

Write your name here	
Surname	Other names
Centre Number	Candidate Number
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<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: left;"> <h1 style="margin: 0;">Edexcel GCSE</h1> <h2 style="margin: 0;">Physics</h2> <h3 style="margin: 0;">Unit P3: Applications of Physics</h3> </div> <div style="text-align: right; font-weight: bold;">Foundation Tier</div> </div>	
Additional Sample Assessment Material Time: 1 hour	Paper Reference 5PH3F/01
You must have: Calculator, ruler	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.*

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
– *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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FORMULAE

You may find the following formulae useful

$$\text{power of lens} = \frac{1}{\text{focal length}}$$

$$\text{current} = \text{number of particles per second} \times \text{charge on each particle} \quad I = N \times q$$

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

$$\text{The relationship between temperature and volume for a gas} \quad V_1 = \frac{V_2 T_1}{T_2}$$

$$\text{The relationship between volume and pressure for a gas} \quad V_1 P_1 = V_2 P_2$$

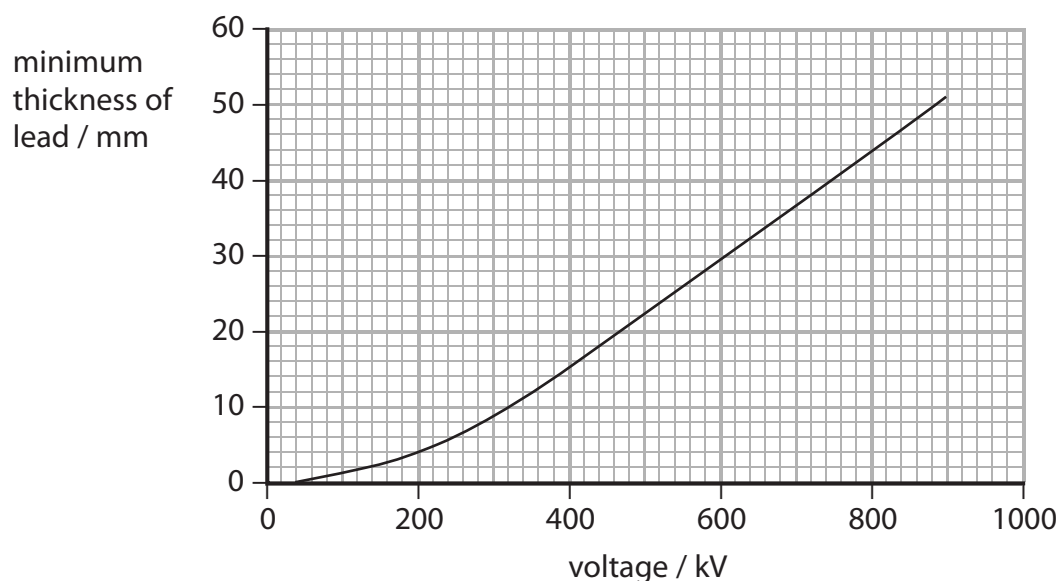


Answer ALL questions

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 ☒.

X-rays

- 1 (a) Rooms containing X-ray machines have walls which are lined with lead. X-ray machines work from different voltages. The graph shows the minimum thickness of lead which should be used for different voltages.



- (i) State the minimum thickness of lead needed for X-ray machines working from 400 kV.

(1)

minimum thickness = mm

- (ii) Calculate the difference in minimum thickness between 400 kV and 900 kV.

(2)

difference in thickness = mm



(b) (i) Explain why thick lead walls are needed around X-ray machines.

(2)

(ii) Explain why some people want to keep the walls as thin as possible.

(2)

(c) Complete the sentence by putting a cross (☒) in the box next to your answer.

X-rays are used

(1)

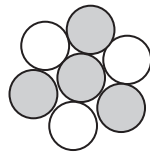
- ☐ **A** to mend broken bones
- ☐ **B** to weld metal joints
- ☐ **C** in a CAT scan
- ☐ **D** in an ultrasound scan

(Total for Question 1 = 8 marks)



Particles and their uses

- 2 (a) The diagram shows the particles in a nucleus of an element.



key

- proton
● neutron

(i) The atomic number of this element is (1)

(ii) The number of electrons in an atom of this element is (1)

- (b) Complete the sentence by putting a cross (☒) in the box next to your answer.

After radioactive decay, a nucleus often undergoes rearrangement.
It can lose energy by emitting

(1)

- ☐ **A** microwaves
☐ **B** radio waves
☐ **C** gamma radiation
☐ **D** ultrasound radiation

- (c) A nucleus undergoes alpha decay.
An alpha particle is described as ${}^4_2\text{He}$.

Explain how alpha decay changes the number of protons and neutrons in the nucleus.

(3)

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(d) (i) A beta particle is

(1)

(ii) Identify **two** other particles involved in beta decay.

(2)

(Total for Question 2 = 9 marks)



Radioactivity and Medical Treatment

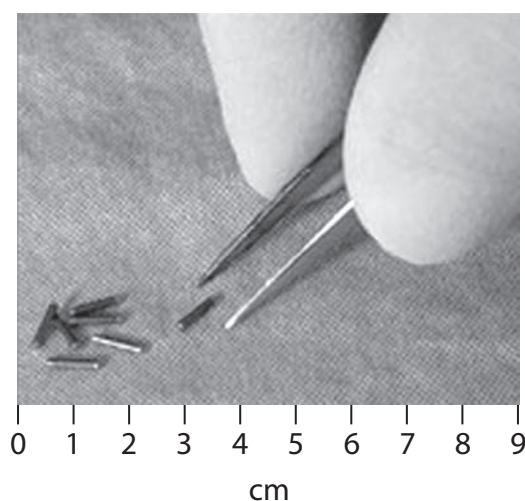
- 3 (a) Which of the following ionising radiations is least penetrating?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ A alpha particles
- ☐ B beta particles
- ☐ C gamma rays
- ☐ D X-rays

- (b) The photograph shows tiny pellets of radioactive material. The pellets are called seeds. They are used to treat cancer patients.



- (i) Complete the sentence by putting a cross (☒) in the box next to your answer.
The length of each seed is about

(1)

- ☐ A 1 mm
- ☐ B 1 cm
- ☐ C 1 m
- ☐ D 1 km



- (ii) The seeds are placed inside the body next to the tumour.
The seeds emit alpha particles.

Describe how these alpha particles affect the nearby tissue.

(2)

- (iii) Other treatments involve firing radiation at the tumour from outside the body.

Describe the advantages of using radioactive seeds inside the body compared with radiation treatment from outside the body.

(3)

- (c) Radiotherapy is sometimes used in palliative care.

Give **two** ways in which palliative care can be used to help patients.

(2)

1

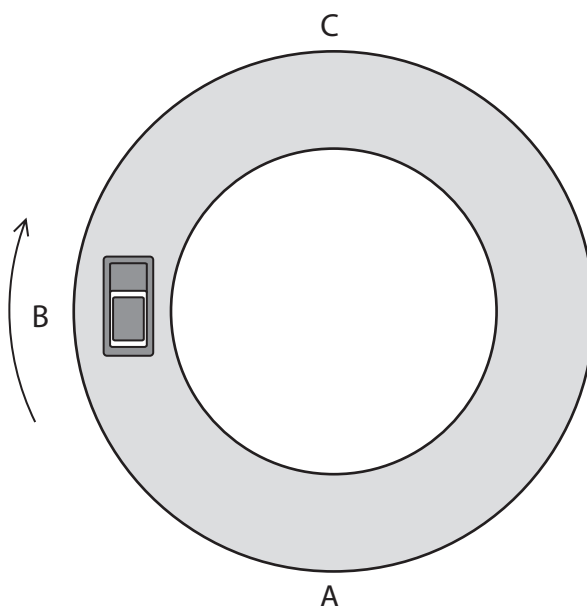
2

(Total for Question 3 = 9 marks)



Circles and accelerators

- 4 The diagram shows a car moving at constant speed around a circular track.



- (a) Use a word from the box to complete the sentence.

centrifugal centripetal circular tangential

The resultant force acting on the car when it is moving as shown in the diagram is known as force.

(1)



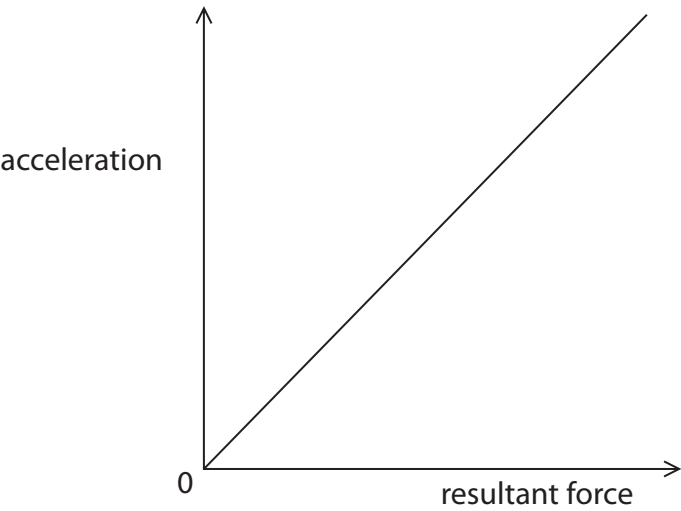
(b) Which of the following statements about an object moving at a constant speed in a circle are true?

Put a tick (✓) against each correct statement.

(2)

statement	tick (✓)
the resultant force on the car is away from the centre of the circle	
the resultant force on the car is towards the centre of the circle	
the car is accelerating	
the resultant force on the car is in the direction in which it is moving	
the car is moving at a constant velocity	

(c) The graph shows how the acceleration of the car changes with the resultant force acting on it.



Explain how the acceleration changes if the resultant force increases from 750 N to 1500 N.

(2)

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(d) Charged particles in some accelerators move very quickly in circles.

(i) This type of accelerator is called a (1)

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Protons can be accelerated in this way but neutrons cannot.

This is because (1)

- ☐ **A** neutrons are too large
- ☐ **B** neutrons are too small
- ☐ **C** neutrons have a negative charge
- ☐ **D** neutrons have no charge

(iii) Describe how scientists can use the high-speed particles from accelerators to help them make discoveries. (3)

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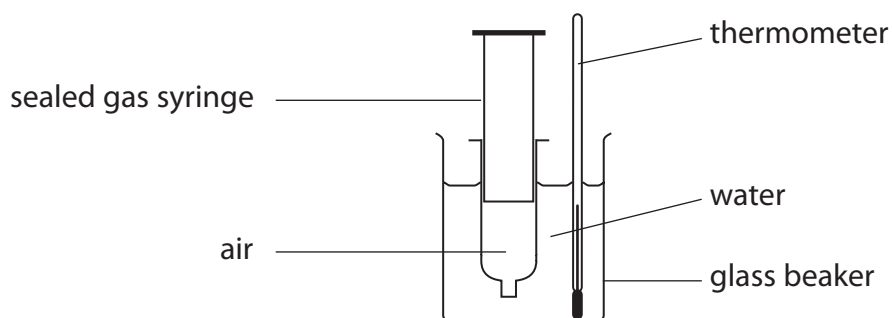
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(Total for Question 4 = 10 marks)



Kinetic Theory of Gases

- 5 The diagram shows a gas syringe in a beaker of water with a thermometer to measure the temperature.



- (a) The thermometer reads 30°C .

Calculate the value of this temperature in kelvin.

(2)

$$30^{\circ}\text{C} = \dots\dots\dots \text{K}$$

- (b) The volume of the air in the syringe is 20 ml when the temperature is 30°C .

Calculate the volume of the air in the syringe when its temperature is 60°C .
State the unit.

(4)

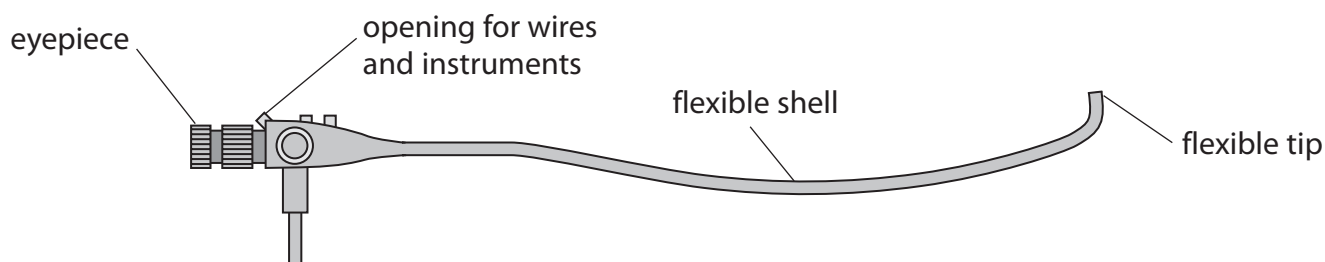
$$\text{volume} = \dots\dots\dots \text{unit} \dots\dots\dots$$



Refraction, prisms and endoscopes

6 The diagram shows an endoscope.

This uses refraction and total internal reflection.

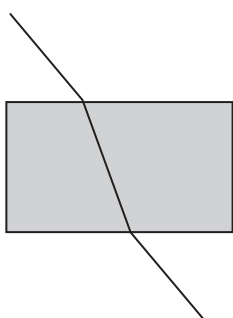


(a) (i) A ray of light is refracted as it passes through a block of glass.

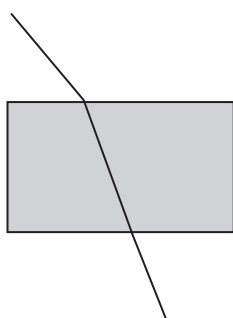
Which of these diagrams correctly shows the path of the ray?

Put a cross (X) in the box next to your answer.

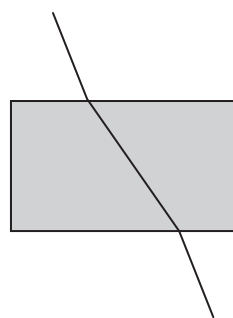
(1)



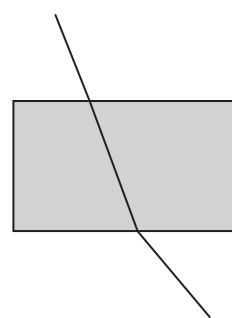
A ☐



B ☐

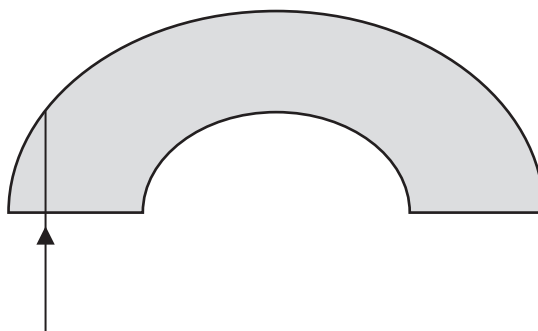


C ☐



D ☐

(ii) A ray of light enters an optical fibre.

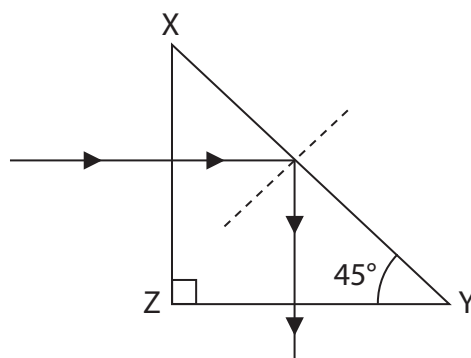


Complete the path of the ray inside the fibre.

(2)

(b) The diagram shows a ray of light being reflected by a prism.

The critical angle of the prism glass is 42° .



Explain if the side XY needs to be silvered like a mirror to cause this reflection.
You may add to the diagram to help with your answer.

(3)

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*(c) Explain how the way in which an endoscope works can make it a more useful instrument for diagnosis and treatment than surgery.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS



Additional Sample Mark Scheme

GCSE Science 2011

GCSE

GCSE Physics (5PH3F/01)



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.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- 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.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

General Information

The following symbols are used in the mark schemes for all questions:

Symbol	Meaning of symbol
eq	Indicates that credit should be given for other correct alternatives to a word or statement
/ oblique	Words or phrases separated by an oblique are alternatives to each other
{ } curly brackets	Indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion
() round brackets	Words inside round brackets are to aid understanding of the marking point but are not required to award the point

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	15 (mm)	15-16 (mm)	(1)

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	51 - 15 (1) 36 (mm) (1)	allow ecf from (a)(i)	(2)

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	An explanation linking two of the following <ul style="list-style-type: none"> • lead absorbs X-rays (1) • (and) thicker lead absorbs more (1) • (this) reduces danger to body/DNA/cells (1) 	Allow wall absorb X-rays thick lead walls absorb a lot of X-rays require a stronger building	(2)

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	An explanation linking two of the following in a logical way <ul style="list-style-type: none"> • lead is {expensive/heavy/dense} (1) • (so) greater thickness more {lead/cost} (1) • (and) could cause structural damage (1) 		(2)

Question Number	Answer	Acceptable answers	Mark
1(c)	C		(1)

Question Number	Answer	Acceptable answers	Mark
2(a) (i)	3		(1)

Question Number	Answer	Acceptable answers	Mark
2(a) (ii)	3		(1)

Question Number	Answer	Acceptable answers	Mark
2(b)	C		(1)

Question Number	Answer	Acceptable answers	Mark
2(c)	<p>An explanation linking the following</p> <ul style="list-style-type: none"> • decrease (1) • (in) proton number by 2 (1) • (in) neutron number by 2 (1) 	<p>alpha contains 2p and 2n</p> <p>mass number decreases by 4 gains 3 marks</p> <p>total number of proton and neutron decreases by 4 also gains 3 marks</p>	(3)

Question Number	Answer	Acceptable answers	Mark
2(d)(i)	electron		(1)

Question Number	Answer	Acceptable answers	Mark
2(d)(ii)	neutron (1) proton (1)		(2)

Question Number	Answer	Acceptable answers	Mark
3(a)	A		(1)

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	B		(1)

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	<p>A description including two of the following points</p> <ul style="list-style-type: none"> destroys (cells/tissue) (1) affects both healthy tissue and tumour (1) mutation of DNA (1) 		(2)

Question Number	Answer	Acceptable answers	Mark
3(b)(iii)	<p>A description including three of the following points</p> <ul style="list-style-type: none"> less damage to {healthy / other} tissue (1) single treatment to insert seeds (1) seeds are close to the tumour (1) fewer side effects (1) 		(3)

Question Number	Answer	Acceptable answers	Mark
3(c)	<p>Any two of the following points</p> <ul style="list-style-type: none"> reducing severity of symptoms (1) managing pain (1) improving quality of life (1) 		(2)

Question Number	Answer	Acceptable answers	Mark
4(a)	centripetal		(1)

Question Number	Answer	Acceptable answers	Mark
4(b)	statements <ul style="list-style-type: none"> • 2 (1) • and 3 (1) deduct a mark for each extra tick to a maximum of 2		(2)

Question Number	Answer	Acceptable answers	Mark
4(c)	An explanation linking the following points <ul style="list-style-type: none"> • acceleration increases (1) • (by a factor of) two (1) 	the force doubles therefore the acceleration doubles (2) the acceleration is (directly) proportional to the force (2)	(2)

Question Number	Answer	Acceptable answers	Mark
4(d)(i)	cyclotron	synchrotron	(1)

Question Number	Answer	Acceptable answers	Mark
4(d)(ii)	D		(1)

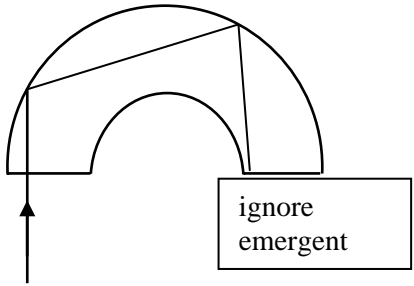
Question Number	Answer	Acceptable answers	Mark
4(d)(iii)	<p>a description including three of the following points</p> <ul style="list-style-type: none"> • fast moving particles collide (1) • collisions split atoms/nuclei / other particles (1) • can find out what protons and neutrons are made up of (1) • look for God Particle (Higgs boson) (1) • find out what happened just after the Big Bang (1) • detect charge on products (1) • detect mass on products (1) • detect other properties on products (1) • detect frequency of interactions (1) 		(3)

Question Number	Answer	Acceptable answers	Mark
5(a)	273 (+ 30) (1) 303 (K) (1)		(2)

Question Number	Answer	Acceptable answers	Mark
5(b)	use temperature in K (1) substitution (1) $20 \times 333 / 303$ evaluation (1) $= 22$ unit (1) ml	(allow ecf from (a)) ecf for temperature accept 21.98 cm^3 give full marks for correct answer, no working	(4)

Question Number		Indicative Content	Mark
QWC	*5(c)	<p>A comparison including some of the following points</p> <p>identify states of matter</p> <ul style="list-style-type: none"> • glass is a solid • water is a liquid • air is a gas <p>Comparisons including</p> <p>speed of movement</p> <ul style="list-style-type: none"> • slow • medium • fast <p>freedom</p> <ul style="list-style-type: none"> • fixed • free within surface • free <p>type of movement</p> <ul style="list-style-type: none"> • particles vibrate • particles move randomly (within liquid) • particles move randomly <p>points can be given on labelled diagrams to a maximum of three</p>	(6)
Level	0	No rewardable content	
1	1 - 2	<ul style="list-style-type: none"> • the comparison is probably restricted to a single aspect of two states of matter • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy 	
2	3 - 4	<ul style="list-style-type: none"> • the comparisons will include one aspect of the three states of matter or two aspects of two states of matter • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy 	
3	5 - 6	<ul style="list-style-type: none"> • the comparisons will be clear and precise and include all three states of matter. The motion of the particles will be clearly and correctly linked to the states of matter • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors 	

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	A		(1)

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	 <p>1 mark for a reflection, using straight lines, clearly above the horizontal by eye. 1 mark for one (or two) extra reflections occurring at the surface</p>		(2)

Question Number	Answer	Acceptable answers	Mark
6(b)	<p>An explanation linking three of the following points</p> <ul style="list-style-type: none"> • angle of incidence is 45° (1) • (which) is greater than 42° (1) • (so) total internal reflection (1) • (so) no need for silvering (1) 		(3)

Question Number		Indicative content	Mark
QWC	*6(c)	<p>An explanation linking some of the following points</p> <p>An explanation of how the endoscope works and is used</p> <ul style="list-style-type: none"> • inserted into body down (or up) tube • is flexible/light travels round corners/bends • light shone down it • light reflected back up • can see what reflects the light <p>An explanation of benefits</p> <ul style="list-style-type: none"> • no need for large incision • less infection risk • does not affect other organs • see organ in action/colour 	(6)
Level	0	No rewardable material	
1	1-2	<ul style="list-style-type: none"> • a limited explanation of the working of an endoscope or a limited explanation of the benefits or drawbacks. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy 	
2	3-4	<ul style="list-style-type: none"> • some explanation of the working of an endoscope with a limited explanation of the benefits or drawbacks. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy 	
3	5 - 6	<ul style="list-style-type: none"> • a detailed explanation of the working of an endoscope clearly linked to benefits and or drawbacks; may give a justified conclusion. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors 	