

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 10 minutes)

Paper  
reference

**1SC0/1PF**

**Combined Science**

**PAPER 3**

**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 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.*
- 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.

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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)

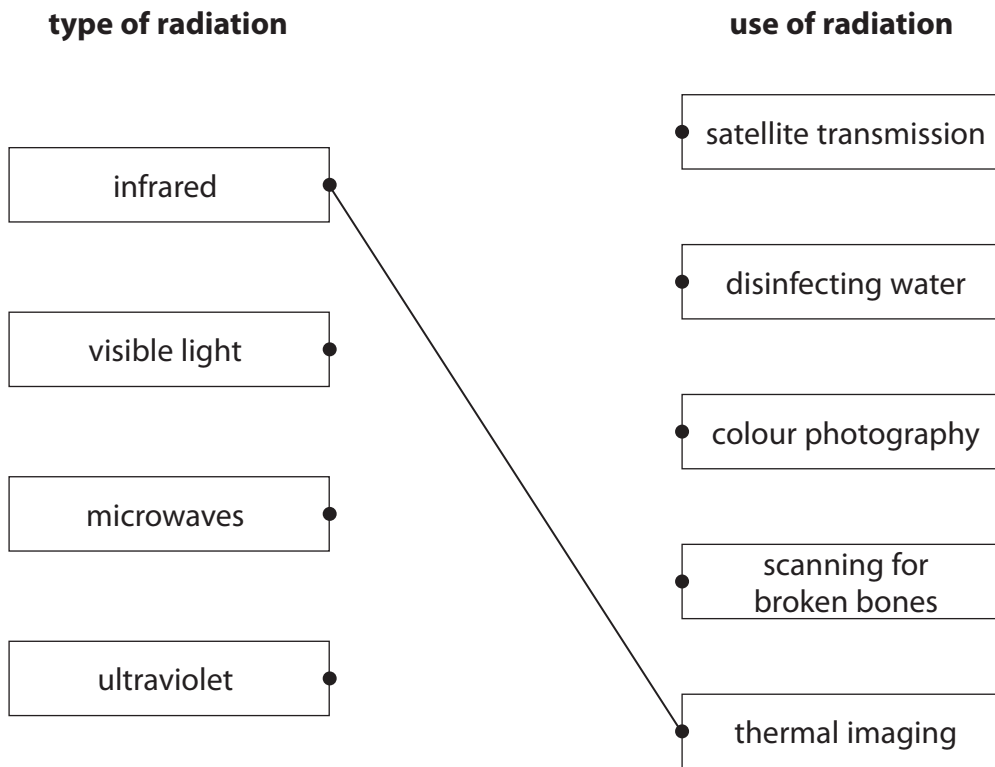


Figure 1

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

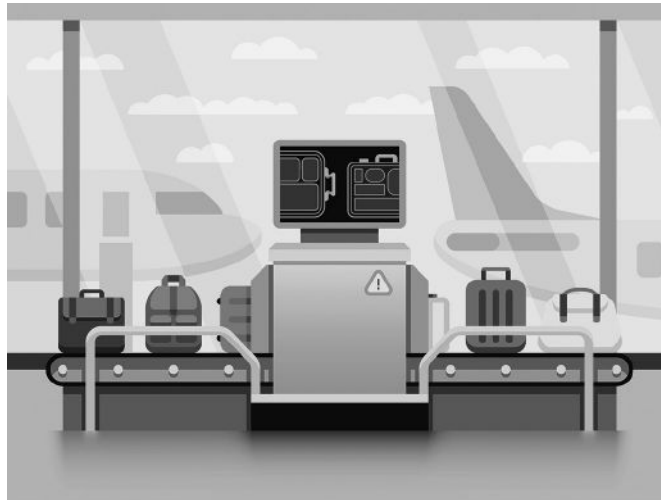
(1)

- A infrared
- B microwaves
- C ultraviolet
- D visible light



(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) The graph in Figure 3 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.

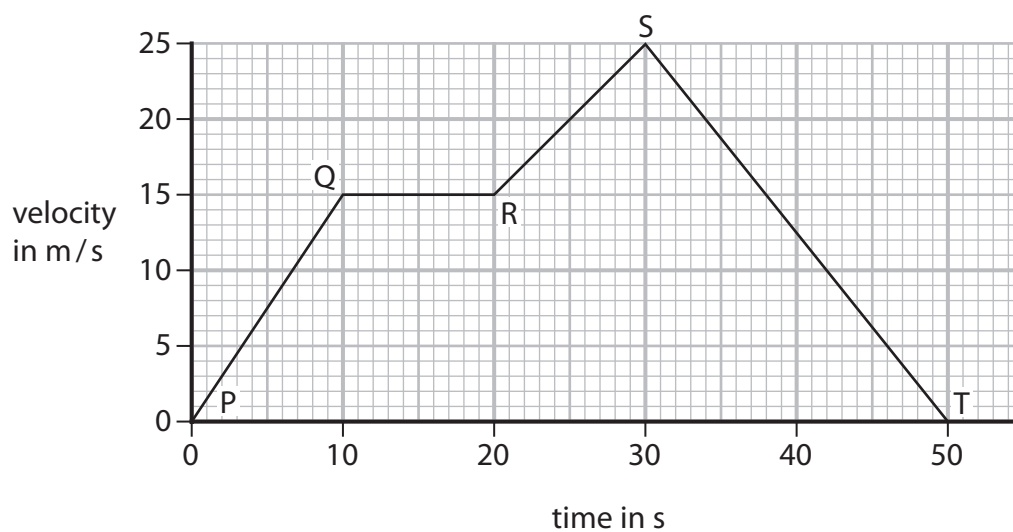


Figure 3

(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



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(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/s<sup>2</sup>

(iv) Calculate the distance the car travels in part QR shown on the velocity/time graph in Figure 3.

(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/s<sup>2</sup>.

(2)

Use the equation

$$F = m \times a$$

force = ..... N

**(Total for Question 2 = 9 marks)**



P 7 2 5 5 8 A 0 5 2 0

3 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
<input type="checkbox"/> <b>A</b>	0	+1
<input type="checkbox"/> <b>B</b>	0	-1
<input type="checkbox"/> <b>C</b>	1	+1
<input type="checkbox"/> <b>D</b>	1	-1

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

A nucleus has a radius of  $1.0 \times 10^{-15}$  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.



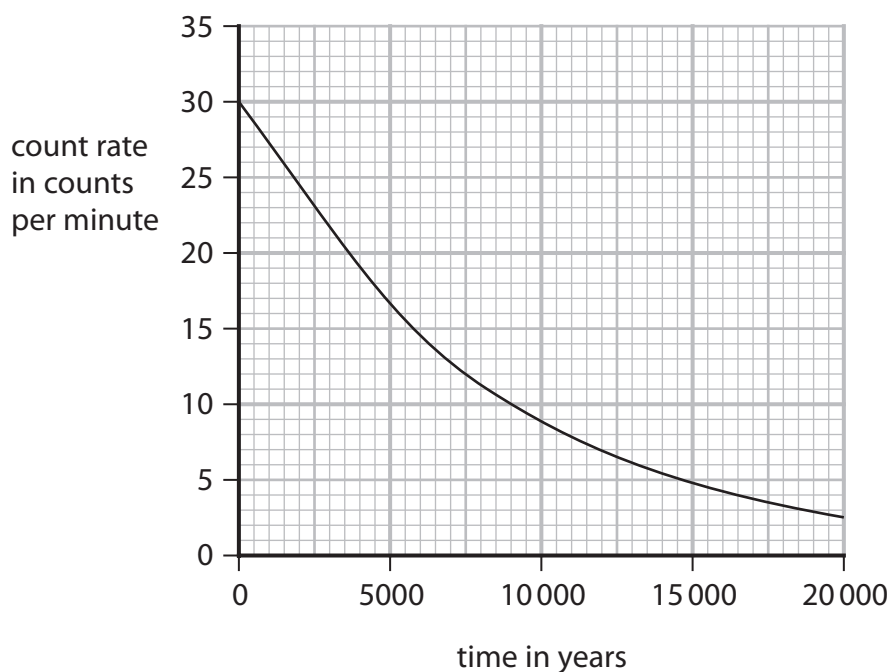
(i) State the number of protons in one atom of carbon-14. (1)

number of protons = .....

(ii) State the number of neutrons in one atom of carbon-14. (1)

number of neutrons = .....

(iii) Figure 4 shows a graph for the decay of the radioactive isotope carbon-14.



**Figure 4**

Use the graph to estimate the half-life of carbon-14. (2)

half-life = ..... years

**(Total for Question 3 = 9 marks)**

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

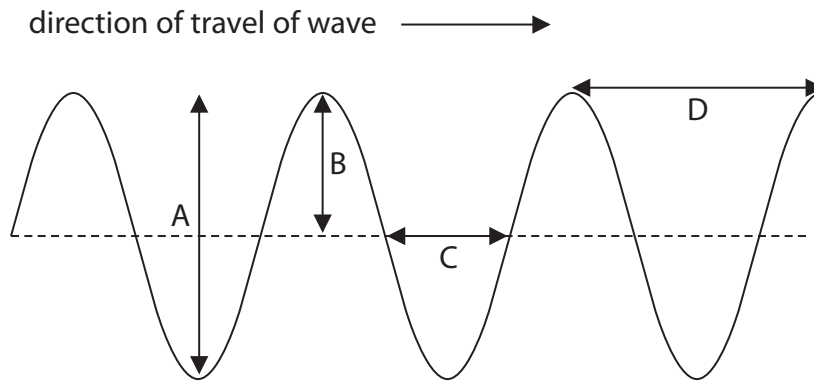


Figure 5

(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 5 is a transverse wave.

(2)

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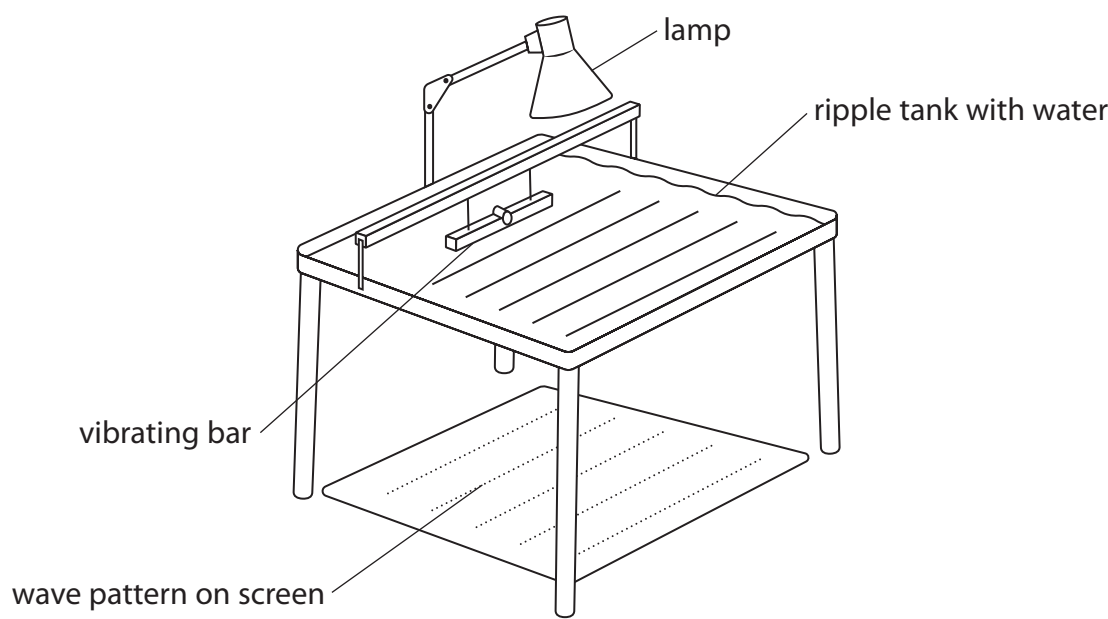
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(b) Figure 6 shows a ripple tank.

A screen is placed below the ripple tank.

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



**Figure 6**

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 4 = 10 marks)**



5 (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 7.



(Source: © Anton Starikov/Shutterstock)

**Figure 7**

The student drops a stack of cupcake cases with the base facing downwards, as shown in Figure 8.



(Source: © Elena Schweitzer/Shutterstock)

**Figure 8**

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

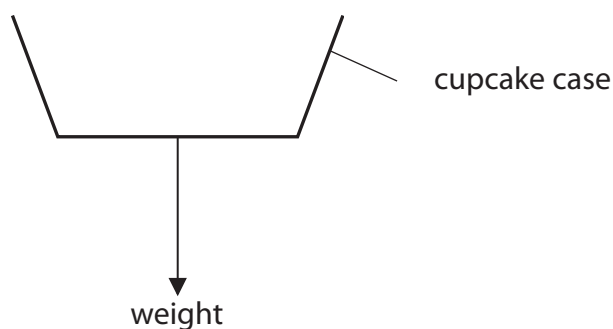
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Figure 9 shows a cupcake case that is falling at a constant velocity.



**Figure 9**

- (iii) Draw an arrow on Figure 9 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  $3 \text{ m/s}^2$  for a time of 7 s.

Calculate the change in velocity of the car.

Use the equation

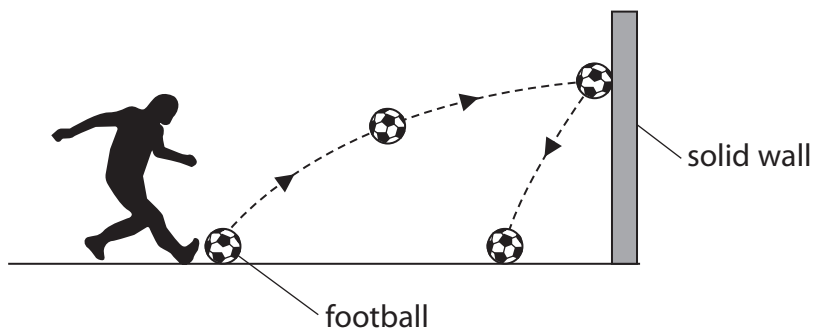
$$\text{change in velocity} = \text{acceleration} \times \text{time taken} \quad (2)$$

change in velocity = ..... m/s

**(Total for Question 5 = 11 marks)**



- 6 (a) Figure 10 shows a football kicked against a wall.



**Figure 10**

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 11 shows how the amount of electricity generated by these resources changed from 2012 to 2020.

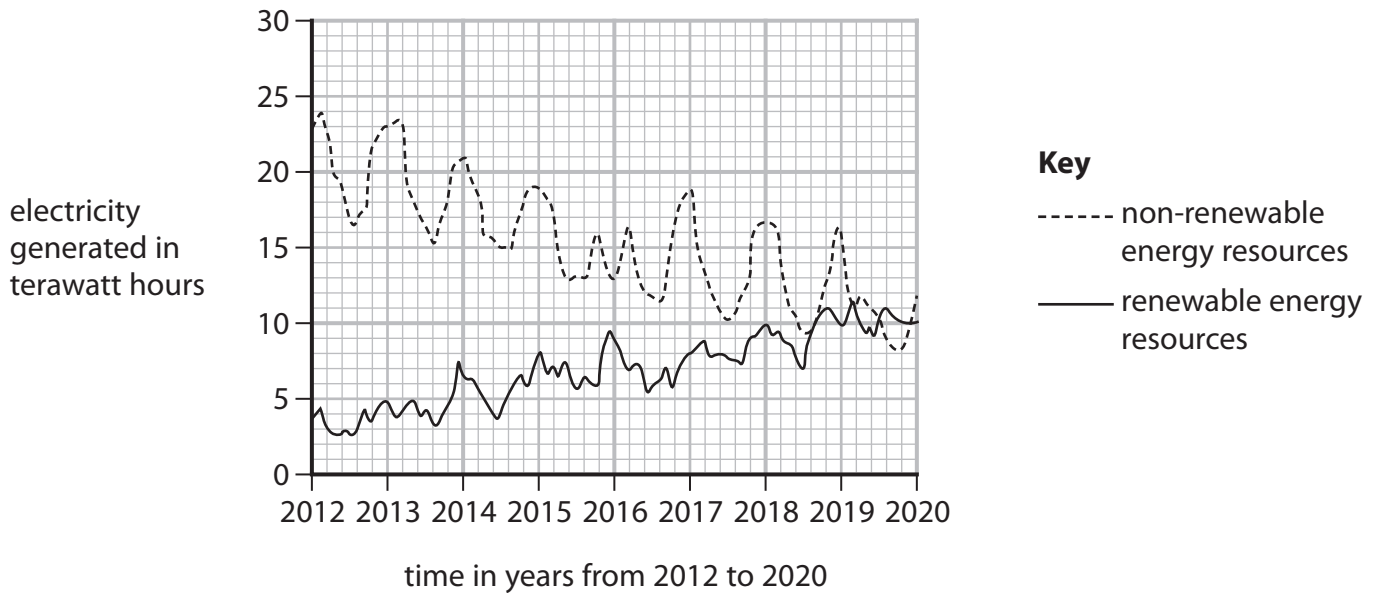


Figure 11

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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 11
- 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)

Area with horizontal dotted lines for writing the answer.

**(Total for Question 6 = 13 marks)**

**TOTAL FOR PAPER = 60 MARKS**

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## Equations

(final velocity)<sup>2</sup> – (initial velocity)<sup>2</sup> = 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)<sup>2</sup>

$$E = \frac{1}{2} \times k \times x^2$$

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

May–June 2023 Assessment Window

Paper  
reference

**1SC0/1PF**

## Combined Science

**PAPER 3**

**Foundation Tier**

**Equation Booklet**

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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	$W = m \times g$
<b>HT momentum = mass × velocity</b>	<b><math>p = m \times v</math></b>
change in gravitational potential energy = mass × gravitational field strength × change in vertical height	$\Delta GPE = m \times g \times \Delta h$
kinetic energy = $\frac{1}{2} \times \text{mass} \times (\text{speed})^2$	$KE = \frac{1}{2} \times m \times v^2$
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 = (current) <sup>2</sup> × resistance	$P = I^2 \times R$
density = mass ÷ volume	$\rho = \frac{m}{V}$



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

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

	moment of a force = force $\times$ distance normal to the direction of the force	
	pressure = force normal to surface $\div$ area of surface	$P = \frac{F}{A}$
<b>HT</b>	<b><math>\frac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}</math></b>	$\frac{V_p}{V_s} = \frac{N_p}{N_s}$
	to calculate pressure or volume for gases of fixed mass at constant temperature	$P_1 \times V_1 = P_2 \times V_2$
<b>HT</b>	<b>pressure due to a column of liquid = height of column <math>\times</math> density of liquid <math>\times</math> gravitational field strength</b>	$P = h \times \rho \times g$

**END OF EQUATION LIST**

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