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IGCSE

Physics

Sample Assessment Materials (SAMs)

Edexcel IGCSE in Physics (4PH0)

First examination 2011

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We will inform centres of any changes to this issue. The latest issue can be found on the Edexcel website: www.edexcel.org.uk.

Acknowledgements

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Authorised by Roger Beard
Prepared by Phil Myers

Contents

Introduction

These sample assessment materials have been prepared to support the specification.

The aim of these materials is to provide students and centres with a general impression and flavour of the actual question papers and mark schemes in advance of the first operational examinations.

Sample question papers

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						4	P	H	0	/	1	P	Signature	

Paper Reference(s)

4PH0/1P

Edexcel IGCSE

Physics

Physics Paper 1

Sample Assessment Material

Time: 2 hours

Materials required for examination
Ruler, protractor, calculator

Items included with question papers
Nil

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Show all the steps in any calculations and state the units. Calculators may be used.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 16 questions in this question paper. The total mark for this paper is 120.
There are 28 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

Write your answers neatly and in good English.

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N 3 5 0 5 5 A 0 1 2 8

Turn over

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EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time $E = I \times V \times t$

pressure × volume = constant $p_1 \times V_1 = p_2 \times V_2$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

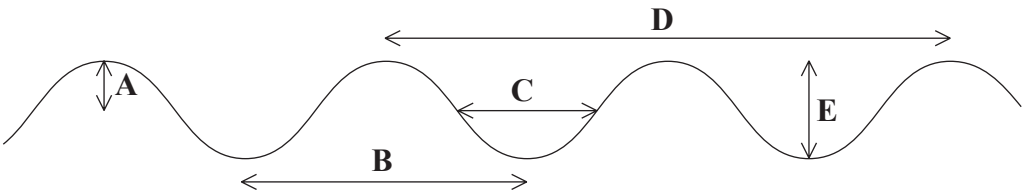
$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad V = \frac{2 \times \pi \times r}{T}$$

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

Leave blank

Answer ALL questions

1. The diagram shows waves on the surface of a lake.



(a) State which letter, **A**, **B**, **C**, **D** or **E**, shows the following

(i) the amplitude of the waves .....

(1)

(ii) the wavelength of the waves .....

(1)

(b) Choose words from the box to complete the sentences.

amplitude	**frequency**	**longitudinal**	**period**	**transverse**	**wavelength**

(i) The number of waves per second is the .....

(1)

(ii) The time taken for each wave is its .....

(1)

(c) (i) Water waves are transverse waves. State **two** other examples of transverse waves.

1 .....

2 .....

(2)

(ii) Some waves are not transverse waves. Name these types of waves.

.....

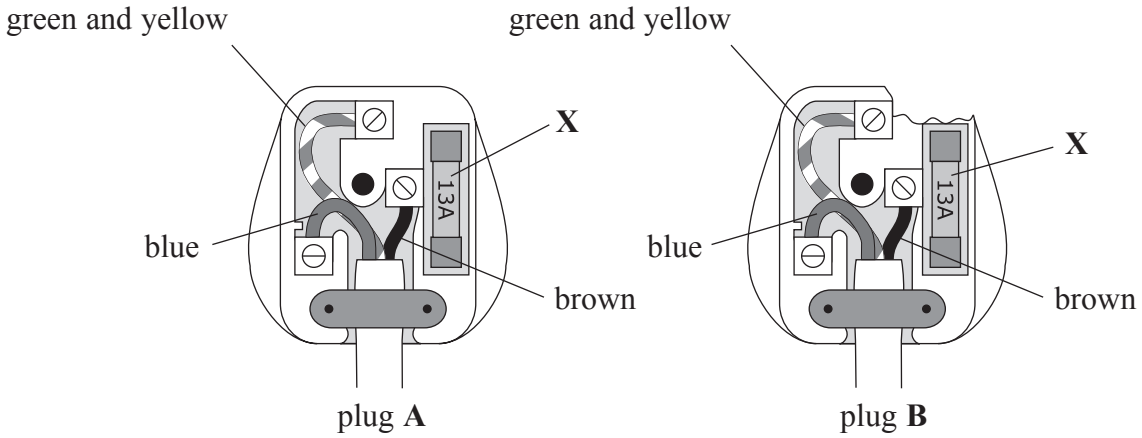
(1)

Q1

(Total 7 marks)

Leave blank

2. (a) The covers are removed from two plugs, **A** and **B**. The diagram shows the inside of the plugs.



(i) Identify a problem with plug **B**.

.....

.....

(1)

(ii) Suggest why this makes plug **B** unsafe.

.....

.....

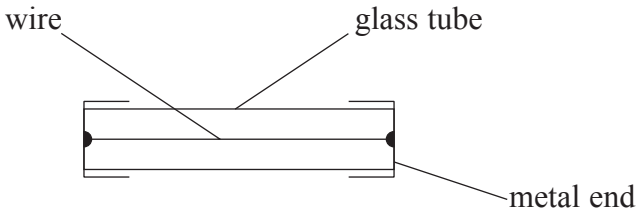
(1)

(iii) Name part **X**.

.....

(1)

(iv) The diagram below shows the structure of part **X**.



State **one** change which occurs in part **X** when the current is too large.

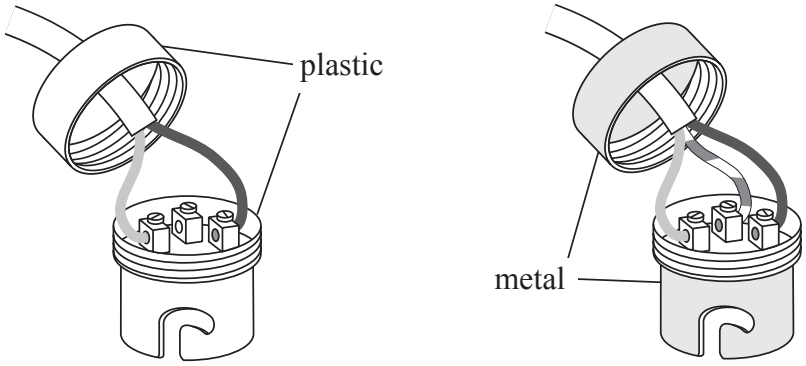
.....

.....

(1)

Leave blank

(b) The diagram shows two light fittings, **Y** and **Z**.



Y **Z**

When the tops are screwed on, each fitting is safe to use.

(i) State why light fitting **Y** is safe to use.

.....

.....

(1)

(ii) Why is light fitting **Z** safe to use?

.....

.....

(1) **Q2**

(Total 6 marks)

Leave blank

3. The table gives information about a journey made by a cyclist.

Time (hours)	Distance (km)
0	0
1	15
2	30
3	45
4	60
5	75
6	90

(a) Plot these points on the grid on the next page.

(3)

(b) (i) Use your graph to find the distance in kilometres which the cyclist travelled in 4.5 hours.

Distance = ... km

(1)

(ii) Use your graph to find the time in hours taken by the cyclist to travel 35 kilometres.

Time = ... hours

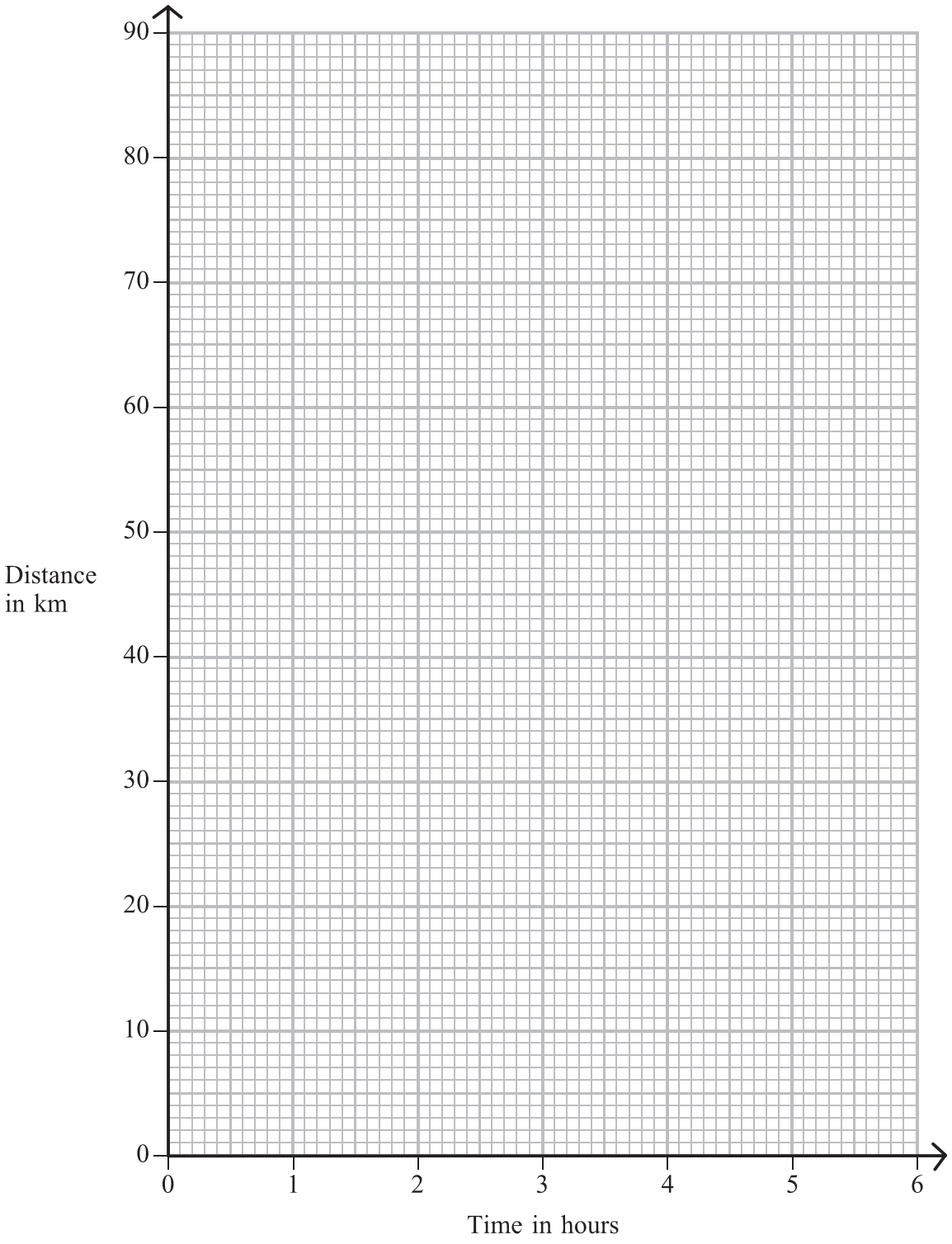
(1)

(c) State the equation which relates **average speed**, **distance moved** and **time taken**.

.....

(1)

Leave blank

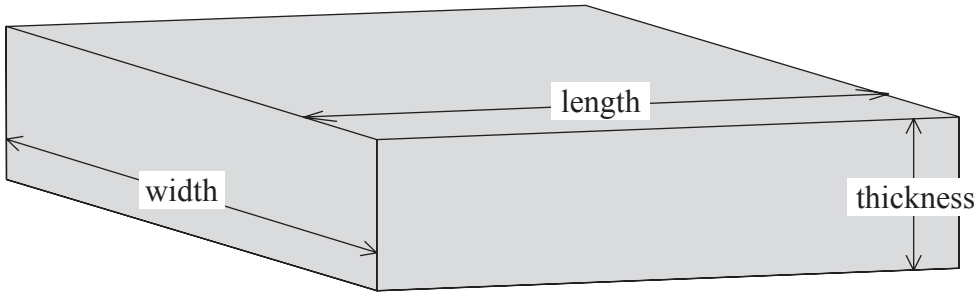


Q3

(Total 6 marks)

Leave blank

4. The diagram shows a rectangular **glass** block.



(a) A student wants to calculate the volume in mm^3. Name the units he should use to measure the length, the thickness and the width.

.....

(1)

(b) The density of the **wood** in a block is 0.8 g/cm^3. A student cuts the block into four equal pieces. Suggest what effect this has on the density.

.....

(1)

(c) The density of the **metal** in a block is 2.7 g/cm^3. Another block of the same metal has twice the mass. Calculate the density of the metal in this larger block?

Density = ... g/cm^3

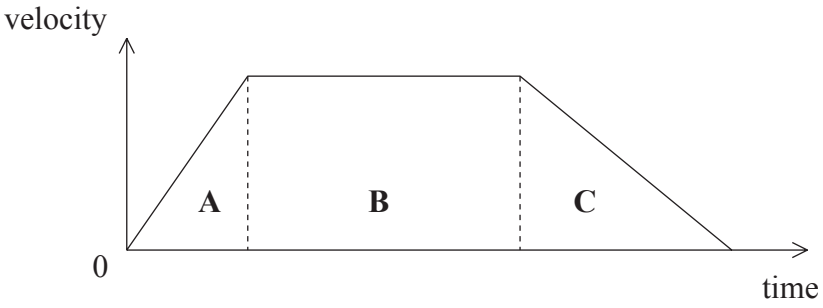
(1)

Q4

(Total 3 marks)

Leave blank

5. A train travels between two stations. The velocity–time graph shows the train's motion.



(a) How do you know that the train is decelerating in part C?

.....

.....

(1)

(b) State the features of the graph that represent the distance travelled between the two stations.

.....

(1)

(c) A second train travels between the two stations at a constant velocity and does not stop. It takes the same time as the first train. On the axes above, draw a line showing the motion of the second train.

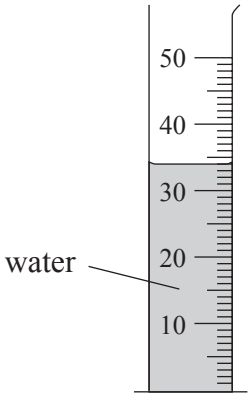
(2)

(Total 4 marks)

Q5

Leave blank

6. (a) The diagram shows a 50 cm^3 measuring cylinder.



State the volume of the water, in cm^3. Volume = ... cm^3

(1)

(b) (i) A student has some glass marbles. They are all the same size and shape and they are all made from the same sort of glass.

The student puts some water in a 100 cm^3 measuring cylinder. She adds the marbles one at a time. Every time she adds a marble she makes a note of the number of marbles in the water and the reading on the measuring cylinder.

Her notes are shown below.

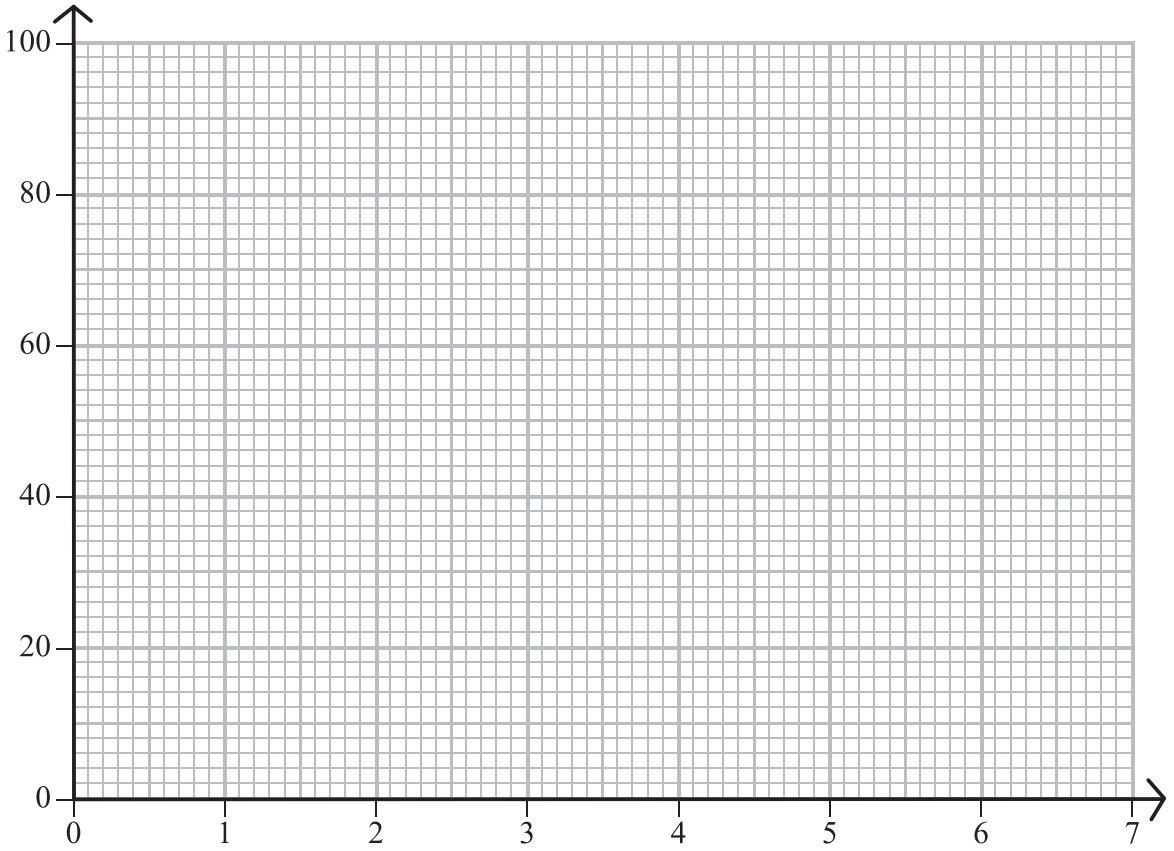
5 marbles, 91	*3, 61*	*2, 50*
1, 39	*6, 94*	*4, 72*

Put these results in a table with column headings and units where appropriate.

(3)

Leave blank

(ii) Add labels to the axes. Plot the results.



(3)

(iii) Identify the anomalous (unexpected) result.

.....

(1)

(iv) Draw the straight line of best fit on the graph.

(1)

(v) Use your graph to find the volume of water in cm^3 in the measuring cylinder before the student adds any marbles.

Volume of water = ... cm^3

(1)

(vi) Suggest what the total volume in cm^3 will be if the student adds another marble to the measuring cylinder.

Total volume = ... cm^3

(1)

(c) State the equation which relates density, mass and volume.

.....

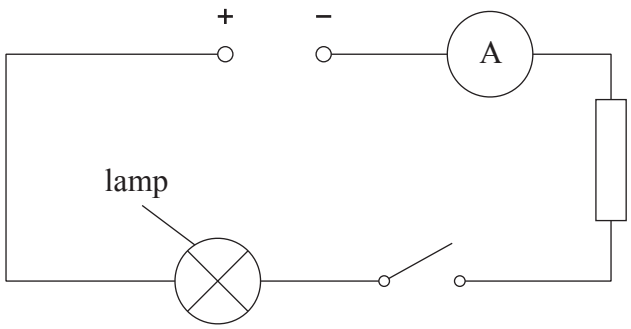
(1)

Q6

(Total 12 marks)

Leave blank

7. A student connects a series circuit as shown.



(a) (i) The student closes the switch. Name **two** components in the circuit, other than the lamp, which affect the size of the current.

1 .....

2 .....

(2)

(ii) The current is 0.40 A. Calculate the charge, in coulombs, that flows during a time of 20 s.

.....

.....

Charge = ...C

(2)

(b) The student was asked to connect a second lamp so that each lamp can be switched on and off independently. Show, by drawing on the circuit above, how this can be done.

(2) **Q7**

(Total 6 marks)

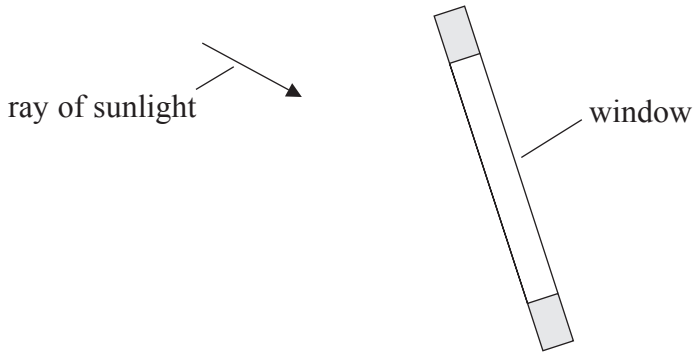
Leave blank

8. (a) State the law of reflection.

.....

(1)

(b) A student is playing in goal in a football match. The window of a nearby building reflects sunlight into his eyes.



(i) Complete the diagram to show the reflection of the ray from the front of the window.

(2)

(ii) Suggest how you could stop sunlight being reflected into your eyes from this window.

.....

(1)

(c) Light is part of the electromagnetic spectrum. State a feature that all parts of the electromagnetic spectrum have in common.

.....

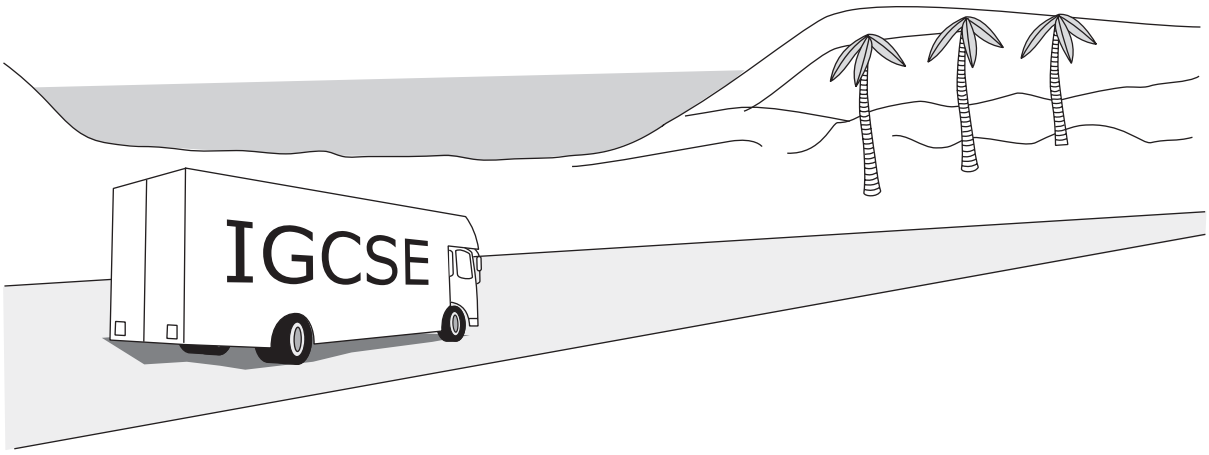
(1)

Q8

(Total 5 marks)

Leave blank

9. (a) The diagram shows a lorry. It is travelling in a straight line and it is accelerating. The total forward force on the lorry is *F* and the total backward force is *B*.



(i) Which is larger, force *F* or force *B*? Explain your answer.

.....

.....

(1)

(ii) State an equation which relates acceleration, mass and unbalanced force.

.....

(1)

(iii) An unbalanced force of 15 000 N acts on the lorry. The mass of the lorry is 12 500 kg. Calculate the lorry's acceleration and give the unit.

.....

.....

Acceleration = ...

(3)

Leave blank

(b) The **thinking distance** is the distance which a vehicle travels in the driver's reaction time. The **braking distance** is the distance which a vehicle travels when the brakes are applied.

(i) State **one** factor which increases the thinking distance.

.....

.....

(1)

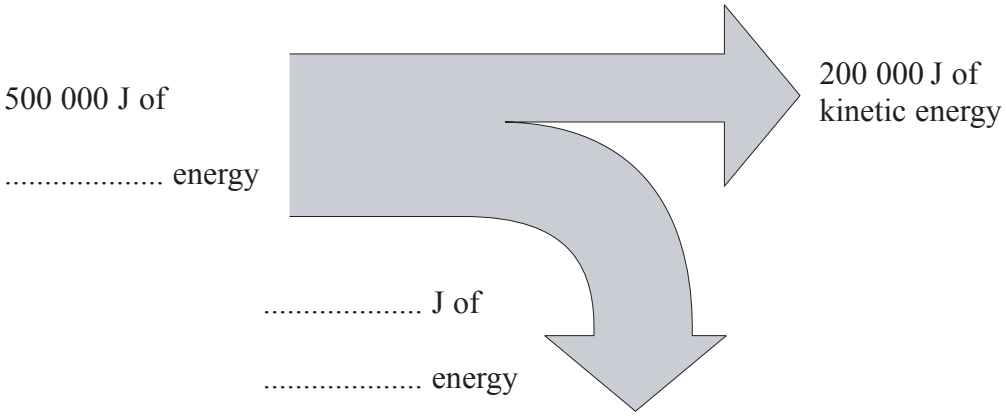
(ii) State **one** factor which increases the braking distance.

.....

.....

(1)

(c) (i) The diagram shows an energy flow for another lorry.
Fill in the gaps in the diagram.



(3)

(ii) The lorry travels 2.0 km. The driving force is 70 kN. Calculate the work done in kilojoules by this driving force.

.....

.....

Work done = ... kJ

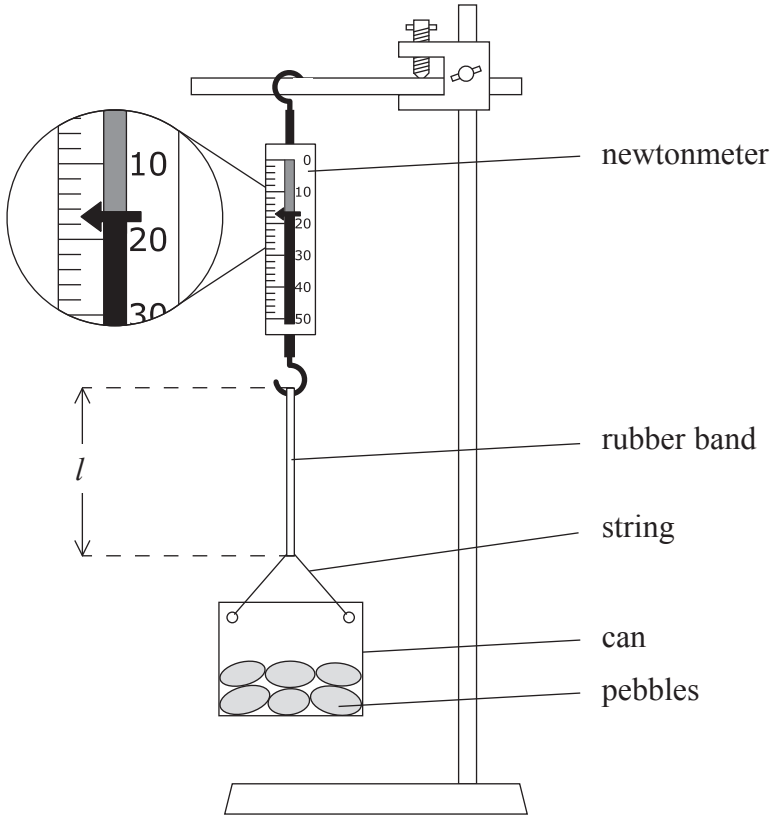
(3)

Q9

(Total 13 marks)

Leave blank

10. A student sets up the equipment shown.



(a) What is the reading, in Newtons, on the newtonmeter?

Reading = ... N
(1)

(b) (i) Name the apparatus the student would use to measure the length of the rubber band.

.....
(1)

(ii) Measure, in mm, the distance *l* shown in the diagram.

l = ... mm
(1)

(c) Another rubber band is 120 mm long when it is not stretched. It is 250 mm long when it is stretched.

Calculate the extension in millimetres of this rubber band.

Extension = ... mm
(1)

Leave blank

(d) The student carries out a similar experiment but this time he uses a spring in place of the rubber band.

(i) Complete the space in his results table below.

Load (N)	Length (mm)	Extension (mm)
0.0	50	0
2.3	60	10
5.0	69	19
6.8		25

(1)

(ii) Suggest, with a reason, **one** improvement which could be made to this experiment.

.....

.....

.....

.....

(2)

(e) (i) State Hooke's Law.

.....

.....

(1)

(ii) State the term for the point beyond which a spring no longer obeys Hooke's Law.

.....

(1) **Q10**

(Total 9 marks)

Leave blank

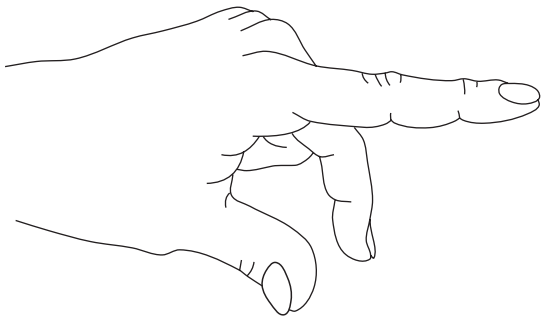
11. A wire carries a current. The wire is perpendicular to a magnetic field. A force acts on the wire and the wire moves.

(a) This effect is used in a d.c. motor. State what the abbreviation **d.c.** stands for.

.....

(1)

(b) Professor J A Fleming invented a rule to describe the directions involved in this effect. It is known as Fleming's left-hand rule.



Complete the sentences.

The first finger points in the direction of the ..... which is

from ..... to ..... .

The second finger points in the direction of the ..... which is

from ..... to ..... .

The thumb points in the direction of the ..... .

(3) **Q11**

(Total 4 marks)

Leave blank

12. (a) A lunar landing module weighs 60 kN on Earth but only about 10 kN on the Moon.

Explain why an object weighs less on the Moon than it does on Earth.

.....

.....

.....

(2)

(b) Comets such as Halley's comet orbit the Sun.

(i) State what causes a comet to orbit the Sun.

.....

(1)

(ii) Describe the orbit of a comet around the Sun.

.....

.....

.....

.....

.....

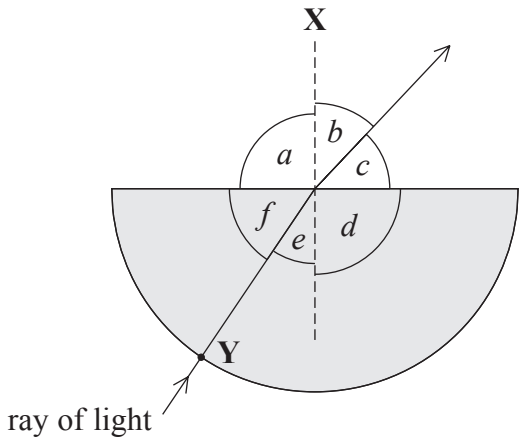
(3)

Q12

(Total 6 marks)

Leave blank

13. (a) The diagram shows a ray of light directed at a semicircular glass block.



(i) Name line **X**.

.....

(1)

(ii) State which letter, *a*, *b*, *c*, *d*, *e* or *f*, is an angle of incidence.

.....

(1)

(iii) Name angle *b*.

.....

(1)

(iv) State an equation which relates angle of incidence, angle of refraction and refractive index of glass.

.....

.....

(1)

(v) At point **Y** light passes from air to glass but refraction does not take place.

How can you tell this from the diagram?

.....

.....

(1)

(vi) Why does refraction not take place at point **Y**?

.....

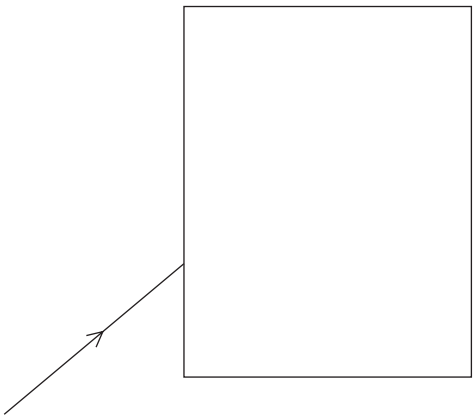
.....

(1)

Leave blank

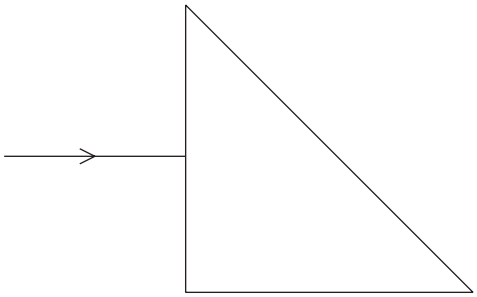
(b) Glass with a critical angle of 42° was used to make the blocks shown below.

(i) Complete the diagram to show how the ray of light passes through the rectangular glass block and out into the air.



(3)

(ii) Complete the diagram to show how the ray of light passes through the triangular glass block and out into the air.



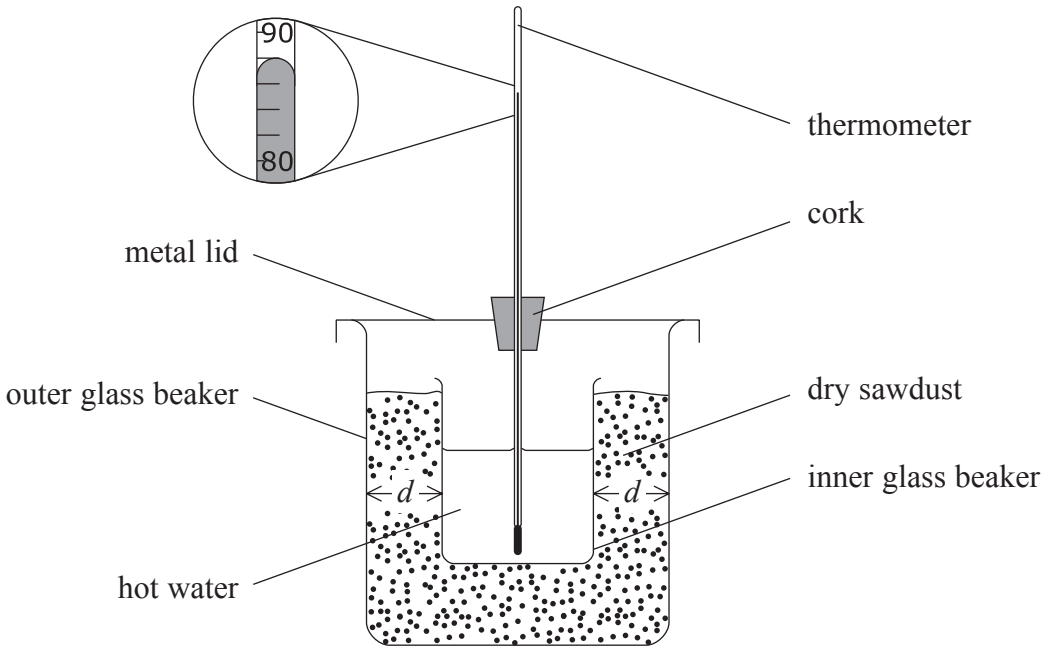
(2)

Q13

(Total 11 marks)

Leave blank

14. A student uses dry sawdust to insulate a glass beaker which contains hot water. The diagram shows how she sets up her equipment.

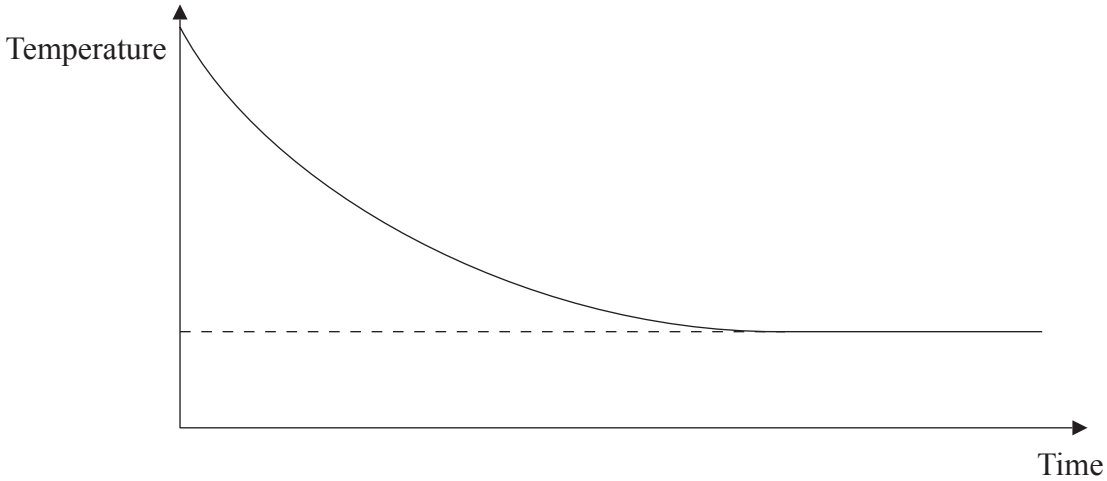


(a) Write down the reading on the thermometer.

Reading = ... °C

(1)

(b) The student records the temperature of the water every five minutes for one hour. The sketch graph shows the pattern of her results.



Another student keeps everything else the same but uses a smaller outer beaker. This means that the distance *d* is less.

(i) Sketch on the graph the curve for this student's results.

(3)

Leave blank

(ii) Suggest why the student keeps everything else the same.

.....

.....

(1)

(c) Suggest, with a reason, **one** improvement which can be made to the experiment.

.....

.....

.....

(2)

(d) Suggest, with a reason, what happens to the results if the sawdust gets wet.

.....

.....

.....

.....

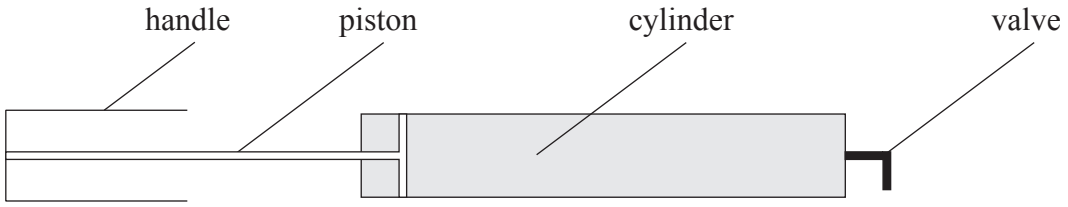
(2)

Q14

(Total 9 marks)

Leave blank

15. The diagram shows the structure of one type of bicycle pump.



(a) Circle **two** words in the box which best describe the motion of the molecules in the air in the cylinder.

backwards	**constant**	**fast**	**forwards**
random	**regular**	**slow**	**steady**

(1)

(b) Explain how the molecules exert a pressure on the inside of the cylinder.

.....

.....

.....

.....

.....

(3)

(c) (i) The pressure inside the pump is 150 kPa when the volume of air in the cylinder is 90 cm^3. Use the equation

$$p_1V_1 = p_2V_2$$

to calculate the pressure in kPa when the air is compressed to a volume of 50 cm^3.

.....

.....

Pressure = ... kPa

(2)

Leave blank

(ii) State two assumptions you needed to make in order to answer (c)(i).

1 .....

.....

2 .....

.....

(2)

(iii) Name the unit which is represented by the symbol kPa.

.....

(1)

Q15

(Total 9 marks)

QUESTION 16 IS ON THE NEXT PAGE

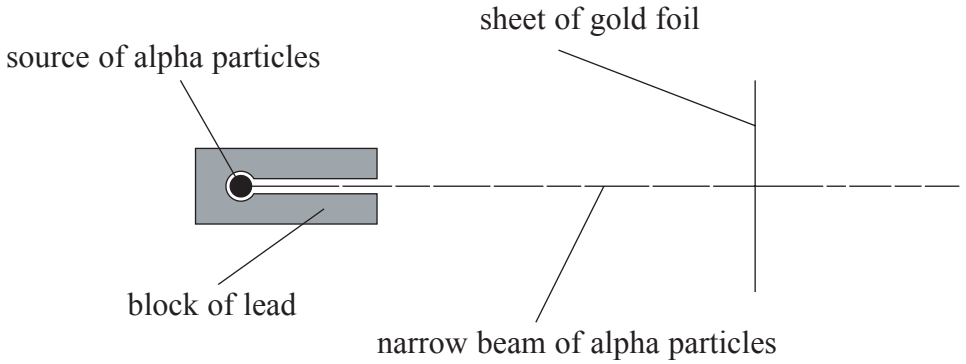
Leave blank

16. (a) Uranium-234 is radioactive. It emits alpha particles and decays to thorium-230. Complete the nuclear equation for this decay.

$$^{234}_{92}U \rightarrow \ ^{\ldots\ldots}_{\ldots\ldots}Th + \ ^{\ldots\ldots}_{\ldots\ldots}He$$

(2)

(b) Geiger and Marsden studied the structure of atoms. The diagram shows part of the equipment which they used.



(i) The block of lead helped to shield the scientists from radiation. State another purpose of the block of lead.

.....

.....

(1)

(ii) Most of the alpha particles went straight through the gold foil. Suggest a reason why.

.....

.....

(1)

(iii) Some of the alpha particles were deflected. What explanation did the scientists suggest for the deflection?

.....

.....

.....

(2)

Leave blank

(iv) Only a small proportion of the alpha particles deflected through a large angle. What explanation did the scientists suggest for the proportion being small?

.....

.....

(1)

(v) Some alpha particles were deflected less than others. What **two** reasons did the scientists suggest for this?

1 .....

.....

2 .....

.....

(2)

(vi) The alpha particles were detected when they hit a zinc sulphide screen. How did the scientists know that an alpha particle had hit the screen?

.....

.....

(1)

Q16

(Total 10 marks)

TOTAL FOR PAPER: 120 MARKS

END

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Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						4	P	H	0	/	2	P	Signature	

Paper Reference(s)

4PH0/2P

Edexcel IGCSE

Physics

Physics Paper 2

Sample Assessment Material

Time: 1 hour

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
Total	

Materials required for examination
Ruler, protractor, compasses, pencil and calculator

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Show all the steps in any calculations and state the units. Calculators may be used.

Information for Candidates

The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 4 questions in this question paper. The total mark for this paper is 60.
There are 16 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

Write your answers neatly and in good English.

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EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time $E = I \times V \times t$

pressure × volume = constant $p_1 \times V_1 = p_2 \times V_2$

$$\frac{\text{pressure}}{\text{kelvin temperature}} = \text{constant} \qquad \frac{p_1}{T_1} = \frac{p_2}{T_2}$$

$$\text{frequency} = \frac{1}{\text{time period}} \qquad f = \frac{1}{T}$$

$$\text{power} = \frac{\text{work done}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{power} = \frac{\text{energy transferred}}{\text{time taken}} \qquad P = \frac{W}{t}$$

$$\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}} \qquad V = \frac{2 \times \pi \times r}{T}$$

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

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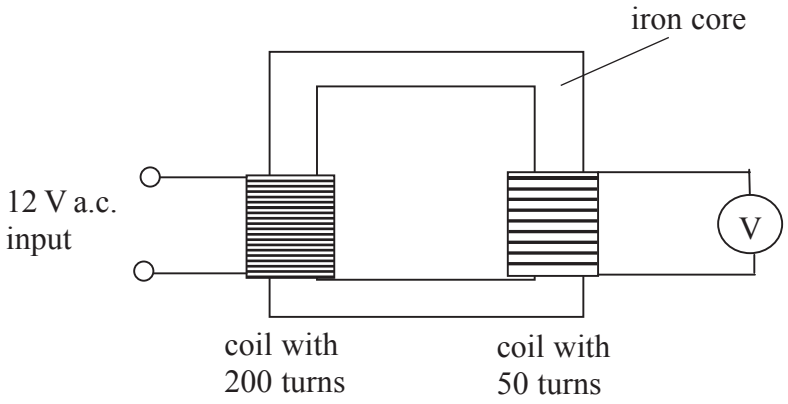
Answer ALL questions

1. (a) A student builds a transformer as shown below.



(i) Calculate the reading in volts on the voltmeter.

.....

.....

Reading on voltmeter = ... V

(3)

(ii) Is the output voltage AC or DC?

.....

(1)

(iii) Name the instrument which will display the input voltage as a wave.

.....

(1)

(iv) This is a step-down transformer. Where is a step-down transformer used in an electricity transmission system?

.....

(1)

(v) Explain why the core is made from a magnetically soft material.

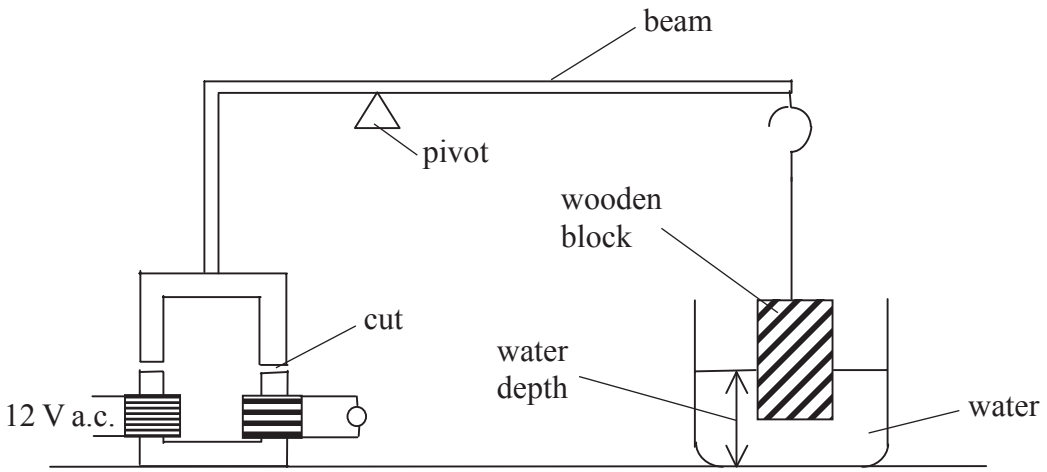
.....

.....

(1)

Leave blank

(b) The student wants to use the transformer as a water depth indicator. He cuts the core of the transformer in two and uses it as shown below. The bottom half of the iron core is fixed. The top half of the iron core is attached to a pivoted beam and is free to move.



The following results were obtained.

Water depth / cm	5.1	5.0	4.9	4.8	4.7	4.6
Voltmeter reading / V	2.6	2.5	2.2	1.7	1.0	0.1

(i) Explain why the voltmeter reading decreases as the water depth decreases.

.....

.....

.....

.....

(2)

(ii) The 0.1 V value is difficult to read reliably. State and explain **one** way in which a larger voltage could be obtained for the same water depth.

.....

.....

.....

.....

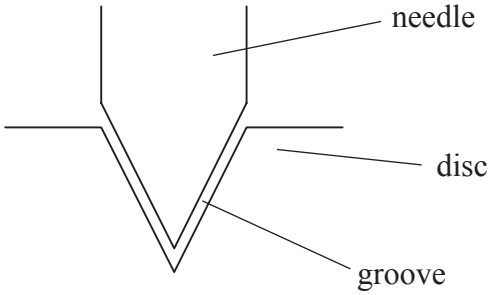
(2)

Q1

(Total 11 marks)

Leave blank

2. (a) Music can be stored on a plastic disc in a single spiral groove.
The groove varies in width and depth.
As the disc rotates a diamond needle moves through the groove.
The needle moves up and down following the shape of the groove.



The shape of the groove determines the amplitude and frequency of the movement of the needle.
The movements are changed into electrical signals and then into sound waves.

(i) The needle moves through a part of the groove that causes it to move up and down rapidly through a large vertical distance.
Describe and explain the sound that can be heard.

.....

.....

.....

.....

.....

(4)

(ii) Explain why such discs can only be used a certain number of times before the quality of the sound deteriorates.

.....

.....

.....

(2)

Leave blank

(b) Compact discs (CDs) were first used in the 1980s to store music in digital form.

(i) Complete the labels to show which is the analogue and which is the digital signal.

..... signal ..... signal

(1)

(ii) Explain your choice.

.....

.....

.....

(2)

(iii) State **one** advantage of using digital rather than analogue signals.

.....

.....

(1)

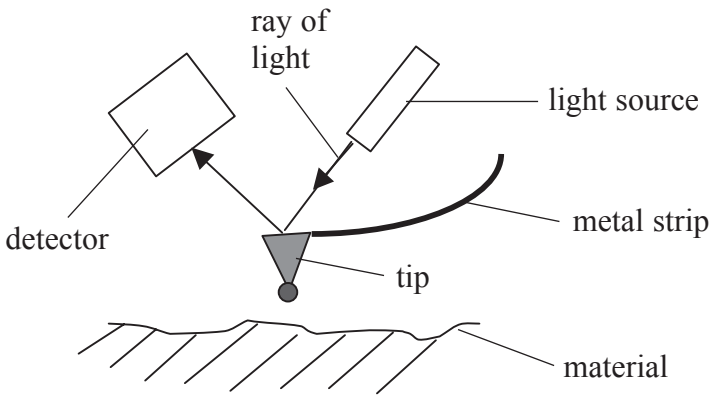
(iv) Give another everyday use of a digital signal, apart from music recording.

.....

(1)

Leave blank

(c) The diagram shows a recent invention called an Atomic Force Microscope that can be used to scan the surface of a material. The movement of the tip causes the path of the ray of light to alter. Images of the atoms on the surface of the material are produced from the light received by the detector.



The bottom of the tip is negatively charged. It is attracted or repelled by the charge on the surface of the material.

(i) Explain what sign of charge on the surface of the material would cause the tip to move upwards.

.....

.....

.....

.....

(3)

(ii) Explain why the metal strip should be elastic and obey Hooke's law.

.....

.....

.....

.....

(3)

Leave blank

(iii) Explain why it is important for the top surface of the tip to be perfectly flat.

.....

.....

.....

.....

(2)

(iv) The same tip is used many times. Explain why the quality of the images produced does not deteriorate.

.....

.....

.....

.....

(2)

Q2

(Total 21 marks)

Leave blank

3. (a) (i) In a liquid the particles are close to one another. Describe the motion of particles in a liquid.

.....

(1)

(ii) Name a process in which a substance changes from a liquid to a gas.

.....

(1)

(iii) State the effect that an increase in temperature has on the speed of molecules in a gas.

.....

(1)

(b) A flask contains air at a pressure of 100 kPa. The temperature of this air is raised from 20 °C to 40 °C.

(i) Calculate the final pressure in kPa of the air.

.....

.....

.....

Final pressure of air ..... kPa

(2)

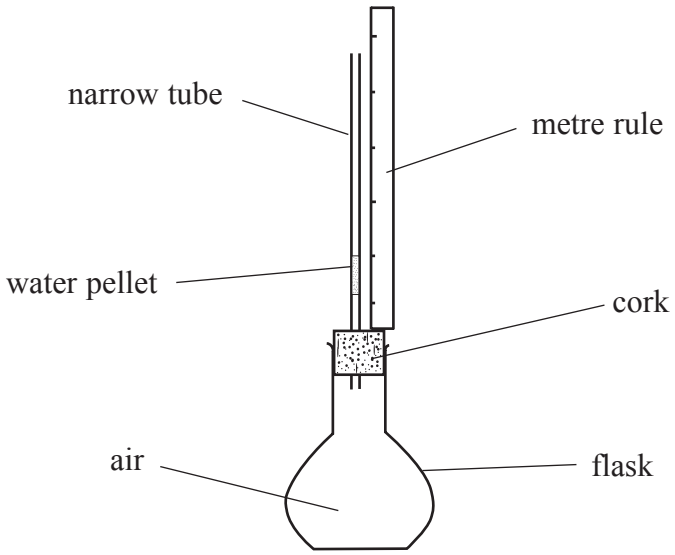
(ii) State **one** assumption that you made in your calculation.

.....

(1)

Leave blank

(c) A student builds the apparatus shown below.
The apparatus consists of a flask with a cork in the top. A narrow tube goes through a hole in the cork and a small water pellet traps a fixed mass of air in the flask. A metre rule is clamped alongside the narrow tube.



The student places his hands around the flask. He notes that the pellet moves up the narrow tube.
Another student explains that this was caused by the heat from his hands. She believes the apparatus can be used as a thermometer to measure temperatures in the range 20 °C to 40 °C. She decides to check this.
She uses the following additional apparatus:

- standard thermometer
- large beaker (larger than the flask)
- large container of cold water
- bunsen burner
- tripod stand

Leave blank

Describe how she could investigate whether it is possible to use the apparatus as a thermometer to measure temperatures in the range 20 °C to 40 °C.

.....

.....

.....

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.....

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.....

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.....

.....

.....

(5) **Q3**

(Total 11 marks)

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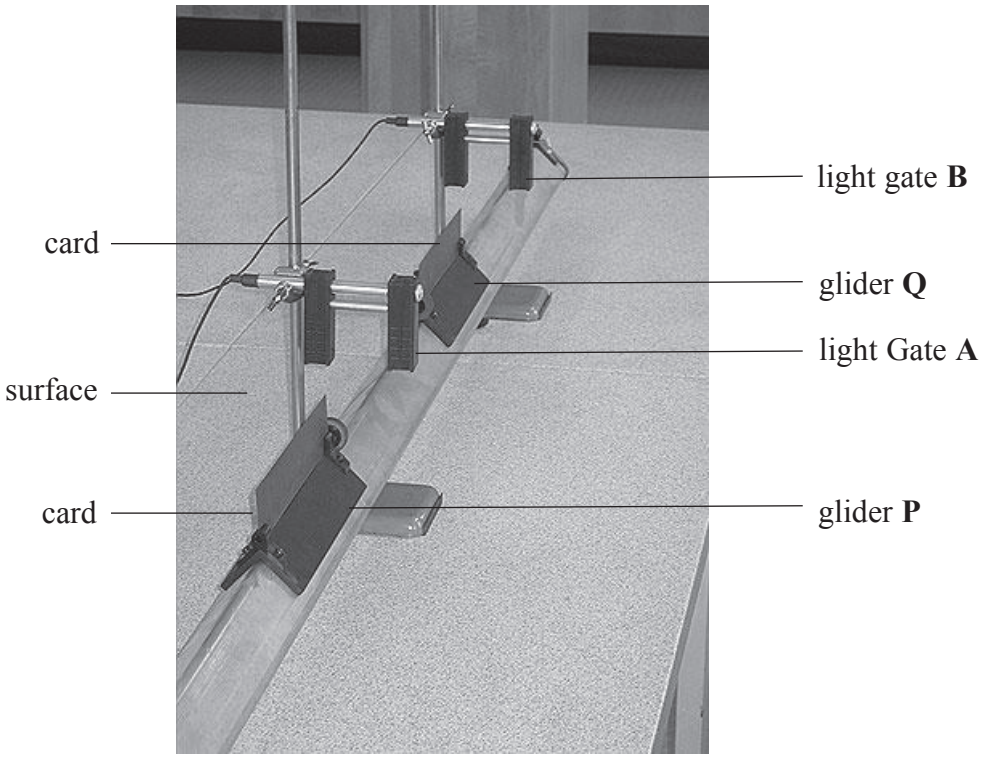
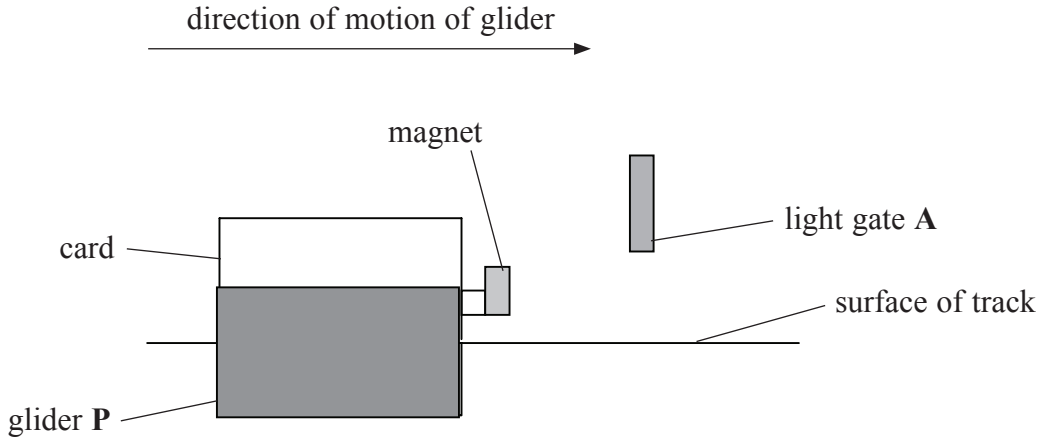
4. A group of students uses a special track. The track is about two metres long and is horizontal.
Two gliders **P** and **Q** can move along the track.
The surface of the track and the inside surface of the gliders are almost frictionless. The photograph shows that the gliders can move through two light gates **A** and **B**.



The mass of glider **P** is 2.4 kg. This glider is moving toward **Q** at a constant velocity of 0.6 m/s. Glider **Q** is stationary.

Leave blank

The diagram below shows a side view. Each glider has a card and a magnet attached. Light gate **A** records the time for which the card is in front of the light gate.



(a) (i) Apart from the time recorded by the light gate **A**, state the other measurement that would be needed to calculate velocity of glider **P**.

.....

(1)

(ii) Why does the surface need to be frictionless and horizontal?

.....

.....

(1)

(b) Momentum is a vector quantity and can be calculated using the equation:

momentum = mass × velocity

(i) State what is meant by a vector quantity.

.....

.....

(1)

(ii) Calculate the momentum in kg m/s of glider **P**.

.....

Momentum of glider **P** = ...

(2)

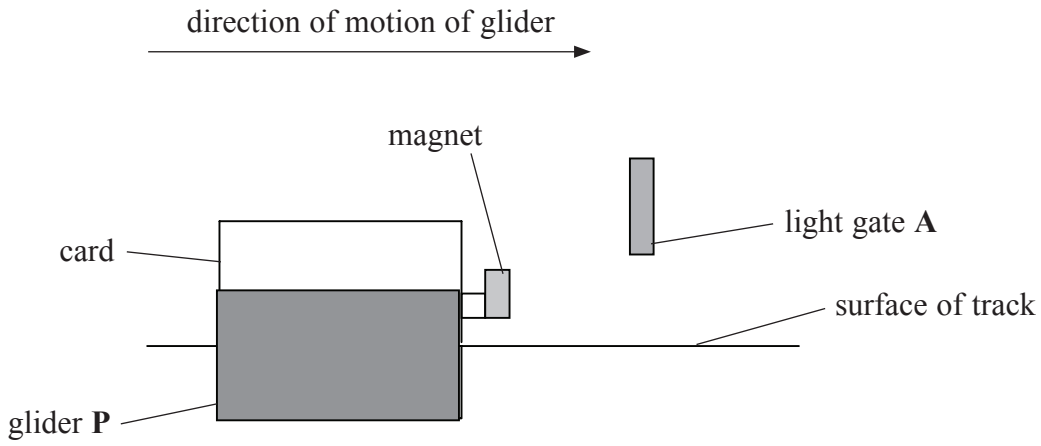
(iii) State the momentum of glider **Q**.

.....

(1)

Leave blank

(c) Glider **P** collides with glider **Q** and they move off together.
The diagram shows the motion of glider **P** before and after the collision.



(i) What is the purpose of the magnets on the gliders?

.....

(1)

(ii) What is the purpose of light gate **B**?

.....

(1)

(iii) If both gliders pass through light gate **B** after collision, glider **Q** will fall off the end of the track.
Explain why it is only necessary for glider **Q** to pass through light gate **B** to determine the velocity of glider **P** after the collision.

.....

.....

.....

.....

(3)

(iv) The momentum of glider **P** has changed after the collision. Has it increased or decreased? Explain your answer.

.....

(1)

Leave blank

(v) Calculate the change in momentum in kg m/s of glider **P**.

.....

Change in momentum of glider **P** = ... kg m/s
(2)

(vi) State the time during which this change has taken place.

Time taken = ... s
(1)

(d) Use the relationship:

$$\text{force} = \frac{\text{change in momentum}}{\text{time taken}}$$

and your values from (c)(v) and (c)(vi) to calculate the force acting on glider **P** during the collision and give the unit.

.....

Force acting on glider **P** = ...
(2)

Q4

(Total 17 marks)

TOTAL FOR PAPER: 60 MARKS

END

Sample mark schemes

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Physics Paper 1

Question Number	Answer	Mark
1(a)(i)	A	1

Question Number	Answer	Mark
1(a)(ii)	B	1

Question Number	Answer	Mark
1(b)(i)	frequency	1

Question Number	Answer	Mark
1(b)(ii)	period	1

Question Number	Answer	Mark
1(c)(i)	any two from: • waves on rope • waves on a spring shaken from side to side • radio/TV (waves) • microwaves • infra-red • light • ultraviolet • X-rays • gamma (rays)	2

Question Number	Answer	Mark
1(c)(ii)	longitudinal (waves) accept examples • sound (waves) • waves on a spring given a 'push and pull'	1

Question Number	Answer	Mark
2(a)(i)	piece missing (accept hole in case/cracked/broken or words to that effect)	1

Question Number	Answer	Mark
2(a)(ii)	access to live part(s) (accept –could get a shock)	1

Question Number	Answer	Mark
2(a)(iii)	Fuse (ignore any reference to rating e.g. 13 A)	1

Question Number	Answer	Mark
2(a)(iv)	fuses/melts/will not conduct (electricity) (allow 'gets hotter')	1

Question Number	Answer	Mark
2(b)(i)	plastic does not conduct (electricity)/is an insulator (of electricity)	1

Question Number	Answer	Mark
2(b)(ii)	it is earthed/there is an earth wire	1

Question Number	Answer	Mark
3(a)	either all seven points correctly plotted (2) (each to within 1 mm and not as 'blobs') **or** five or six points correctly plotted (1) + appropriate line for the candidate's points drawn with a ruler (1)	3

Question Number	Answer	Mark
3(b)(i)	answer in the range 67 to 68 inclusive or correct from candidate's graph	1

Question Number	Answer	Mark
3(b)(ii)	2 hours 20 minutes **or** 140 minutes or 2.3 or 2.35	1

Question Number	Answer	Mark
3©	distance (moved) = (average) speed × time (taken) **or** any correctly transposed version	1
Question Number	**Answer**	**Mark**
4(a)	millimeters/mm	1

Question Number	Answer	Mark
4(b)	nothing/no change/zero/it is (still) 0.8 g/cm^3	1

Question Number	Answer	Mark
4(c)	(the) same/2.7 g/cm^3	1

Question Number	Answer	Mark
5(a)	graph (line) sloping downwards **or** its velocity/speed is falling/getting less **or** graph has negative slope	1

Question Number	Answer	Mark
5(b)	area under the graph (accept A+B+C)	1

Question Number	Answer	Mark
5(c)	horizontal line from the velocity axis and beneath the maximum on the printed graph (1) finishing vertically (by eye) above the time end on the printed graph (1)	2

Question Number	Answer	Mark
6(a)	34 (no tolerance)	1

Question Number	Answer	Mark
6(b)(i)	table with appropriate headings (1) in numerical order (either ascending or descending) (1) <u>all</u> data correctly entered (1) (example of a fully correct response number of marbles total volume* in cm^3 “ 1 39 2 50 3 61 4 72 5 91 6 94 or ‘reading on the measuring cylinder’ “ or may be shown after each entry in this column)	3

Question Number	Answer	Mark
6(b)(ii)	both axes correctly labelled (1) all six points correct each to within 1 mm and not as 'blobs' (1) four or five points correct (1)	**3**

Question Number	Answer	Mark
6(b)(iii)	5 (marbles) 91 (cm^3) or unambiguously identified	**1**

Question Number	Answer	Mark
6(b)(iv)	straight line through other points (Should not go through the origin)	**1**

Question Number	Answer	Mark
6(b)(v)	28 (cm^3)	**1**

Question Number	Answer	Mark
6(b)(vi)	105 (cm^3)	**1**

Question Number	Answer	Mark
6(c)	density = mass ÷ volume or any correctly transposed version	**1**

Question Number	Answer	Mark
7(a)(i)	(electrical) supply/battery/cell/power source (1) resistor (accept 'resistance' do not credit wire/wiring) (1)	**2**

Question Number	Answer	Mark
7(a)(ii)	8 (C) (2) **or** credit 'charge = current × time' **or** '0.40 × 20' with (1)	**2**

Question Number	Answer	Mark
7(b)	lamp parallel to printed lamp shown clearly on the circuit diagram (1) with independent switch (1)	**2**

Question Number	Answer	Mark
8(a)	angle of incidence = angle of reflection accept $<i = <r$	**1**

Question Number	Answer	Mark
8(b)(i)	ray continued in a straight line to front face of window but not beyond (1) then reflected so that, judged by eye, angle of reflection = angle of incidence (1)	**2**

Question Number	Answer	Mark
8(b)(ii)	any one of • move the window (so as to change its angle or the effect) or words to that effect eg student moves to change the angle • cover the <u>outside</u> of the window (e.g. with a shutter) do not credit 'close the blinds/curtains) do not credit 'student should wear a hat etc.'	**1**

Question Number	Answer	Mark
8(c)	all travel at the same speed /speed of light /300 million metres per second **or** (they are all) transverse waves **or** (they all) transfer energy (from one place to another) **or** (they all) travel through a vacuum	**1**

Question Number	Answer	Mark
9(a)(i)	(force) F (is bigger) because the lorry is **accelerating** do not credit just '… is moving forward'	**1**

Question Number	Answer	Mark
9(a)(ii)	(unbalance) force = mass × acceleration accept F = ma **or** F – B = mass × acceleration	**1**

Question Number	Answer	Mark
9(a)(iii)	1.2 (2) allow acceleration = (unbalanced) force ÷ mass **or** 15 000 ÷ 12 500 for (1) m/s^2 (1) **or** m/s/s **or** ms^{-2} **or** metres per second per second	**3**

Question Number	Answer	Mark
9(b)(i)	driver tired/ill/drunk/has taken drugs/poor reaction(s)/inexperienced/faster speed etc or words to that effect	**1**

Question Number	Answer	Mark
9(b)(ii)	poor/worn brakes/loose/slippery/poor road surface/faster speed etc or words to that effect	**1**

Question Number	Answer	Mark
9(c)(i)	chemical (1) 300 000 (1) wasted/heat/heat and sound (and chemical) (1)	**3**

Question Number	Answer	Mark
9(c)(ii)	140 000 kJ (3) **or** work (done) = force × distance (1) **either** 2 km = 2000 m **or** 70 kN = 70 000 N (1)	**3**

Question Number	Answer	Mark
10(a)	17 (N) do not credit '23 (N)'	**1**

Question Number	Answer	Mark
10(b)(i)	ruler/rule accept 'metre rule' accept 'tape measure'	1

Question Number	Answer	Mark
10(b)(ii)	21 (mm)	1

Question Number	Answer	Mark
10(c)	130 (mm)	1

Question Number	Answer	Mark
10(d)(i)	75	1

Question Number	Answer	Mark
10(d)(ii)	more (pairs of) readings (1) to improve reliability/to allow a line to be drawn on the graph with greater certainty/to make the pattern clearer (or words to that effect) (1)	2

Question Number	Answer	Mark
10(e)(i)	extension is proportional to load	1

Question Number	Answer	Mark
10(e)(ii)	elastic limit	1

Question Number	Answer	Mark
11(a)	direct current	1

Question Number	Answer	Mark
11(b)	(first finger) (magnetic) field North/N to South/S (1) (second finger) current from positive(+) to negative (-)(1) (thumb) movement/motion/force/thrust (1)	3

Question Number	Answer	Mark
12(a)	mass of the Moon is less than the mass of the Earth (1) and gravitational field strength/*g* is less on the Moon (**or** gravitational field strength/*g* is about six times greater on Earth than on the Moon) (1) accept any other suitable correct answer	**2**

Question Number	Answer	Mark
12(b)(i)	gravitational force/attraction accept 'gravity'	**1**

Question Number	Answer	Mark
12(b)(ii)	any three points (1) each • ellipse/elliptical (accept minor misspelling but not anything which could just as well be 'eclipse') • with the Sun at one focus • period of more than one (Earth) year • from the far side of the Solar System/outer Solar System **(or** 'from the Kuiper belt (short-period comets)'**or** 'from the Oort cloud(long-period comets)')	**3**

Question Number	Answer	Mark
13(a)(i)	Normal do not credit 'vertical' or 'perpendicular'	**1**

Question Number	Answer	Mark
13(a)(ii)	e	**1**

Question Number	Answer	Mark
13(a)(iii)	(angle of) refraction accept minor misspellings but not anything which could be 'reflection	**1**
Question Number	**Answer**	**Mark**
13(a)(iv)	refractive index (of glass) = sine of the angle of incidence ÷ sine of the angle of refraction **or** $\eta = \frac{\sin i}{\sin r}$	**1**

Question Number	Answer	Mark
13(a)(v)	(ray of light) does not change direction/(continues in) a straight line	1

Question Number	Answer	Mark
13(a)(vi)	any one of • angle of incidence is zero • ray on the normal • ray is perpendicular to the surface	1

Question Number	Answer	Mark
13(b)(i)	diagram shows that • refraction occurs, ray continues in a straight line to the opposite face (1) • angle of refraction is less than 90° (1) • ray emerges and continues in a straight line so that (by eye) it is parallel to the original direction (1)	3

Question Number	Answer	Mark
13(b)(ii)	diagram shows that • ray continues in a straight line to the opposite face then downwards (1) • at right angles then outwards through the base without deviation (1)	2

Question Number	Answer	Mark
14(a)	88 (°C)	1

Question Number	Answer	Mark
14(b)(i)	starts at same temperature and falls (1) more steeply (1) to room temperature and then stays constant (1)	3

Question Number	Answer	Mark
14(b)(ii)	so that the (two sets of) results can be compared (fairly/reliably)	1

Question Number	Answer	Mark
14(c)	Any suitable correct answer, examples are: • have a non metallic /wooden /plastic etc lid (1) to reduce heat loss by conduction (1) • have a larger outer beaker (1) so that distance '*d*' can be increased/ more sawdust can be used/insulation will be improved/ heat loss (by conduction) will be reduced (1)	**2**

Question Number	Answer	Mark
14(d)	the (hot) water will cool (to room temperature) more rapidly/the temperature (of the water) will fall more quickly (1) (because) wet sawdust is not such a good insulator/is a better heat conductor than dry sawdust (1) **or** (because) (trapped) water is not such a good insulator/is a better heat conductor than (trapped) air (1)	**2**

Question Number	Answer	Mark
15(a)	random fast (both unambiguously indicated and no others)	**1**

Question Number	Answer	Mark
15(b)	molecules exert a force (1) when they hit/collide with the (inside) walls (of the container) (1) force acting on a surface/area results in pressure (**or** pressure = force ÷ area) (1)	**3**

Question Number	Answer	Mark
15I(i)	270 (kPa) **or** 150 × 90 = pressure × 50 (1) **or** any correctly transposed version of the above equation (1)	**2**

Question Number	Answer	Mark
15(c)(ii)	no change in temperature (1) no change in mass/no gas escapes/leaks (from the cylinder) (1) (either order)	**2**

Question Number	Answer	Mark
15(c)(iii)	kilopascal(s) (allow minor misspellings such as 'kiloPascal(s)')	**1**

Question Number	Answer	Mark
16(a)	230 above 90 for thorium (both in correct positions) (1) 4 above 2 for helium (both in correct positions) (1)	**2**

Question Number	Answer	Mark
16(b)(i)	(so that the only alpha) particles (which escape/leave) go in the same/one direction	**1**

Question Number	Answer	Mark
16(b)(ii)	(the gold) foil/it is mostly empty space **or** 'most of a gold atom is empty space'	**1**

Question Number	Answer	Mark
16(b)(iii)	repelled (by the nucleus of an atom of gold) (1) (because) an alpha particle and a nucleus both have the same/positive charge (1)	**2**

Question Number	Answer	Mark
16(b)(iv)	(relative to the rest of the atom) the nucleus is very small (so the change of hitting it is very small)	**1**

Question Number	Answer	Mark
16(b)(v)	(these alpha particles) were not so close to the nucleus (as those which were deflected more) (1) (these alpha particles) were faster (than those which were deflected more) (1)	**2**

Question Number	Answer	Mark
16(b)(vi)	(there was a tiny) flash of light **or** scintillation (observed)	 **1**

Physics Paper 2

Question Number	Answer	Mark
1(a)(i)	uses turns ratio $V/12 = 50/200$ $V = 3$(V)	**3**

Question Number	Answer	Mark
1(a)(ii)	a.c.	**1**

Question	Answer	Mark
1(a)(iii)	oscilloscope	**1**

Question Number	Answer	Mark
1(a)(iv)	after transmission accept - at a substation, near houses	**1**

Question Number	Answer	Mark
1(a)(v)	easily (or quickly) demagnetises (or remagnetises)	**1**

Question Number	Answer	Mark
1(b)(i)	• gap widens and flux decreases (1) • block drops and raises top of core (1) **or** reward any other correct response.	**2**

Question Number	Answer	Mark
1(b)(ii)	raise height of beaker and reduce gap (2) **or** more secondary turns mean step up/output will increase (2)	**2**

Question Number	Answer	Mark
2(a)(i)	high(er) pitch/note high(er) frequency loud(er) large(er) amplitude	**4**

Question Number	Answer	Mark
2(a)(ii)	hard needle (1) wore away groove (1)	**2**

Question Number	Answer	Mark
2(b)(i)	left : digital right : analogue	1

Question Number	Answer	Mark
2(b)(ii)	analogue – continuous digital – on and off	2

Question Number	Answer	Mark
2(b)(iii)	clearer/ interference can be removed/ can be reproduced exactly accept any other suitable answer	1

Question Number	Answer	Mark
2(b)(iv)	Eg TV digital reception/digital radio any other suitable answer	1

Question Number	Answer	Mark
2(c)(i)	negative repulsion like charge repel	3

Question Number	Answer	Mark
2(c)(ii)	strip must return to original position when force removed force proportional to extension	3

Question Number	Answer	Mark
2(c)(iii)	light reflected need good reflecting surface	2

Question Number	Answer	Mark
2(c)(iv)	no contact/friction little wear	2

Question Number	Answer	Mark
3(a)(i)	random	1

Question Number	Answer	Mark
3(a)(ii)	boiling / evaporation	1

Question Number	Answer	Mark
3(a)(iii)	Increases	1

Question Number	Answer	Mark
3(b)(i)	100/293 = p/313 p = 107 (kPa) 106.8 (2 marks) **or** 100/20 = p/40 p = 200 (kPa) - (1 mark))	2

Question Number	Answer	Mark
3(b)(ii)	constant mass or volume	1

Question Number	Answer	Mark
3(c)	Any five from: • flask in beaker • water in beaker • beaker on tripod • Bunsen under tripod • Bunsen on/heat water • note temp on standard thermometer • mark on rule/tube at known temp • repeat at least every 5°C • check for (linear) scale	5

Question Number	Answer	Mark
4(a)(i)	length of card	1

Question Number	Answer	Mark
4(a)(ii)	so velocity constant	1

Question Number	Answer	Mark
4(b)(i)	has direction as well as size	1

Question Number	Answer	Mark
4(b)(ii)	4.0 × 3.0 = 12	2

Question Number	Answer	Mark
4(b)(iii)	zero	1

Question Number	Answer	Mark
4(c)(i)	gliders stick together	1

Question Number	Answer	Mark
4(c)(ii)	find speed of P (and Q) after collision	1

Question Number	Answer	Mark
4(c)(iii)	Any three from: Card on Q cut light Use length of card on Q Find velocity of Q P and Q have same velocities	3

Question Number	Answer	Mark
4(c)(iv)	decreased because velocity had decreased	1

Question Number	Answer	Mark
4(c)(v)	× (0.6 – 0.4) = 0.48	2

Question Number	Answer	Mark
4(c)(vi)	0.1 (s)	1

Question Number	Answer	Mark
4(d)	0.48 ÷ 0.1 = 4.8 N	2

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