

Write your name here

Surname

Other names

Centre Number

Candidate Number

Edexcel GCSE

Physics

Unit P3: Applications of Physics

Foundation Tier

Wednesday 5 June 2013 – Afternoon

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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PEARSON

FORMULAE

You may find the following formulae useful

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

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

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

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

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



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Questions begin on next page

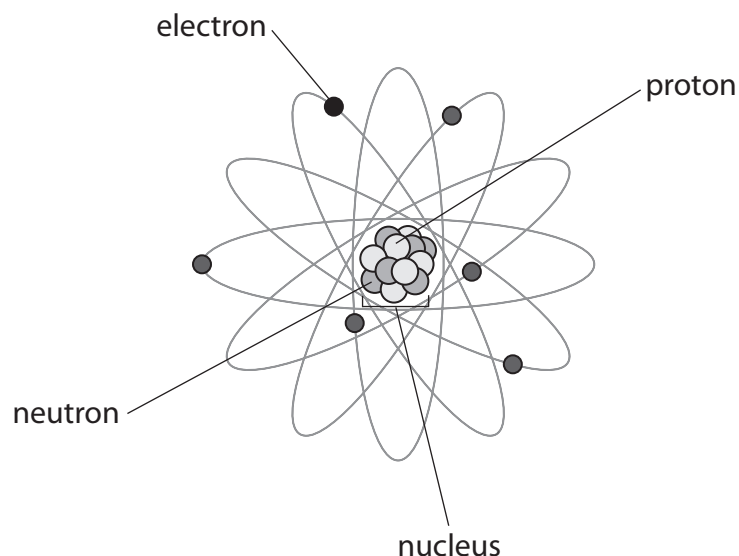


Answer ALL questions

**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 ☒.**

Atoms and radioactivity

1 The diagram shows the structure of an atom.



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

The size of the charge on each electron is

(1)

- A** a third of the charge on the proton
- B** half the charge on the proton
- C** the same as the charge on the proton
- D** twice the charge on the proton

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

The atomic number of a neutral atom is always the same as the number of

(1)

- A** electrons
- B** electrons and neutrons
- C** protons and neutrons
- D** neutrons



(b) The element radium has a radioactive isotope, radium-226.

This can be written as ${}_{88}^{226}\text{Ra}$.

This radioactive isotope emits alpha particles.

The alpha particle has a mass number of 4 and contains two protons.

Using the numbers in the box complete the following sentences.

82	84	86	90	222	224	228	230
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(i) When an alpha particle is emitted by ${}_{88}^{226}\text{Ra}$ the mass number becomes (1)

(ii) When an alpha particle is emitted by ${}_{88}^{226}\text{Ra}$ the atomic number becomes (1)

(c) Describe how the emissions from radioactive substances can be dangerous to living things. (2)

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(d) Explain **one** precaution that is taken in hospitals to limit the risks of exposure to radiation. (2)

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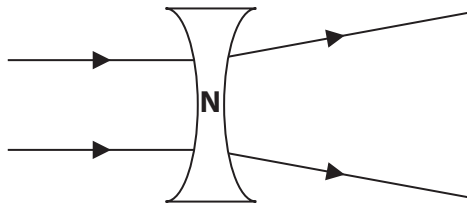
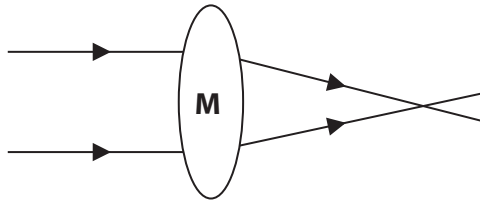
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(Total for Question 1 = 8 marks)



Lenses

- 2 (a) The diagrams show rays of light passing through two lenses labelled **M** and **N**.



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

The light changes direction as it leaves the lenses.
This is called

(1)

- A** contraction
- B** diffraction
- C** reflection
- D** refraction

- (ii) The focal length of lens **M** is 2 m.

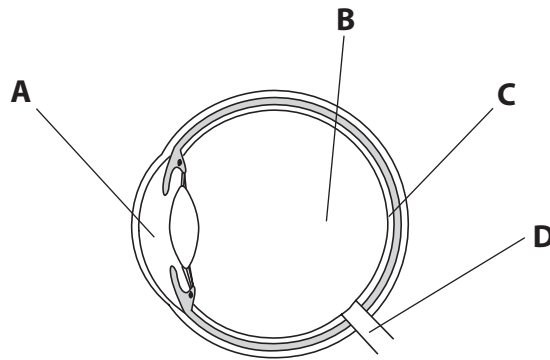
Calculate the power of lens **M**.

(2)

power = D



(b) The diagram shows an eye of a short sighted person.
A diverging lens is used to correct short sight.



(i) The eye will form an image of a distant object.

Which letter shows where the image will form for the short sighted eye?

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

(1)

- A
- B
- C
- D

(ii) Draw on the diagram a diverging lens in a position which would correct the short sightedness.

(1)

(iii) Describe how the diverging lens corrects this defect of vision.

(2)

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(iv) Suggest one way of correcting short sight other than wearing glasses.

(1)

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(Total for Question 2 = 8 marks)



Applications of light and sound

3 Diagram 1 shows a glass prism which can be used to turn an image the right way up.

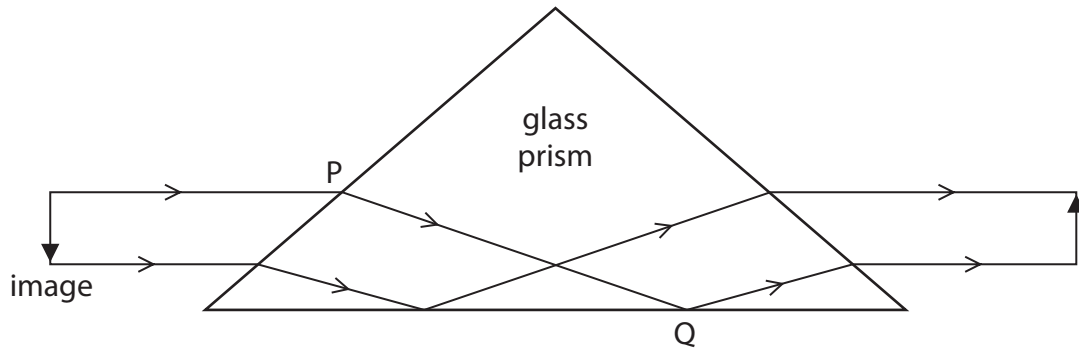


Diagram 1

- (a) (i) In diagram 1, total internal reflection occurs at Q.
Explain why total internal reflection occurs at Q.

(2)

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(ii) The way in which the light changes direction at P is shown in diagram 2.

Mark on the diagram (*i*) for the angle of incidence and (*r*) for the angle of refraction for the ray of light shown.

(2)

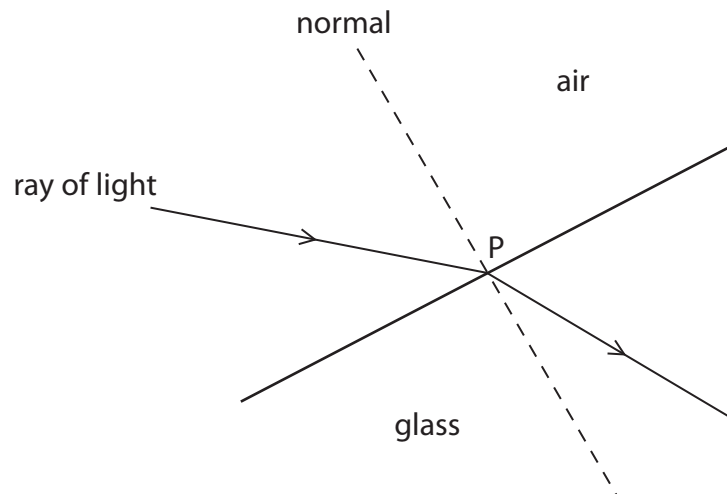


Diagram 2

(iii) Which of these is correct for the light as it enters the prism at P?

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

(1)

- A frequency decreases
- B frequency increases
- C speed decreases
- D speed increases



(b) Light waves and sound waves are both used in the diagnosis and treatment of medical conditions

(i) A doctor uses an endoscope to look inside the body of a patient.

Explain how optical fibres are used in endoscopes.
You may draw a labelled diagram to help with your answer.

(3)

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(ii) Describe how ultrasound can be used as a medical treatment for illness or injury.

(2)

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(Total for Question 3 = 10 marks)



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Collision

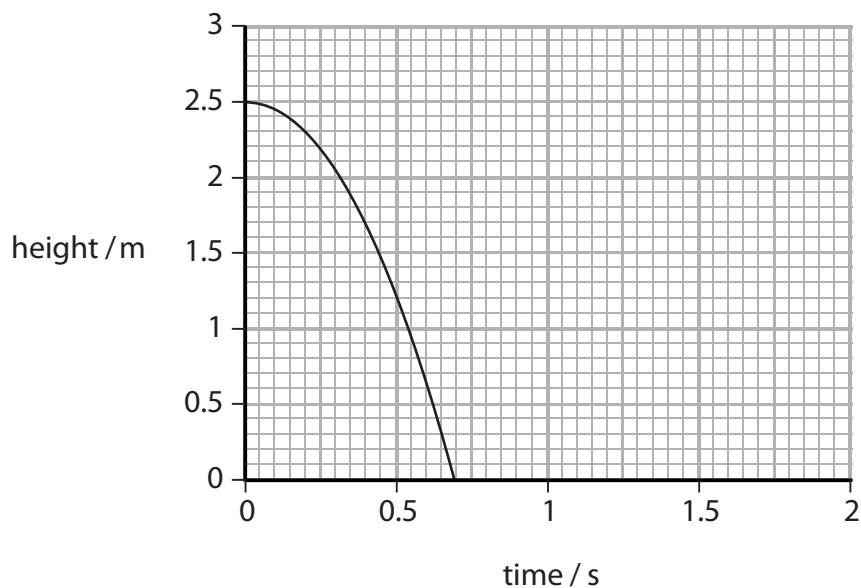
- 4 (a) The man in the photograph balances a ball above the ground.



He lets the ball fall.

He starts a timer at the same time.

The graph shows how the height of the ball above the ground changes with time.



- (i) From the graph, state the height of the ball above the ground when the timer was started.

(1)

height above ground = m



(ii) From the graph, state the time taken for the ball to reach the ground.

(1)

time = s

(iii) The ball bounces back to a height of 1.9 m.
Continue the line on the graph to show this.

(3)

(iv) Explain why the ball does not bounce back to its original height.

(2)

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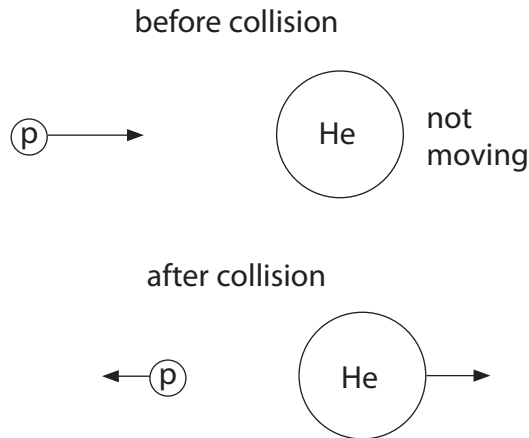
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(b) The diagram shows a collision between a proton (p) and a helium nucleus (He).



(i) The table gives some information about the collision.

		before collision	after collision
proton	kinetic energy (arbitrary units)	12.5	4.5
helium nucleus	kinetic energy (arbitrary units)	0	8

Use information from the table to show that the collision is elastic.

(2)

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(ii) State the name of **one** device that can be used to accelerate protons to very high speeds.

(1)

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(Total for Question 4 = 10 marks)



Monitoring heart action and pulse

- 5 The photograph shows a pulse oximeter. This is used to show the heart rate and the amount of oxygen in the blood.



- (a) (i) Where is the oximeter usually placed to take measurements?

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

- A** on the finger
- B** over the heart
- C** on the neck
- D** on the wrist

(1)

- (ii) There are two LEDs used in an oximeter.
One emits visible light.
State what type of radiation the other LED emits.

(1)

.....

.....



(iii) The oximeter shows a heart rate of 89 beats per minute.
Calculate the frequency in beats per second.

(2)

frequency = beats/second

(iv) Calculate the time between each heartbeat.

Use the equation

$$\text{time between heartbeats} = \frac{1}{\text{frequency}}$$

(2)

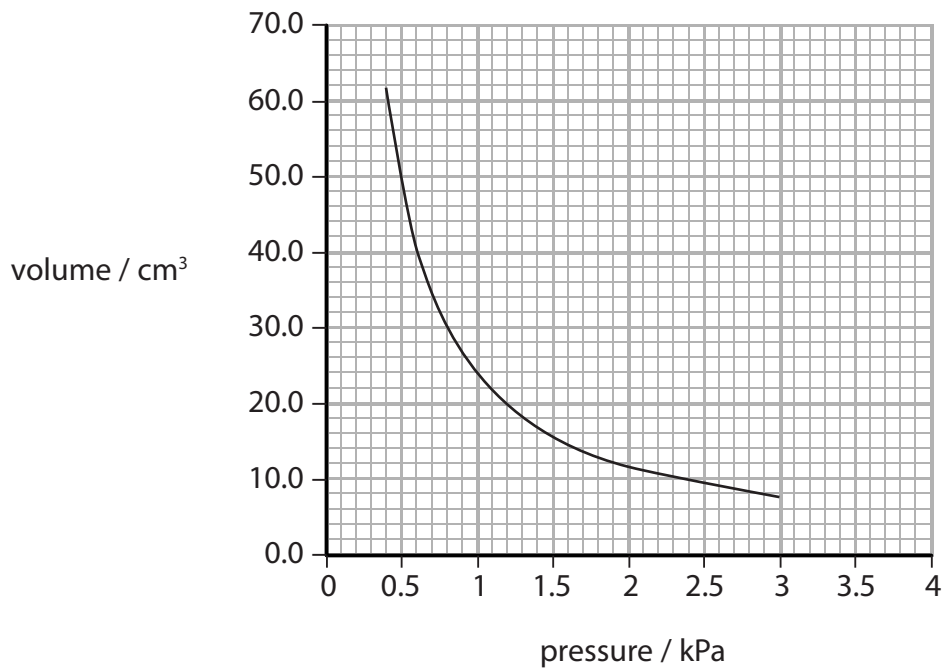
time between heartbeats = s



Gases

6 (a) A student investigated how the volume and pressure of a gas were related.

The graph shows how the volume of a gas changes with pressure.



The table shows the results used to plot the graph.

pressure / kPa	volume / cm ³
2.5
2.0	11.9
.....	14.0
1.4	17.0
1.0	24.0
0.4	61.5

(i) Use the graph to complete the table.

(2)



(ii) The results were taken at a constant temperature of 23 °C.

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

A temperature of 23 °C can be written in kelvin as

(1)

- A** -273 K
- B** 250 K
- C** 273 K
- D** 296 K

(iii) Estimate a value for the volume when the pressure becomes 4 kPa.

(1)

volume = cm³

(iv) When the pressure of the gas is 2.2 kPa, the volume of the gas is 10.8 cm³.

Use the equation

$$V_2 = \frac{P_1 V_1}{P_2}$$

to calculate the volume of the gas when the pressure of the gas is 0.2 kPa.

(2)

volume = cm³



