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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P 4 1 9 4 6 A 0 1 2 0

PEARSON

## FORMULAE

You may find the following formulae useful

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

current = number of particles per second × charge on each particle $I = Nq$

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

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

The relationship between volume and pressure for a gas $V_1 P_1 = V_2 P_2$

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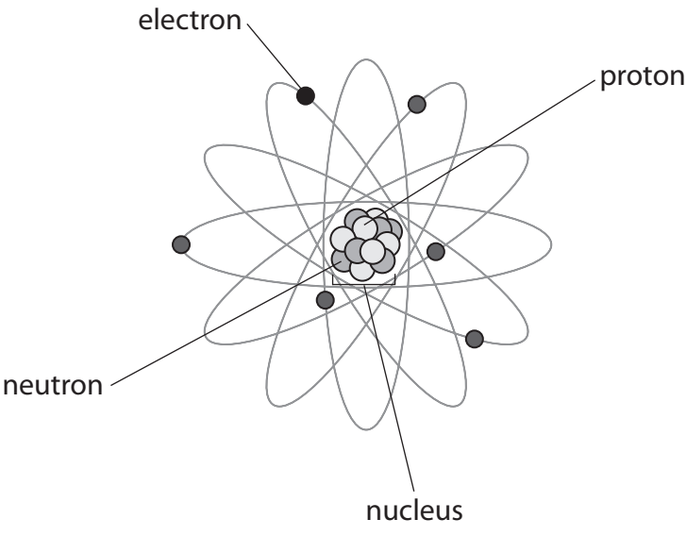
**Questions begin on next page**

**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 $^{226}_{88}Ra$.

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 |

(i) When an alpha particle is emitted by $^{226}_{88}Ra$ the mass number becomes .....

**(1)**

(ii) When an alpha particle is emitted by $^{226}_{88}Ra$ 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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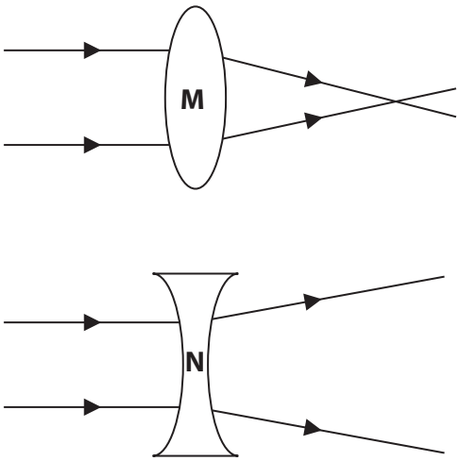
**(Total for Question 1 = 8 marks)**

**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

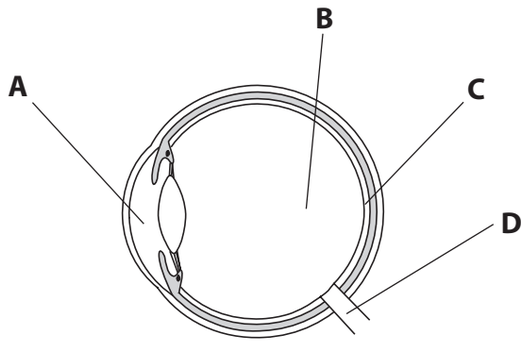
(ii) The focal length of lens **M** is 2 m.

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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.....

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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.

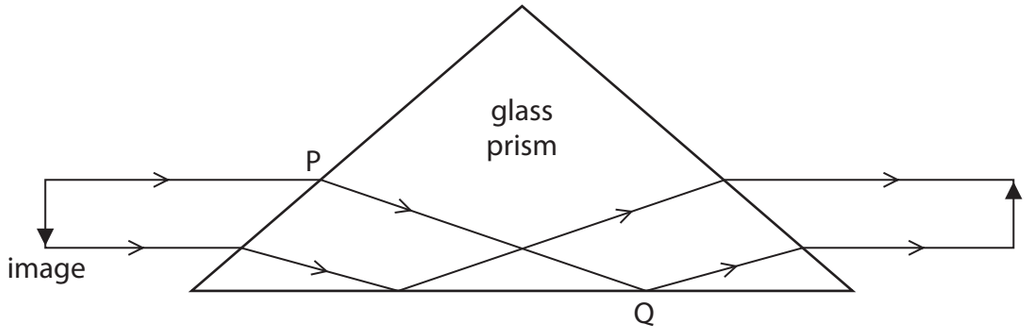


Diagram 1

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

**(2)**

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.....

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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)**

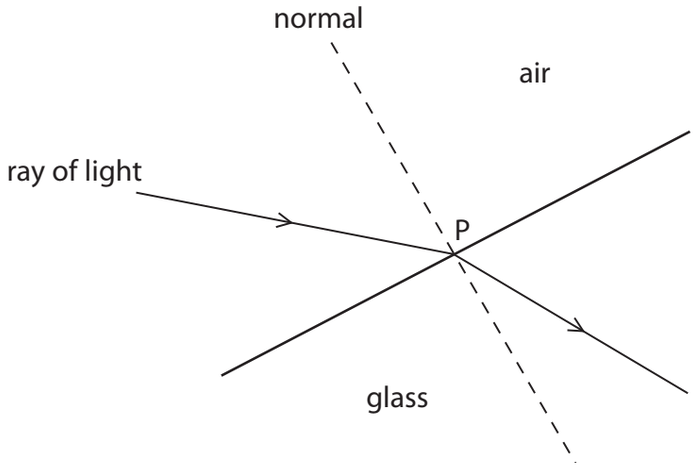


Diagram 2

(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)**

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

**(2)**

**(Total for Question 3 = 10 marks)**

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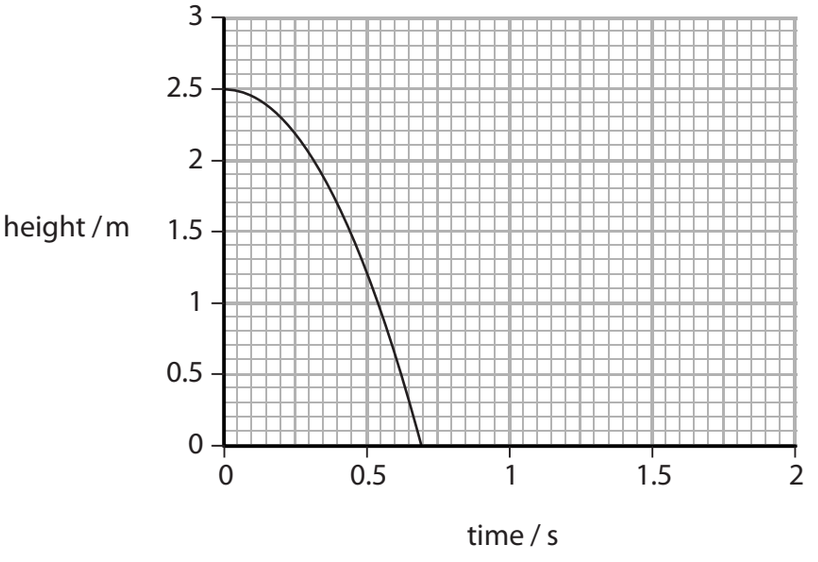
## Collision

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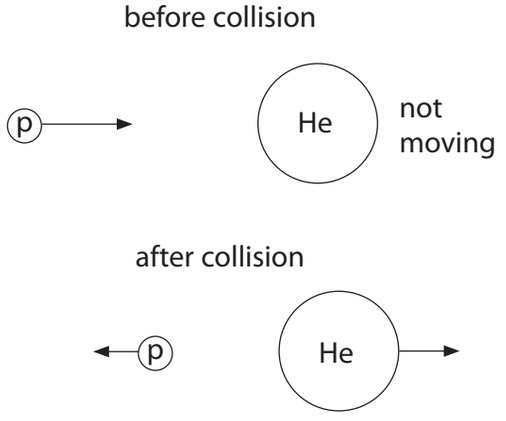
(b) The diagram shows a collision between a proton (p) and a helium nucleus (He).




(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)**

.....

.....

.....

.....

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

**(1)**

.....

.....

**(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.

**(1)**

☒ **A** on the finger

☒ **B** over the heart

☒ **C** on the neck

☒ **D** on the wrist

(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

*(b) Doctors use an electrocardiogram (ECG) machine to monitor the action of a person's heart.

Describe how a doctor can use an ECG machine to collect and display information from a person's beating heart in order to check heart action.

You may draw a labelled diagram to help with your answer.

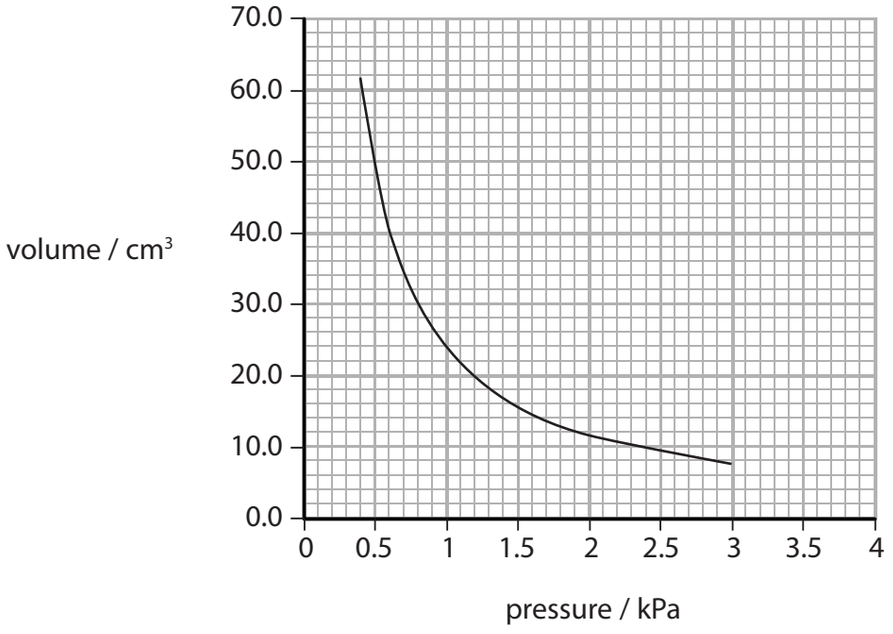
**(6)**

**(Total for Question 5 = 12 marks)**

**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 = ..... $cm^3$

(iv) When the pressure of the gas is 2.2 kPa, the volume of the gas is 10.8 $cm^3$.

Use the equation

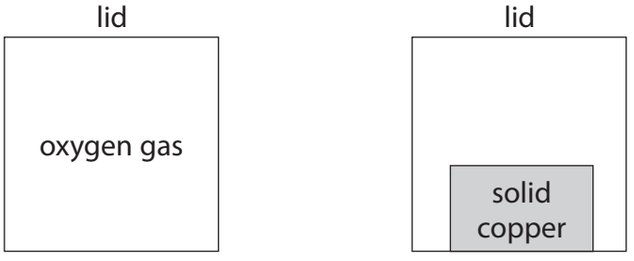
$$V_2 = \frac{P_1 V_1}{P_2}$$

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

**(2)**

volume = ..... $cm^3$

*(b) The diagrams show a block of solid copper and some oxygen gas in two closed containers.




The oxygen exerts a pressure on the lid of its container.

The copper does not exert a pressure on the lid of its container.

Explain, using kinetic theory, why the oxygen exerts a pressure on the lid but the copper does not.

**(6)**

**(Total for Question 6 = 12 marks)**

**TOTAL FOR PAPER = 60 MARKS**