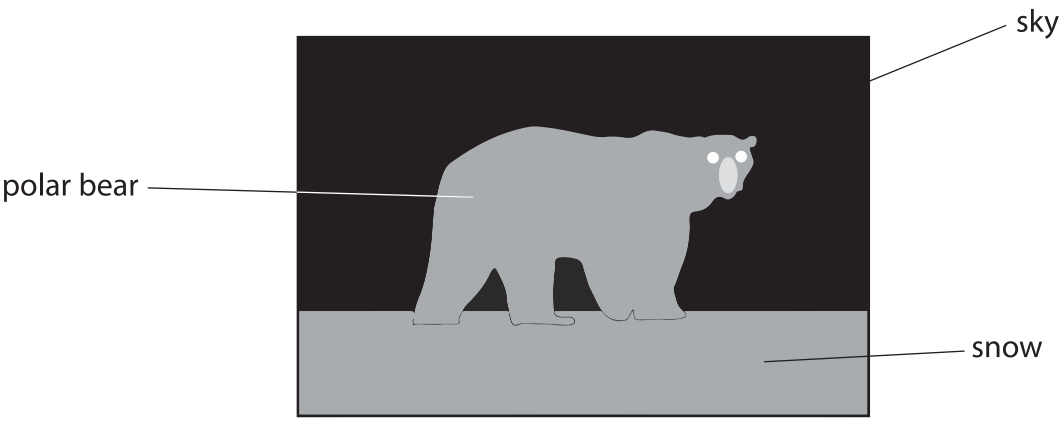
(Total for Question 11 = 11 marks)

12 Polar bears have thick fur to keep them warm.

(a) This photograph of a polar bear was taken using visible light.

The diagram shows a thermal image of the same scene.



Darker colours in this image indicate lower temperatures.

Discuss what information the image gives about the temperatures of the objects shown.

(2)

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(b) The polar bear's fur includes short hairs and longer hairs.

These longer hairs are hollow and contain air.

(i) Explain how its fur reduces the amount of thermal energy lost by the polar bear.

(2)

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(ii) Underneath its white fur, a polar bear has black skin.

Discuss how these colours affect the overall amount of thermal energy lost by the polar bear's body.

(3)

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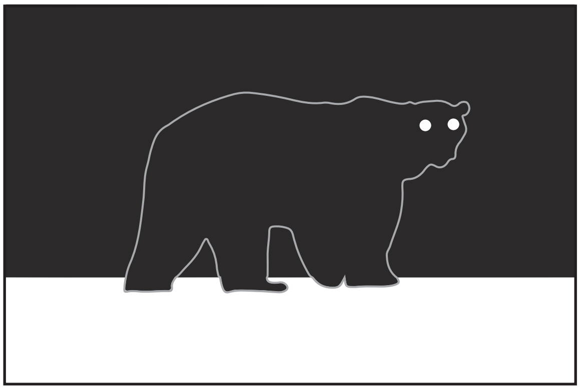
(c) The diagram shows another image of the same scene.



The image was made during the day using ultraviolet rays from the Sun.

Brighter colours in this image indicate larger amounts of ultraviolet radiation.

The grey line is added to show the position of the polar bear.

(i) Compare the absorption and reflection of ultraviolet rays by the objects shown in the image.

(2)

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(ii) Suggest why the sky appears dark, even though the Sun emits ultraviolet rays.

(1)

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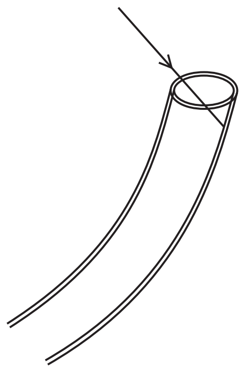
(iii) The hollow hairs in polar bear fur are transparent tubes filled with air.

It was thought that these hairs could act like optical fibres and guide ultraviolet rays down to the polar bear's skin.

It is now known that this idea is **incorrect**. The ultraviolet rays do **not** reach the polar bear's skin.

The diagram shows an ultraviolet ray entering the air inside a hollow hair.



Suggest why this radiation does not pass down to the polar bear's skin.

(2)

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(Total for Question 12 = 12 marks)

TOTAL FOR PAPER = 120 MARKS

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