

**Paper Reference(s) 1PH0/1H**  
**Pearson Edexcel Level 1/Level 2 GCSE (9–1)**

**Physics**  
**Paper 1**  
**Higher Tier**

<b>Total Marks</b>
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**Wednesday 20 May 2020 – Afternoon**

**Time: 1 hour 45 minutes plus your additional time allowance**

**In the boxes below, write your name, centre number and candidate number.**

<b>Surname</b>					
<b>Other names</b>					
<b>Centre Number</b>					
<b>Candidate Number</b>					

**YOU MUST HAVE**

**Calculator, ruler**

**YOU WILL BE GIVEN**

**Equations Booklet, Diagram Booklet**

**INSTRUCTIONS**

**Answer ALL questions.**

**Answer the questions in the spaces provided – there may be more space than you need.**

**Calculators may be used.**

**Any diagrams may NOT be accurately drawn, unless otherwise indicated.**

**You must show all your working out with your answer clearly identified at the end of your solution.**

## **INFORMATION**

**The total mark for this paper is 100.**

**The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.**

**In questions marked with an asterisk (\*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.**

**An equations booklet is provided.**

## **ADVICE**

**Read each question carefully before you start to answer it.**

**Try to answer every question.**

**Check your answers if you have time at the end.**

**Answer ALL questions. Write your answers in the spaces provided.**

**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 ☐.**

- 1 (a) Radioactive substances are used in the generation of electricity.**

**State TWO other uses of radioactive substances.  
(2 marks)**

**1** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**(continued on the next page)**

**1 continued.**

**(b) Look at Figure 1 for Question 1(b) in the Diagram Booklet. It is a diagram of a nuclear reactor, used in the generation of electricity.**

**P may be used to shut down the reactor when necessary.**

**Q slows down neutrons to enable a chain reaction to take place.**

**State the name of the two parts labelled P and Q.  
(2 marks)**

**P** \_\_\_\_\_

**Q** \_\_\_\_\_

**(continued on the next page)**

**1 continued.**

**(c) Explain how neutrons enable a nuclear chain reaction to take place. (2 marks)**

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**(TOTAL FOR QUESTION 1 = 6 MARKS)**

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- 2 Look at Figure 2 for Question 2 in the Diagram Booklet. It shows that a student lifts a toy car from a bench and places the toy car at the top of a slope.**
- (a) Describe an energy transfer that occurs when the student lifts the toy car from the bench and places the toy car at the top of the slope. (2 marks)**

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**2 continued.**

**(b) The student lets the toy car roll down the slope.**

**Describe how the student could find, by experiment, the speed of the toy car at the bottom of the slope. (4 marks)**

[illegible]



**2 continued.**

- (c) The student needs to develop the experiment to determine the loss in potential energy and the gain in kinetic energy as the toy car is rolling down the slope.**

**State the other measurements the student must make. (2 marks)**

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**2 continued.**

- (d) When the toy car rolls down the slope, some energy is transferred to the surroundings as thermal energy.**

**State how the student could calculate the amount of energy transferred to the surroundings.**

**(1 mark)**

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**(TOTAL FOR QUESTION 2 = 9 MARKS)**

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**3 (a) Which of these is a vector? (1 mark)**

☐ **A energy**

☐ **B force**

☐ **C mass**

☐ **D work**

**(b) (i) State the equation that relates acceleration to change in velocity and time taken. (1 mark)**

**(continued on the next page)**

**3 continued.**

- (ii) A van accelerates from a velocity of 2 m/s to a velocity of 20 m/s in 12 s.**

**Calculate the acceleration of the van.  
(2 marks)**

**acceleration = \_\_\_\_\_ m/s<sup>2</sup>**

**(continued on the next page)**

**3 continued.**

**(c) Look at Figure 3 for Question 3(c) in the Diagram Booklet. It is a velocity/time graph for 15 s of a cyclist's journey.**

**(i) Calculate the distance the cyclist travels in the 15 s. (3 marks)**

**distance = \_\_\_\_\_ m**

**(continued on the next page)**

**3 continued.**

- (ii) Another cyclist starts from rest, but his acceleration decreases as time increases.**

**Sketch the velocity/time graph for this cyclist on Figure 3. (2 marks)**

**(TOTAL FOR QUESTION 3 = 9 MARKS)**

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- 4 (a) The Sun has a mass of  $2.0 \times 10^{30}$  kg.

A white dwarf has a mass of  $3.4 \times 10^{29}$  kg.

Calculate the value of

$$\frac{\text{mass of this white dwarf}}{\text{mass of the Sun}}$$

(2 marks)

value = \_\_\_\_\_

(continued on the next page)

**4 continued.**

**(b) Look at Figure 4 for Question 4(b) in the Diagram Booklet. It shows a diagram giving some information about main sequence stars.**

**Luminosity is a measure of how bright something is.**

**An increase in luminosity means an increase in brightness.**

**(i) Estimate the temperature of the Sun. (1 mark)**

**temperature of the Sun = \_\_\_\_\_ K**

**(ii) State how the brightness of a main sequence star changes with its temperature. (1 mark)**

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**4 continued.**

**(iii) State how the brightness of a main sequence star changes with its mass. (1 mark)**

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**4 continued.**

- (c) Nuclear fusion provides the energy source for stars including the Sun.**

**Describe what happens during nuclear fusion.  
(3 marks)**

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**4 continued.**

- (d) A nebula may evolve into a main sequence star, such as the Sun.**

**Explain how a nebula may evolve into a main sequence star. (3 marks)**

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**(TOTAL FOR QUESTION 4 = 11 MARKS)**

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- 5 (a) A radio station transmits on 97.4 MHz.

To receive the waves an aerial needs a length equal to half the wavelength of the radio waves being transmitted.

Calculate the length of the aerial needed.

The speed of the radio waves is  $3.00 \times 10^8$  m/s.  
(3 marks)

length of aerial = \_\_\_\_\_ m

(continued on the next page)

**5 continued.**

- (b) Look at Figure 5 for Question 5(b) in the Diagram Booklet. To investigate refraction in a rectangular glass block a student uses the apparatus.**

**Describe how the student should measure the angle of refraction. (2 marks)**

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**5 continued.**

- (c) Look at Figure 6 for Question 5(c) in the Diagram Booklet. It shows a simplified diagram of radio waves from a transmitter moving upwards, then meeting a boundary between lower and upper layers of the atmosphere.**

**Explain what happens to the radio waves after they meet the boundary between the lower and upper layers as shown in Figure 6.**

**Your explanation should refer to changes in direction and speed of the waves. (4 marks)**

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**5 continued.**

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**(TOTAL FOR QUESTION 5 = 9 MARKS)**

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- 6 (a) Four students and their teacher do an experiment to measure the speed of sound in air.**

**The teacher stands at a distance and fires a starting pistol into the air.**

**The students see the flash when the pistol is fired. They measure the time from when they see the flash to when they hear the bang.**

**Look at Figure 7 for Question 6(a) in the Diagram Booklet. It shows a diagram a student drew of the arrangement.**

**The students obtained a value of 240 m/s for the speed of sound.**

**The accepted value, in a science data book, is 343 m/s.**

- (i) Calculate the difference between the students' value and the accepted value as a percentage of the accepted value. (2 marks)**

**percentage difference = \_\_\_\_\_ %**



**6 continued.**

**(ii) When the distance was 100 m, the students measured the following times:**

**0.43 s**

**0.35 s**

**0.50 s**

**0.38 s**

**Explain why their times vary so much.  
(2 marks)**

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**6 continued.**

**(iii) Explain ONE way the students might improve this experiment. (2 marks)**

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**6 continued.**

**(b) Look at Figure 8 for Question 6(b) in the Diagram Booklet. It represents a sound wave coming from a loudspeaker and shows the effects on particles of the air at one instant in time.**

**(i) Draw and label a distance of one wavelength in Figure 8. (1 mark)**

**(ii) Describe the motion of the particles as the wave travels through the air. (2 marks)**

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**(TOTAL FOR QUESTION 6 = 9 MARKS)**

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- 7 (a) Which of these describes isotopes of an element?  
(1 mark)

<input type="checkbox"/> A	same atomic number	different number of neutrons
<input type="checkbox"/> B	same atomic number	different number of protons
<input type="checkbox"/> C	same mass number	different number of neutrons
<input type="checkbox"/> D	same mass number	different number of protons

- (b) Look at Figure 9 for Question 7(b) in the Diagram Booklet. It represents a decay that can happen inside the nucleus of an atom.

Which decay is represented in Figure 9? (1 mark)

- ☐ A alpha
- ☐ B beta minus
- ☐ C beta plus
- ☐ D gamma

(continued on the next page)

**7 continued.**

**(c) The half-life of cobalt-60 is 5 years.**

**A school cobalt source had an activity of 38.5 kBq  
in the year 2000.**

**Estimate the activity of this source in the  
year 2020. (3 marks)**

**activity = \_\_\_\_\_ kBq**

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**7 continued.**

- (d) Explain what can happen to the body if a person has a prolonged exposure to gamma rays.  
(2 marks)**

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**7 continued.**

**(e) A G-M tube is connected to a counter.**

**A teacher places the G-M tube near to a radioactive source.**

**A student starts the counter and clock at the same time and writes down the readings shown on the counter every 15 s.**

**Look at Figure 10 for Question 7(e) in the Diagram Booklet. The student plots the readings with a line of best fit.**

**(i) Calculate the average count rate, in counts/s, from the graph.**

**Show your working on the graph. (2 marks)**

**average count rate = \_\_\_\_\_ counts/s**

**(continued on the next page)**

**7 continued.**

- (ii) The student says that the experiment must have been done carelessly because the data seemed quite scattered away from the best fit line.**

**The teacher claims such results should be expected in radioactivity experiments.**

**Justify the teacher's claim. (2 marks)**

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**(TOTAL FOR QUESTION 7 = 11 MARKS)**

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- 8 (a) A kettle is used to heat water.

Look at Figure 11 for Question 8(a) in the Diagram Booklet. It shows a graph of temperature against time for the water in the kettle.

Calculate the rate of increase in temperature at a time of 150 s, by drawing a tangent to the curve in Figure 11 at a time of 150 s. (3 marks)

\_\_\_\_\_ °C/s

(continued on the next page)

8 continued.

(b) The kettle has an efficiency of 91% in supplying energy to the water.

The thermal energy of the water increases by  $3.3 \times 10^5 \text{ J}$  in 200 s.

Calculate the total amount of energy supplied to the kettle in the 200 s. (2 marks)

Use the equation

$$\text{efficiency} = \frac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}}$$

total amount of energy supplied = \_\_\_\_\_ J

(continued on the next page)

**8 continued.**

**\*(c) The global demand for electricity is increasing.**

**There is a debate about whether nuclear power generation should or should not contribute to meeting this increasing demand.**

**Discuss the arguments for and against using nuclear power to meet the increasing global demand for electricity. (6 marks)**

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**(TOTAL FOR QUESTION 8 = 11 MARKS)**

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- 9 (a) Look at Figure 12 for Question 9(a) in the Diagram Booklet. It is a diagram showing a rocket that is sent into space to try and change the path of a small asteroid.
- (i) The rocket has a mass of  $5.5 \times 10^5 \text{ kg}$  and is travelling to the right at  $14 \text{ km/s}$ .

Which of these is a correct calculation of the momentum of the rocket in  $\text{kg m/s}$ ? (1 mark)

Use the equation

$$p = m \times v$$

- ☐ A  $7.7 \times 10^3 \text{ kg m/s}$
- ☐ B  $7.7 \times 10^6 \text{ kg m/s}$
- ☐ C  $7.7 \times 10^9 \text{ kg m/s}$
- ☐ D  $7.7 \times 10^{12} \text{ kg m/s}$

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**9 continued.**

- (ii) The asteroid has a momentum of  $7.5 \times 10^{10} \text{ kg m/s}$  and a mass of  $8.0 \times 10^6 \text{ kg}$ .**

**Calculate the speed of the asteroid. (2 marks)**

**speed of the asteroid = \_\_\_\_\_ m/s**

**(continued on the next page)**

**9 continued.**

- \*(b) A student investigates the effect of a crumple zone on the force exerted during a collision.**

The student has one trolley with a spring at the front and another trolley without a spring.



Look at Figure 13 for Question 9(b) in the Diagram Booklet. It shows the arrangement the student uses.

After a trolley is released, it accelerates down a slope and bounces off a rigid wall.

The speed of a trolley can be measured just before a collision with the wall and just after a collision with the wall.

The silver foils are connected to a millisecond timer.

The silver foils make contact with each other during the collision, so the time they are in contact can be read from the millisecond timer.

(continued on the next page)

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**9 continued.**

**Explain how the student could investigate the effect of a crumple zone on the average force exerted during the collision.**

**Your explanation should include:**

- **how to determine the force (you may wish to refer to an equation from the Equations Booklet provided)**
- **how the effect of crumple zones may be shown in the investigation**
- **precautions that may be necessary to achieve accurate results.**

**(6 marks)**

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**9 continued.**

- (c) Newton's third law, when applied to the collision of the rocket and the asteroid as shown in Figure 12, can be stated as follows:**

**The force exerted by the rocket on the asteroid is equal and opposite to the force exerted by the asteroid on the rocket.**

**Explain how this statement links to the conservation of momentum in the collision.  
(4 marks)**

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**9 continued.**

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**(TOTAL FOR QUESTION 9 = 13 MARKS)**

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**10 Look at Figure 14 for Question 10(a) in the Diagram Booklet. It shows the hearing responses of a human, a mouse and a bird over a range of frequencies of sound.**

- (a) (i) Describe TWO differences between the hearing responses of the human and the mouse.  
(2 marks)**

**1** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**(continued on the next page)**

**10 continued.**

- (ii) A farmer wants to use an alarm to scare away these birds.**

**State which frequency would be most effective.**

**Give the appropriate units. (1 mark)**

**frequency \_\_\_\_\_**

- (iii) State the reason for your choice of frequency in (ii). (1 mark)**

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**10 continued.**

**(b) Describe the difference between 'infrasound' and 'ultrasound'. (2 marks)**

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**10 continued.**

- (c) A transducer can transmit and detect ultrasonic waves.**

**Look at Figure 15 for Question 10(c) in the Diagram Booklet. It shows ultrasonic waves transmitted by the transducer on the bottom of a ship.**

**The waves reflect off the sea floor and are received back at the transducer.**

**The waves travel at 1500 m/s.**

**The time between transmission and reception is 48 milliseconds.**

**Calculate the depth of water, D, shown in Figure 15.  
(2 marks)**

**depth of water, D = \_\_\_\_\_ m**

**(continued on the next page)**

**Turn over**

**10 continued.**

**(d) Explain how vibrations from earthquakes may be used to study the core of the Earth. (4 marks)**

[illegible]

**(TOTAL FOR QUESTION 10 = 12 MARKS)**

**TOTAL FOR PAPER = 100 MARKS**  
**END**