Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Thursday 25th May 2023

Morning (Time: 1 hour 45 minutes)

Paper reference **1PH0/1F**

Physics

PAPER 1

Foundation Tier

You must have:
Calculator, ruler, Equation Booklet (enclosed)

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 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.
- A list of equations is included at the end of this exam paper.

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.

Turn over

Pearson

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 This question is about waves in the electromagnetic (e-m) spectrum.

(a) (i) Figure 1 shows some types of radiation that form part of the e-m spectrum and some uses of e-m radiation.

Draw **one** straight line from each type of e-m radiation to its use.

One line has been drawn for you.

(3)

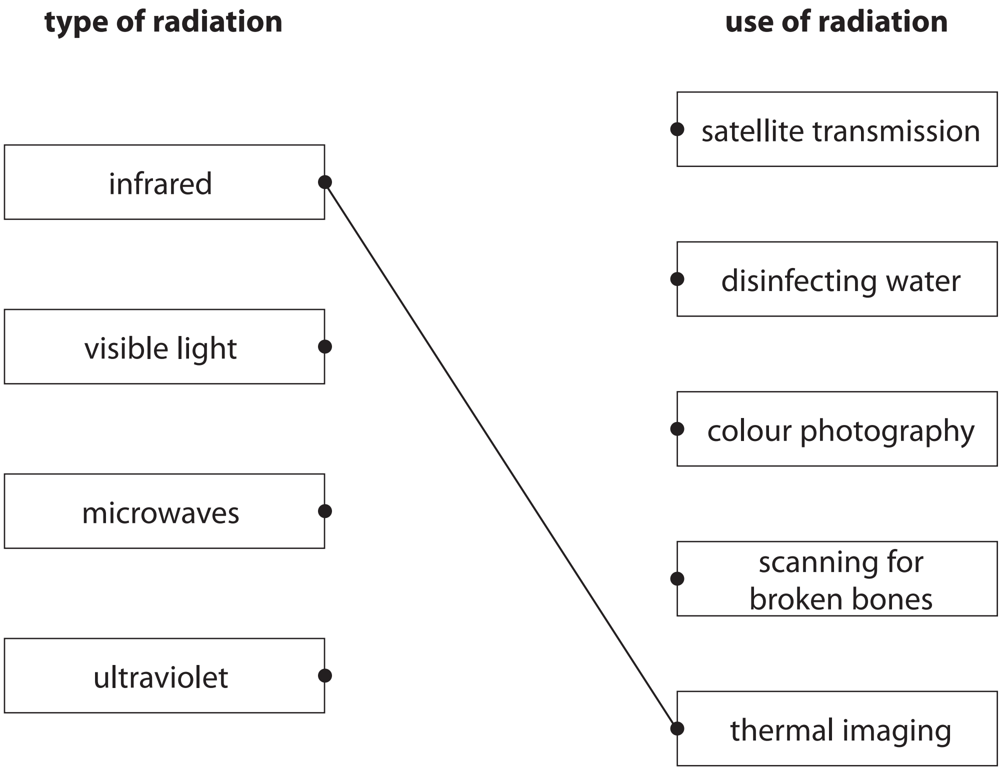


Figure 1

(ii) Which of these waves has the highest frequency?

(1)

☐ **A** infrared

☐ **B** microwaves

☐ **C** ultraviolet

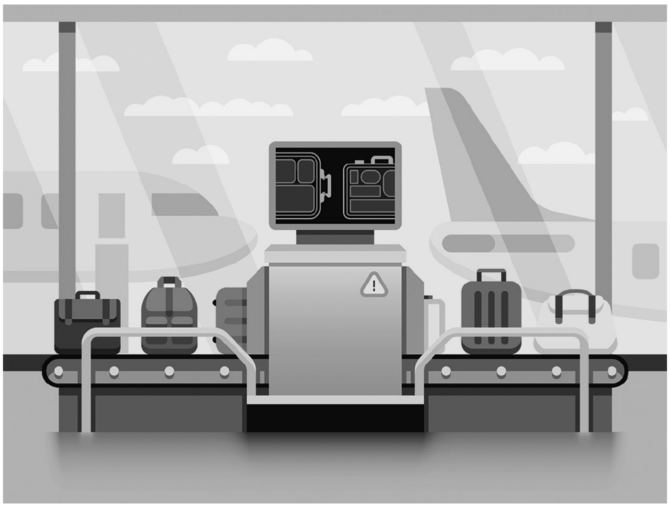
☐ **D** visible light

P 7 2 5 7 2 A 0 2 3 2

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

(b) X-rays are also part of the e-m spectrum.

Figure 2 shows an airport security scanner using X-rays to scan passengers' bags.



(Source: © Net Vector / Shutterstock)

Figure 2

(i) Explain why X-rays are used to scan passengers' bags.

(2)

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(ii) Explain why passengers are **not** scanned with X-rays.

(2)

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(Total for Question 1 = 8 marks)

2 (a) Figure 3 shows a ray of light striking a mirror.

The angle of incidence is 30˚ and the ray of light is reflected.

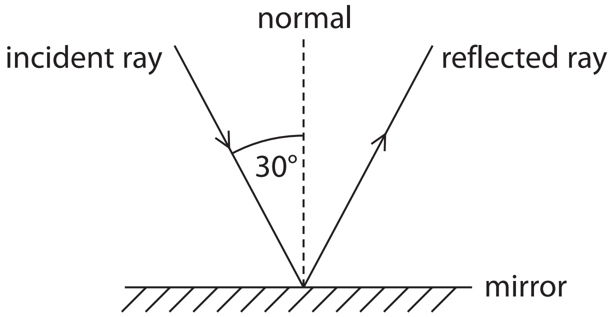

Figure 3

The angle of reflection is the angle between

(1)

☒ **A** the mirror and the incident ray

☒ **B** the mirror and the normal

☒ **C** the reflected ray and the incident ray

☒ **D** the reflected ray and the normal

(b) Figure 4 shows two lenses, P and Q, arranged to form a simple telescope.

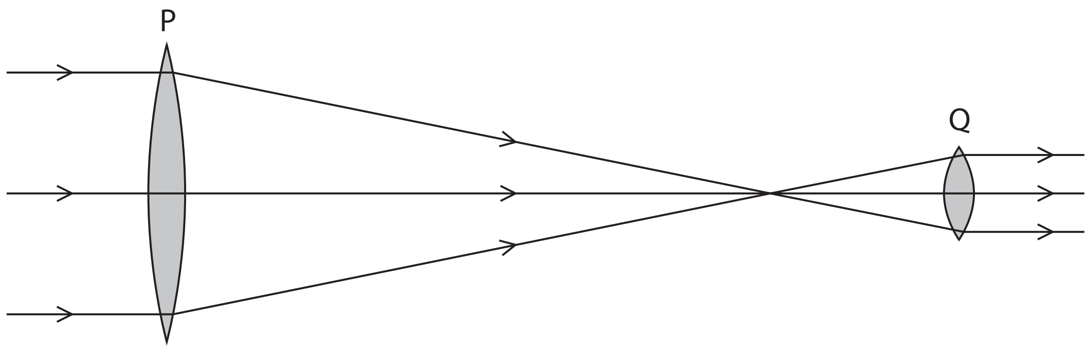

Figure 4

(i) State **one** use for a telescope.

(1)

....

....

(ii) Which of these describes the lenses?

(1)

☒ **A** P is converging, Q is diverging

☒ **B** P is diverging, Q is converging

☒ **C** P and Q are both converging

☒ **D** P and Q are both diverging

(iii) The focal length of lens Q is 0.14 m.

Calculate the power of the lens.

(2)

Use the equation

$$\text{power} = \frac{1}{\text{focal length in m}}$$

power of lens = ... dioptre

(c) A student is in a laboratory that has windows.

The student is given a converging lens, and a sheet of paper.

Describe how the student can produce an image of the window frame on the sheet of paper.

(2)

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(Total for Question 2 = 7 marks)

3 (a) The graph in Figure 5 shows how the velocity of a car changes with time.

The car starts from rest and travels along a level, straight road for 50 s.

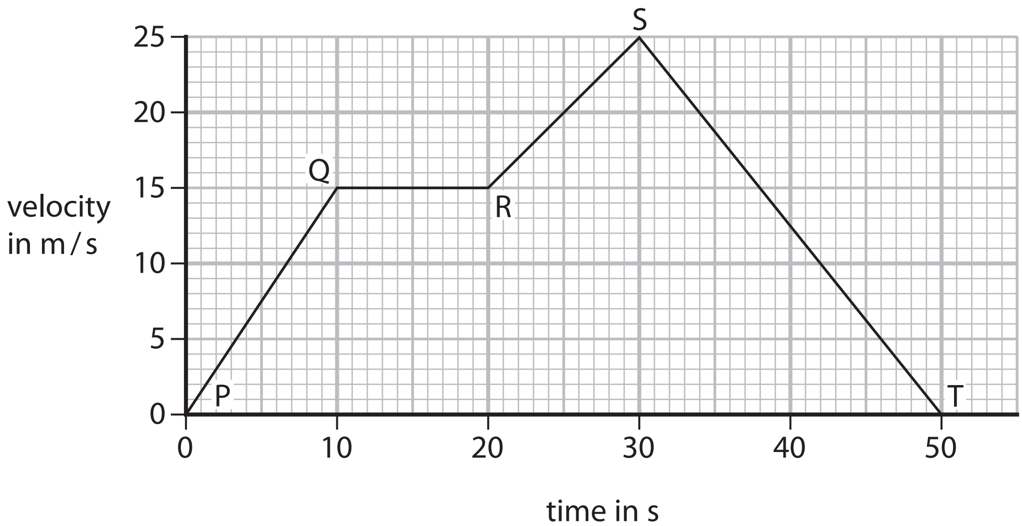

Figure 5

(i) Which part of the graph shows when the car has constant velocity?

(1)

☒ **A** PQ

☒ **B** QR

☒ **C** RS

☒ **D** ST

(ii) Which part of the graph shows when the car has the greatest acceleration?

(1)

☒ **A** PQ

☒ **B** QR

☒ **C** RS

☒ **D** ST

(iii) Calculate the acceleration of the car in the first 10 s shown on the graph.

(2)

Use the equation

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

acceleration = ... m / s²

(iv) Calculate the distance the car travels in part QR shown on the velocity / time graph in Figure 5.

(3)

distance = ... m

(b) A different car has a mass of 1200 kg.

Calculate the force needed to give this car an acceleration of 2.4 m / s².

(2)

Use the equation

$$F = m \times a$$

force = ... N

(Total for Question 3 = 9 marks)

4 An atom has a central nucleus containing neutrons and protons.

Electrons orbit the nucleus.

(a) (i) Which row of the table gives the relative mass and charge of a proton?

(1)

		relative mass	charge
☒	**A**	0	+1
☒	**B**	0	–1
☒	**C**	1	+1
☒	**D**	1	–1

(ii) An atom has a radius of 1.0×10^{-10} m.

A nucleus has a radius of 1.0×10^{-15} m.

Calculate the ratio of the radius of the atom to the radius of the nucleus.

(2)

ratio of radius of atom to radius of nucleus = ...

(iii) Explain why an atom has no charge overall.

(2)

....

....

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....

(b) One isotope of carbon is carbon-14.

$$^{14}_{6}C$$

(i) State the number of protons in one atom of carbon-14.

(1)

number of protons = ...

(ii) State the number of neutrons in one atom of carbon-14.

(1)

number of neutrons = ...

(iii) Figure 6 shows a graph for the decay of the radioactive isotope carbon-14.

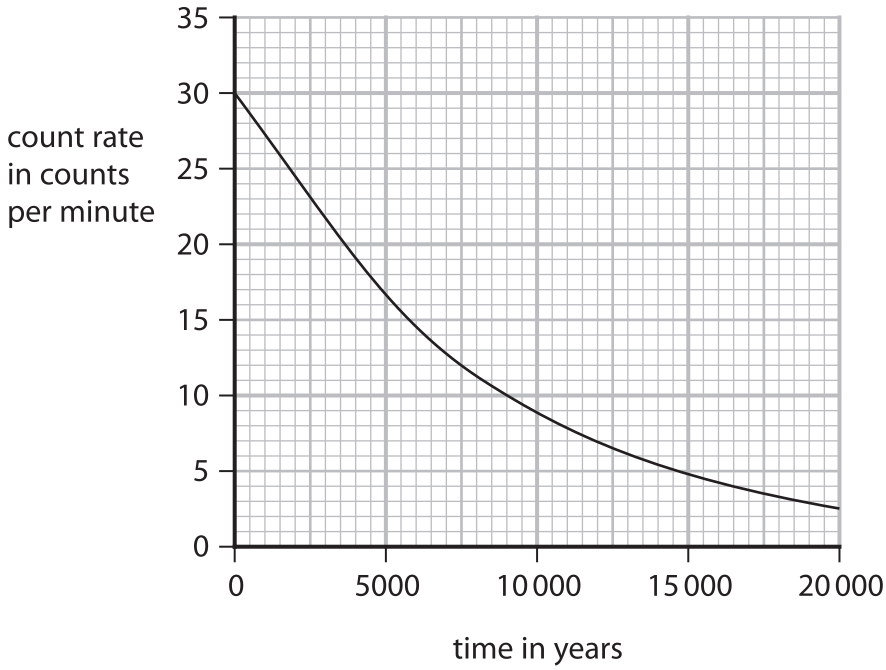

Figure 6

Use the graph to estimate the half-life of carbon-14.

(2)

half-life = ... years

(Total for Question 4 = 9 marks)

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5 (a) Figure 7 shows a wave on the surface of water.

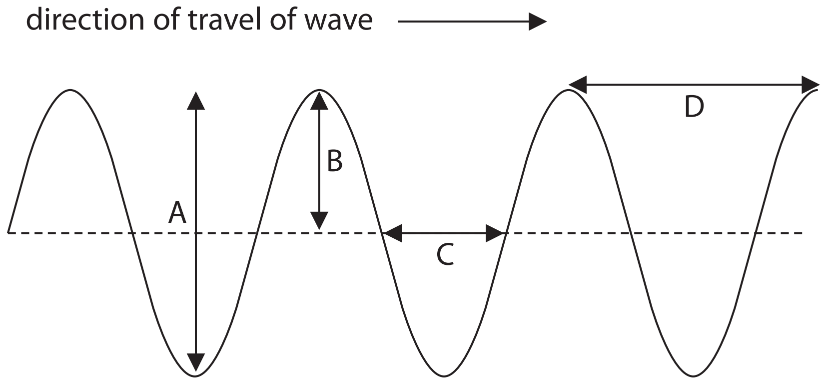

Figure 7

(i) Which of the arrowed lines shows the amplitude of the wave?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(ii) Explain why the wave shown in Figure 7 is a transverse wave.

(2)

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(b) Figure 8 shows a ripple tank.

A screen is placed below the ripple tank.

The wave pattern produced by the ripples can be seen on the screen.

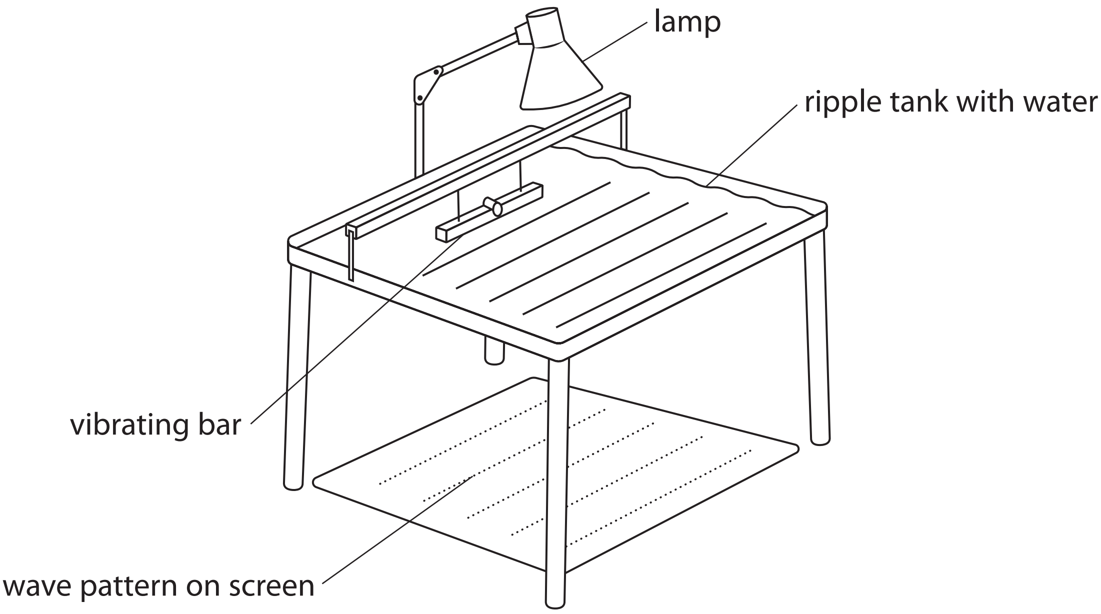

Figure 8

A student has a stop clock and a ruler.

(i) Describe how the student could measure the frequency of the ripples.

(2)

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(ii) Describe how the student could measure the wavelength of the ripples.

(2)

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(c) In a swimming pool, a wave is produced with a wavelength of 4.0 m and a velocity of 0.8 m / s.

Calculate the frequency of the wave.

State the unit of frequency.

(3)

Use the equation

$$v = f \times \lambda$$

frequency of wave .... unit ....

(Total for Question 5 = 10 marks)

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6 (a) Figure 9 shows a metal cube filled with hot water.

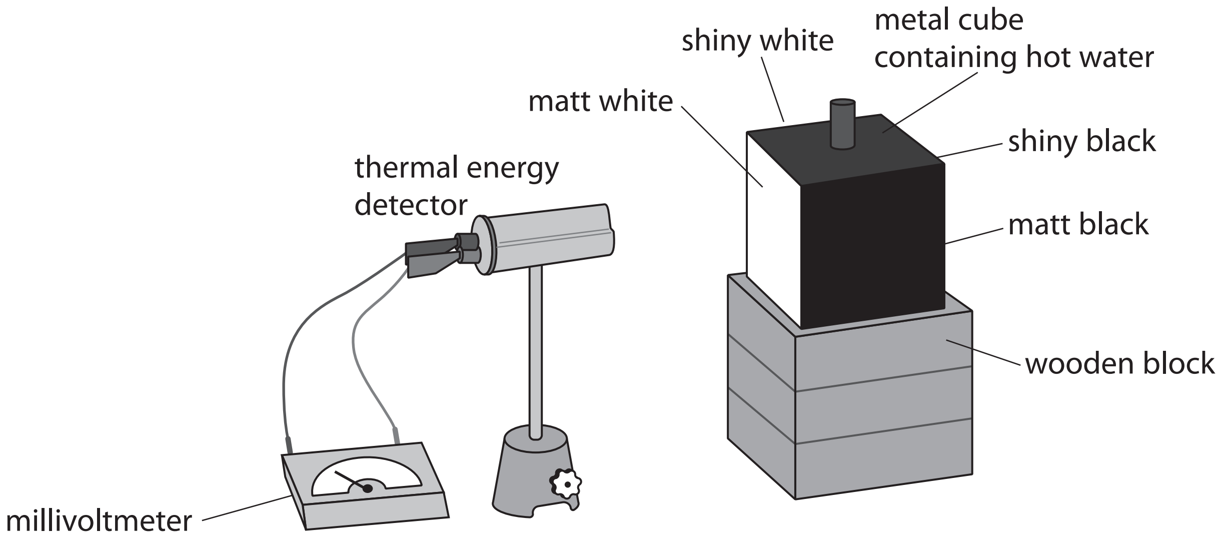

Figure 9

Four sides of the cube have different surfaces, as shown in Figure 9.

The four surfaces are at the same temperature.

The thermal energy radiated by each side of the box is measured using a thermal energy detector connected to a millivoltmeter.

The detector is moved to get a reading of the thermal energy emitted from each side of the box.

Figure 10 shows the table of results.

type of surface	millivoltmeter reading in mV
matt white	32
shiny white	20
shiny black	
matt black	55

Figure 10

(i) Suggest a possible millivoltmeter reading for the shiny black surface.

(1)

.... mV

(ii) State what must be kept the same to take the measurement for each surface.

(1)

....

....

(iii) Suggest why the cube is placed on a block of wood.

(1)

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....

(b) A hot surface emits radiation of different wavelengths.

The graph in Figure 11 shows how the intensity of the radiation emitted changes with the wavelength.

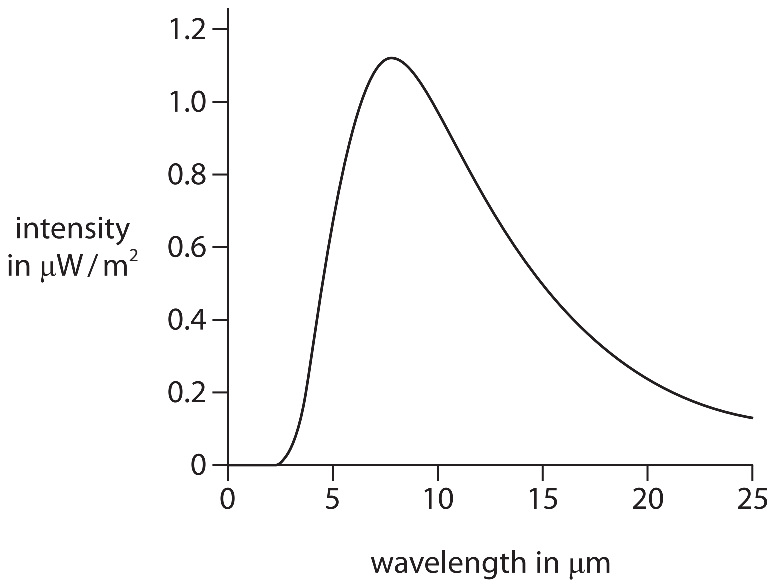

Figure 11

Describe how intensity changes with wavelength in Figure 11.

(2)

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(c) Figure 12 shows two cans, a radiant heater and some other apparatus.

The cans absorb thermal radiation from the heater.

One can has a matt black surface and the other can has a shiny silver surface.

Both cans contain water at the same temperature.

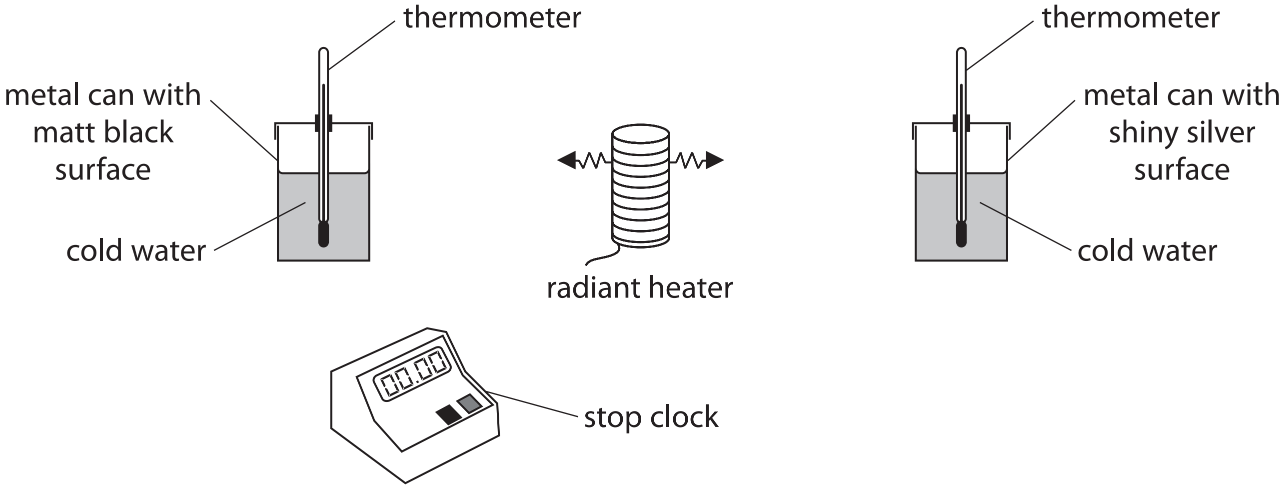

Figure 12

Describe how a student could use the apparatus in Figure 12 to determine which can is the better absorber of thermal radiation.

(4)

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(Total for Question 6 = 9 marks)

7 This question is about radioactivity and its uses.

(a) Which of these radiations does **not** have a charge?

(1)

- ☒ **A** alpha
- ☒ **B** beta minus
- ☒ **C** beta plus
- ☒ **D** gamma

(b) Which of these radiations is used in smoke detectors?

(1)

- ☒ **A** alpha
- ☒ **B** beta minus
- ☒ **C** beta plus
- ☒ **D** gamma

(c) The diagram in Figure 13 shows a radioactive source used to check the thickness of paper.

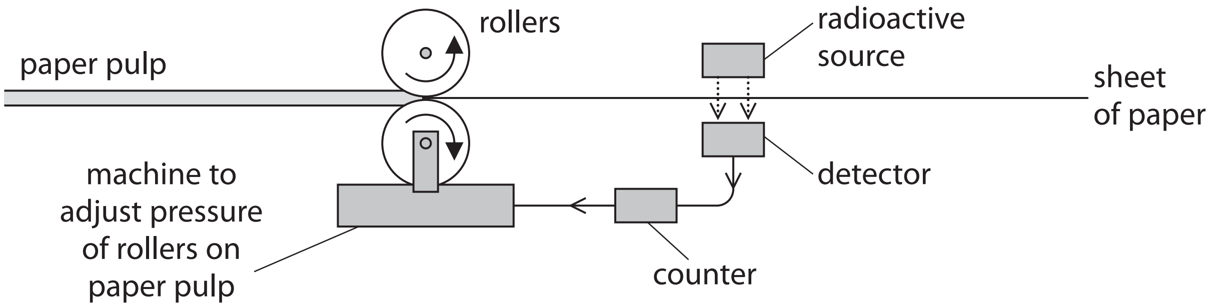

Figure 13

(i) Name the type of radiation used to check the thickness of the paper.

(1)

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(ii) Give the name of **one** device which could detect this type of radiation.

(1)

....

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When the paper is the correct thickness, the count rate is 4000 counts per minute.

(iii) The count rate increases when the paper gets thinner.

Give **one** reason for this increase.

(1)

....

....

(iv) The rollers need to be adjusted if the count rate increases by 5%.

Calculate the maximum count rate that would be allowed before the rollers need to be adjusted.

(2)

maximum count rate = ... counts per minute *(d) Radioactivity from radioactive sources can be used in the diagnosis and treatment of cancer.

Describe **one** way radioactivity can be used in the diagnosis of cancer and **one** way radioactivity can be used in the treatment of cancer.

(6)

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(Total for Question 7 = 13 marks)

8 (a) Which of these is a scalar quantity?

(1)

- ☒ **A** acceleration
- ☒ **B** distance
- ☒ **C** force
- ☒ **D** weight

(b) A student has some cupcake cases.

One cupcake case is shown in Figure 14.

(Source: © Anton Starikov/Shutterstock)

Figure 14

The student drops a stack of cupcake cases with the base facing downwards, as shown in Figure 15.

(Source: © Elena Schweitzer/Shutterstock)

Figure 15

The speed of the falling stack of cupcake cases depends on the number of cupcake cases in the stack.

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(i) The student also has a stop clock and a metre rule.

Describe an investigation to show how the speed of the falling stack of cupcake cases depends on the number of cupcake cases in the stack.

(4)

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(ii) A stack of cupcake cases has a mass of 0.005 kg.

Calculate the weight, in newtons, of the stack of cupcake cases.

Gravitational field strength = 10 N/kg

(2)

Use the equation

$$W = mg$$

weight = ... N

Figure 16 shows a cupcake case that is falling at a constant velocity.

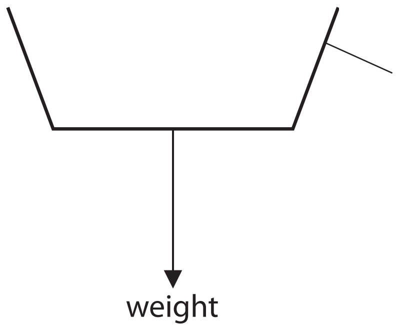

Figure 16

(iii) Draw an arrow on Figure 16 to show the force due to air resistance on the cupcake case.

(1)

(iv) State the value of the acceleration of the cupcake case when it is falling at a constant velocity

(1)

....

(c) A car travels along a straight road.

The car accelerates at 3 m / s^2 for a time of 7 s.

Calculate the change in velocity of the car.

Use the equation

change in velocity = acceleration × time taken

(2)

change in velocity = ... m / s

(Total for Question 8 = 11 marks)

P 7 2 5 7 2 A 0 2 2 3 2

9 (a) Figure 17 shows a football kicked against a wall.

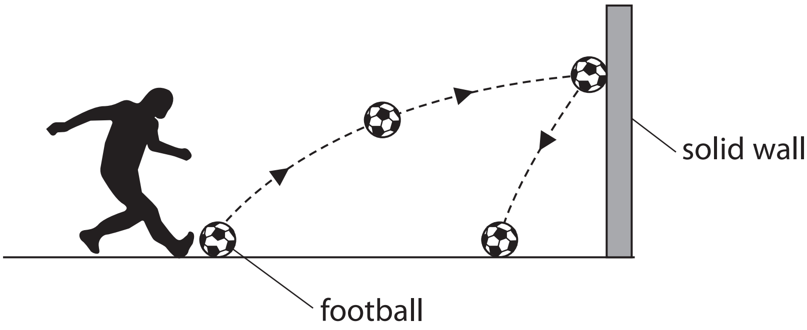

Figure 17

The football has a mass of 0.42 kg.

(i) The football gains 11 J of gravitational potential energy as it moves from the ground to the wall.

Calculate the height at which the ball hits the wall.

(3)

Gravitational field strength = 10 N / kg

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

height = ... m

(ii) Calculate the kinetic energy of the football when it is moving at a velocity of 12 m / s.

(2)

Use the equation

$$KE = \frac{1}{2} \times m \times v^2$$

kinetic energy = ... J

(iii) Describe the energy transfers that happen when the ball hits the wall.

(2)

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*(b) In the UK, electricity is generated using non-renewable and renewable energy resources.

The graph in Figure 18 shows how the amount of electricity generated by these resources changed from 2012 to 2020.

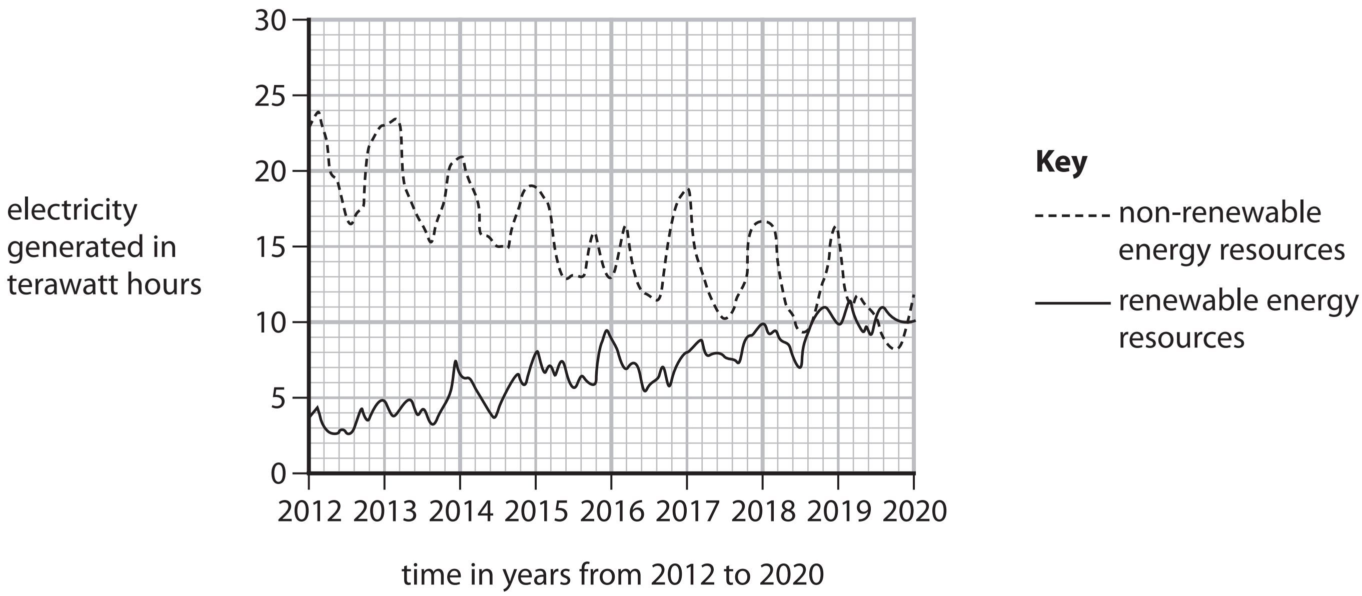

Figure 18

Explain how and why the amount of electricity generated by renewable and non-renewable energy resources has changed from 2012 to 2020.

Your answer should include

- the trends shown in Figure 18
- the change in the amount of electricity generated by at least one renewable resource
- the change in the amount of electricity generated by at least one non-renewable resource.

(6)

(Total for Question 9 = 13 marks)

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10 (a) Figure 19 shows two objects, **E** and **D**.

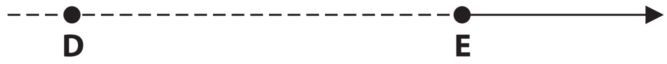

Figure 19

E emits a sound.

D detects the sound.

E is moving in the direction shown by the arrow, but **D** is not moving.

E emits a sound of wavelength 1.86 m.

D measures the wavelength of this sound as 1.98 m.

(i) Calculate the difference between the wavelength that **E** emits and the wavelength that **D** detects.

(1)

difference in wavelength = ... m

(ii) The velocity of sound is 330 m/s.

Calculate the velocity of **E**.

(2)

Use the equation

$$\text{velocity of } \mathbf{E} = \frac{\text{velocity of sound} \times \text{difference in wavelength}}{\text{wavelength } \mathbf{E} \text{ emits}}$$

velocity of **E** = ... m/s

(b) The wavelength of light emitted from distant galaxies is different when the light is detected on Earth.

Explain how this difference in wavelength shows that the Universe is expanding.

(2)

....

....

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....

(c) CMB radiation provides evidence that the Universe had a definite beginning.

Use the table in Figure 20 to give a typical value for the wavelength of CMB radiation.

type of radiation	typical wavelength
gamma rays	1.0×10^{-12} m
X-rays	3.0×10^{-11} m
ultraviolet	200 nm
visible	600 nm
infrared	4.0 μm
microwaves	1.0 mm
radio waves	50 m

Figure 20

(2)

wavelength = ...

(d) During the evolution of a star, the nebula collapses and becomes a main sequence star.

(i) State what causes the nebula to collapse.

(1)

....

P 7 2 5 7 2 A 0 2 8 3 2

(ii) Explain why the nebula stops collapsing as it becomes a main sequence star.

(3)

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(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS

Equations

(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance $v^2 - u^2 = 2 \times a \times x$
energy transferred = current × potential difference × time $E = I \times V \times t$
potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil $V_p \times I_p = V_s \times I_s$
change in thermal energy = mass × specific heat capacity × change in temperature $\Delta Q = m \times c \times \Delta\theta$
thermal energy for a change of state = mass × specific latent heat $Q = m \times L$
$P_1 V_1 = P_2 V_2$ to calculate pressure or volume for gases of fixed mass at constant temperature
energy transferred in stretching = 0.5 × spring constant × (extension)^2 $E = ½ \times k \times x^2$

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Pearson Edexcel Level 1/Level 2 GCSE (9–1)

May–June 2023 Assessment Window

Paper reference	1PH0/1F

Physics

PAPER 1

Foundation Tier

Equation Booklet

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Turn over

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P 7 2 5 7 2 A

Pearson

If you're taking **GCSE (9–1) Combined Science** or **GCSE (9–1) Physics**, you will need these equations:

HT = higher tier

	distance travelled = average speed × time	
	acceleration = change in velocity ÷ time taken	$a = \frac{(v - u)}{t}$
	force = mass × acceleration	$F = m \times a$
	weight = mass × gravitational field strength	$W = m \times g$
HT	**momentum = mass × velocity**	$\boldsymbol{p = m \times v}$
	change in gravitational potential energy = mass × gravitational field strength × change in vertical height	$\Delta GPE = m \times g \times \Delta h$
	kinetic energy = 1/2 × mass × $(\text{speed})^2$	$KE = \frac{1}{2} \times m \times v^2$
	efficiency = $\frac{(\text{useful energy transferred by the device})}{(\text{total energy supplied to the device})}$	
	wave speed = frequency × wavelength	$v = f \times \lambda$
	wave speed = distance ÷ time	$v = \frac{x}{t}$
	work done = force × distance moved in the direction of the force	$E = F \times d$
	power = work done ÷ time taken	$P = \frac{E}{t}$
	energy transferred = charge moved × potential difference	$E = Q \times V$
	charge = current × time	$Q = I \times t$
	potential difference = current × resistance	$V = I \times R$
	power = energy transferred ÷ time taken	$P = \frac{E}{t}$
	electrical power = current × potential difference	$P = I \times V$
	electrical power = $(\text{current})^2$ × resistance	$P = I^2 \times R$
	density = mass ÷ volume	$\rho = \frac{m}{V}$

	force exerted on a spring = spring constant × extension	$F = k \times x$
	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2 \times a \times x$
HT	**force = change in momentum ÷ time**	$\boldsymbol{F = \frac{(mv - mu)}{t}}$
	energy transferred = current × potential difference × time	$E = I \times V \times t$
HT	**force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density × current × length**	$\boldsymbol{F = B \times I \times l}$
	For transformers with 100% efficiency, potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_P \times I_P = V_S \times I_S$
	change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = m \times c \times \Delta\theta$
	thermal energy for a change of state = mass × specific latent heat	$Q = m \times L$
	energy transferred in stretching = 0.5 × spring constant × (extension)^2	$E = \frac{1}{2} \times k \times x^2$

If you're taking **GCSE (9–1) Physics**, you also need these extra equations:

	moment of a force = force × distance normal to the direction of the force	
	pressure = force normal to surface ÷ area of surface	$P = \frac{F}{A}$
HT	$\frac{\textit{potential difference across primary coil}}{\textit{potential difference across secondary coil}} = \frac{\textit{number of turns in primary coil}}{\textit{number of turns in secondary coil}}$	$\boldsymbol{\frac{V_p}{V_S} = \frac{N_p}{N_S}}$
	to calculate pressure or volume for gases of fixed mass at constant temperature	$P_1 \times V_1 = P_2 \times V_2$
HT	**pressure due to a column of liquid = height of column × density of liquid × gravitational field strength**	$\boldsymbol{P = h \times \rho \times g}$

END OF EQUATION LIST

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