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| Surname | Other names |
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**Pearson Edexcel GCSE**

| Centre Number | Candidate Number |
|---|---|
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# Physics

## Unit P3: Applications of Physics

**Foundation Tier**

| Friday 24 June 2016 – Morning<br>**Time: 1 hour** | Paper Reference<br>**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

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

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

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

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 ☒.**

## Gases

**1** Three states of matter are solid, liquid and gas.

(a) (i) Particles in each state of matter move in different ways.

Draw a line from each state of matter to the description of the way in which the particles move.

**(3)**

| State of matter | Particles |
|---|---|
| solid | move randomly and are close together |
| liquid | do not move |
| gas | move around quickly and are far apart |
| | vibrate about fixed positions |

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

**(1)**

When a gas is cooled most of the particles

- ☐ **A** become heavier
- ☐ **B** become lighter
- ☐ **C** move faster
- ☐ **D** move slower

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(b) The volume of dry air in a sealed balloon can be changed by cooling the balloon.

The temperature of the air in the balloon is 20 °C.

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

When 20 °C is changed to kelvin it becomes

**(1)**

☐ **A** 253 K

☐ **B** 273 K

☐ **C** 293 K

☐ **D** 373 K

(ii) At this temperature, the volume of air in the balloon is 0.25 $m^3$.

When the balloon is cooled the volume becomes 0.10 $m^3$.

Assume that there is no change in pressure.

Calculate the new temperature of the air in the balloon in kelvin.

Use the equation $T_2 = \frac{V_2 T_1}{V_1}$

**(2)**

temperature of the air in the balloon = ..... K

(iii) Suggest one way of increasing the volume of the balloon.

**(1)**

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**(Total for Question 1 = 8 marks)**

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## Electrical activity of the heart

**2** (a) Diagram 1 shows the electrocardiogram (ECG) trace for a single heartbeat.

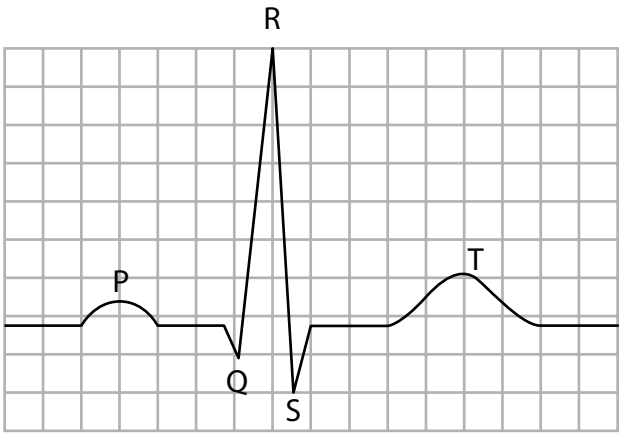


Diagram 1

On the vertical scale each square represents 0.2 mV.

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

**(1)**

The potential difference between R and S is about

☒ **A** 0.9 mV

☒ **B** 1.8 mV

☒ **C** 9.0 mV

☒ **D** 1.8 V

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(b) Diagram 2 shows the ECG trace for a heart that is beating too fast.

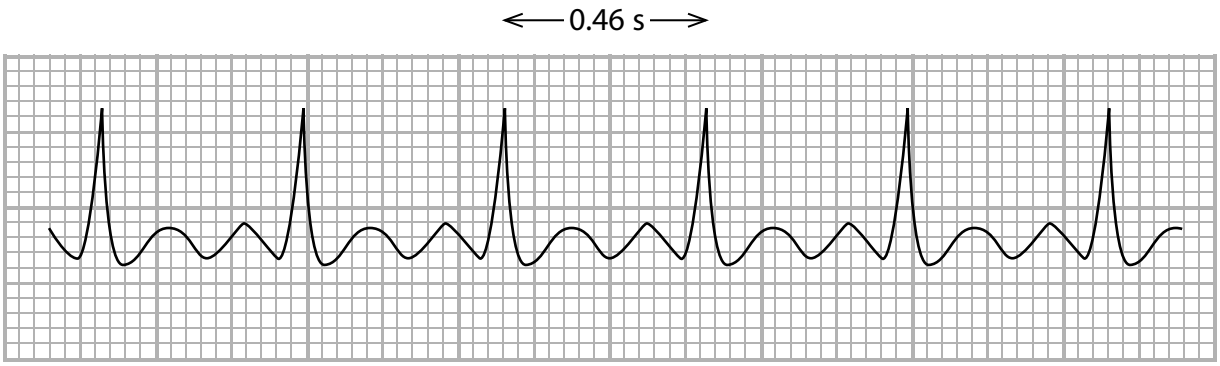


Diagram 2

(i) The time between beats for this heart is 0.46 s.

Calculate the frequency of the heartbeats.

**(2)**

frequency of heartbeats = ..... Hz

(ii) When a heart is beating at a normal rate it has a frequency of 1.25 Hz.

Calculate this heart rate in beats per minute.

**(2)**

heart rate = ..... beats per minute

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(c) Suggest how good contact is made between the patient's skin and the electrodes of the ECG machine.

**(1)**

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(d) Describe what a pacemaker does when it is put inside the body of a patient.

**(2)**

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**(Total for Question 2 = 8 marks)**

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## Centripetal force and circular motion

**3** (a) In the box are the names of some forces that can provide a centripetal force.

| friction | gravity | magnetism | reaction | tension |
|---|---|---|---|---|

Choose words from the box to complete each sentence.

**(2)**

(i) When a satellite orbits the Earth the centripetal force is provided by

..... .

(ii) When a motorbike goes around a flat circular track the centripetal force is provided by ..... .

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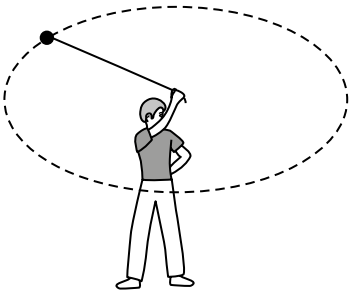
(b) A student investigates circular motion by whirling a ball about his head.
The ball travels in a **horizontal** circle.



(i) State in which direction the centripetal force on the ball acts.

**(1)**

.....

.....

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

**(1)**

The centripetal force on the ball is provided by the

☒ **A** air resistance

☒ **B** force of gravity

☒ **C** weight of the ball

☒ **D** pull of the string

(c) The student measures the force on the ball and the speed of the ball.
He repeats his experiment for different values of force.

The results of the student's experiment are shown in the table.

| Force / N | 0.00 | 0.25 | 0.50 | 1.00 | 2.00 | 3.00 | 4.00 |
|---|---|---|---|---|---|---|---|
| Speed / m /s | 0.0 | 1.7 | 2.5 | 3.5 | 4.9 | 6.0 | 6.9 |

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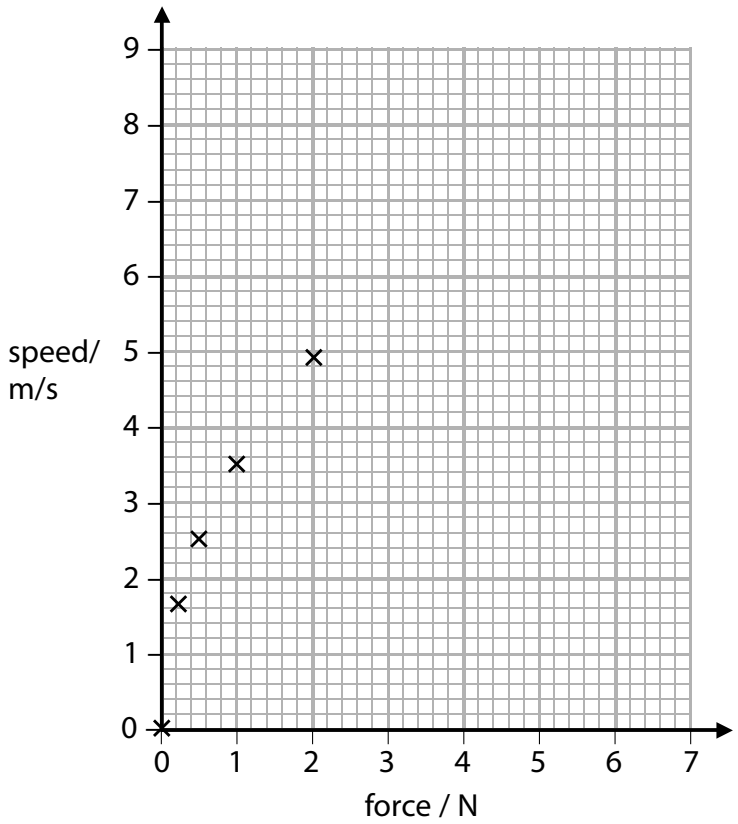
He plots the first five points.

(i) Complete the graph by plotting the other two points.

**(2)**

(ii) Draw a curve of best fit.

**(1)**




(iii) Use your graph to estimate the speed of the ball when the force is 6 N.

**(1)**

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(iv) Use the graph to describe how the speed varies with the force on the ball.

**(2)**

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

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## Ionising radiation

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

Alpha radiation is ionising because alpha particles

**(1)**

- ☐ **A** are charged
- ☐ **B** are heavy particles
- ☐ **C** contain neutrons
- ☐ **D** have a low frequency

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

Beta plus ($\beta^+$) particles are

**(1)**

- ☐ **A** electrons
- ☐ **B** neutrons
- ☐ **C** positrons
- ☐ **D** protons

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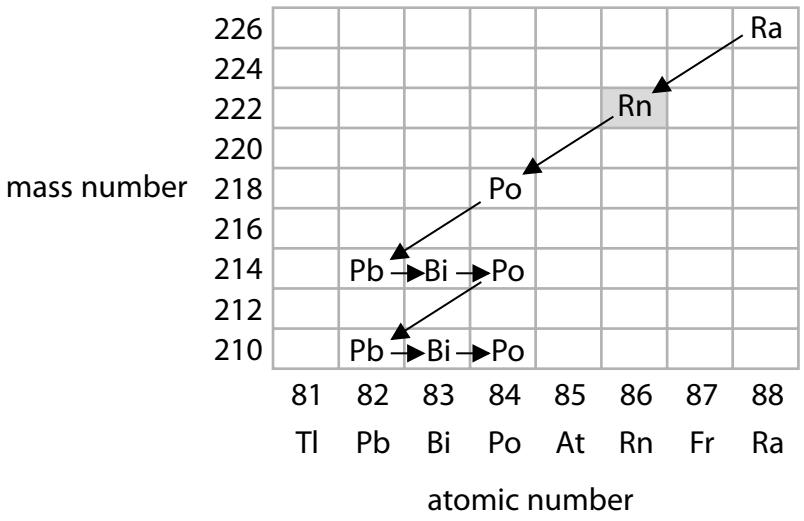
(b) The chart shows part of a radioactive decay series




(i) From the chart find the mass number and atomic number of radon (Rn).

**(2)**

Mass number of radon = .....

Atomic number of radon = .....

(ii) Radon (Rn) decays by emitting an alpha particle from the nucleus.

State what happens to the mass number **and** to the atomic number of radon (Rn) when an alpha particle is emitted.

**(2)**

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(iii) Some unstable isotopes of lead (Pb) decay by the emission of a beta minus ($\beta^-$) particle.

Describe what happens to a nucleus in the process of the beta minus ($\beta^-$) decay.

**(2)**

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.....

(iv) Gamma radiation is often emitted with the alpha or beta particles.

Explain what happens to the nucleus when gamma radiation is emitted.

**(2)**

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**(Total for Question 4 = 10 marks)**

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## Medical physics

**5** Cyclotrons and X-rays are both used in medical physics.

(a) Cyclotrons are used to accelerate particles.

(i) Which type of field is used in a cyclotron to keep protons moving in a circle?

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

**(1)**

☐ **A** electric

☒ **B** frictional

☐ **C** gravitational

☐ **D** magnetic

(ii) Explain how the protons accelerated in a cyclotron are used to produce radioactive isotopes.

**(2)**

(iii) Suggest why neutrons cannot be accelerated in a cyclotron.

**(1)**

(b) X-rays are used in hospitals for diagnosis and treatment.

(i) Explain why the properties of X-rays make them suitable for the treatment of cancer.

**(2)**

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*(ii) Exposure to X-rays can be dangerous for patients receiving a diagnosis or treatment and for radiographers who use the X-ray equipment.

Explain the precautions that are taken to ensure the safety of both patients and radiographers exposed to radiation.

**(6)**

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

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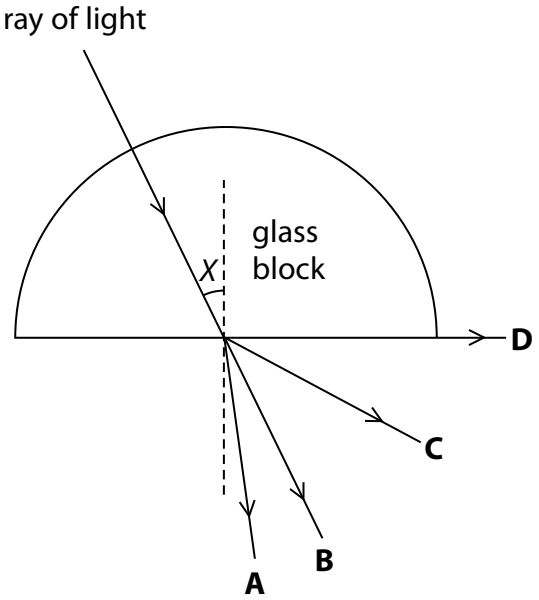
**6** (a) The diagram shows light incident on the centre of a semi circular glass block. Angle *X* is less than the critical angle.




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

The ray of light emerges from the glass block along the path towards

**(1)**

☒ **A**

☒ **B**

☒ **C**

☒ **D**

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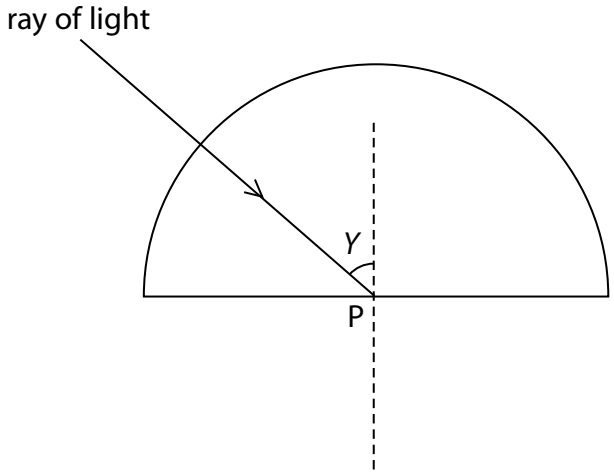
(b) In the diagram, the angle *Y* is greater than the critical angle.

Complete the diagram to show what happens to the ray of light after it reaches the surface of the glass at point P.

**(1)**

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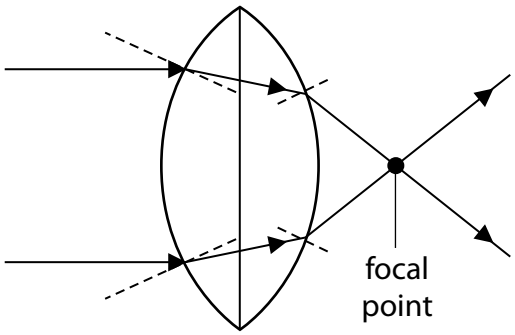
(c) The diagram shows light passing through a powerful converging lens.




Explain why the light changes direction when it passes from air into the glass lens.

**(2)**

.....

.....

.....

.....

(d) The focal length of a lens is 0.25m.

Calculate the power of this lens.

**(2)**

power of the lens = ..... D

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*(e) The photographs show two effects of light.

© www.coolthings.com.au

**Fibre optic lamp**

© www.scienceblogs.com

**Plane mirror**

Discuss what is happening to the light in each example.

(You may draw diagrams to help with your answer.)

**(6)**

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

**TOTAL FOR PAPER = 60 MARKS**

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