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)

Wednesday 22 May 2024

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 you make are related or follow on from each other where appropriate.

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 the electromagnetic spectrum.

(a) X-rays and microwaves are both parts of the electromagnetic spectrum.

Use words from the box to complete the sentences.

(3)

amplitude	**frequency**	**longitudinal**	**speed**	**transverse**	**wavelength**

X-rays and microwaves are both .... waves.

In a vacuum, x-rays and microwaves always have the same ....

X-rays always have a higher .... than microwaves.

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(b) Figure 1 shows the full electromagnetic spectrum.

Figure 2 gives information about four of the types of electromagnetic radiation shown in Figure 1.

radio waves	microwaves	infrared	visible light	ultraviolet	x-rays	gamma rays

Figure 1

State the name of each type of radiation next to its information.

(4)

Information	**Type of electromagnetic radiation**
emitted by bright objects **and** can be detected by the human eye	....
emitted by radioactive nuclei **and** can be used to treat cancer	....
produced in an aerial **and** can be used for communication	....
can cause skin cancer in humans **and** can be used to detect forged banknotes	....

Figure 2

(Total for Question 1 = 7 marks)

2 (a) A car is being driven at a constant velocity.

The driver sees an obstacle in the road ahead.

The driver uses the brakes to stop as quickly as possible.

Figure 3 shows the velocity/time graph for the car from the time when the driver sees the obstacle.

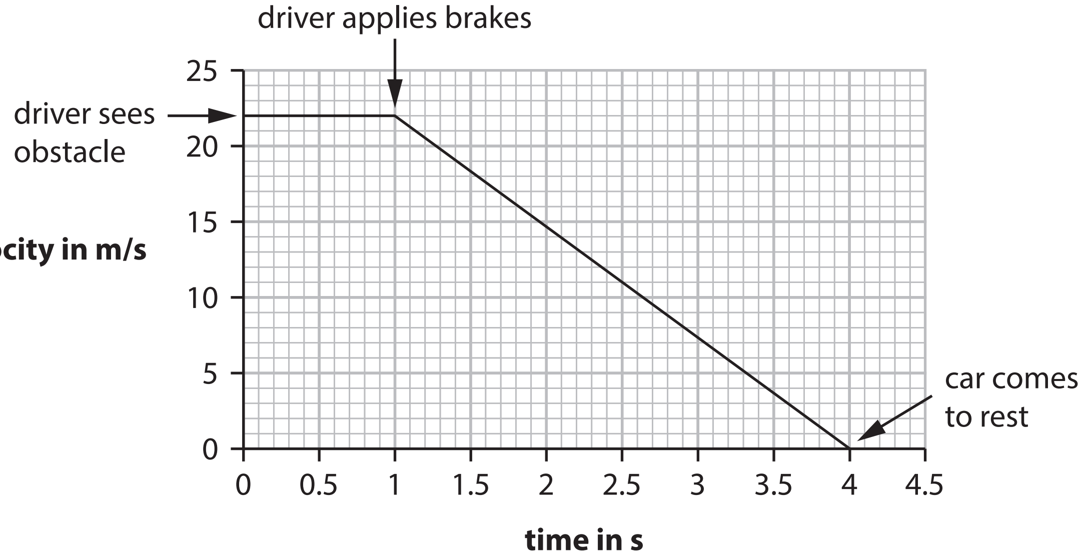

Figure 3

(i) Which of these is the driver's rection time shown in Figure 3?

(1)

☒ **A** 0 s

☒ **B** 1 s

☒ **C** 4 s

☒ **D** 22 s

(ii) State **one** factor that might increase a driver's reaction time.

(1)

....

....

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(iii) Calculate the distance travelled between when the driver applies the brakes and when the car comes to rest in Figure 3.

Use the equation

distance = area under the sloping line of the graph in Figure 3

(3)

distance = ... m

(b) The stopping distance of a car is the thinking distance plus the braking distance.

A car has a device that can detect an obstacle in the road ahead.

The device is linked to a computer that can apply the brakes.

It is claimed that, in an emergency, the computer-controlled car will have a shorter stopping distance than if the car is controlled by a human driver.

Explain why this claim could be true.

(2)

....

....

....

....

(c) A different car has a device that can detect rain.

This device is linked to a computer that can change the speed of the car.

In wet weather, the computer changes the speed of the car.

(i) State the change in speed that the computer should make when the road is wet.

(1)

....

....

(ii) Give a reason why this change in speed is necessary when the road is wet.

(1)

....

....

(Total for Question 2 = 9 marks)

3 (a) A sound wave can transfer information across a room.

Which row of the table shows what else a sound wave can transfer?

(1)

	can transfer energy	can transfer air
☒ **A**	yes	yes
☒ **B**	yes	no
☒ **C**	no	yes
☒ **D**	no	no

(b) Which of these always increases as a sound gets louder?

(1)

- ☒ **A** amplitude
- ☒ **B** frequency
- ☒ **C** speed
- ☒ **D** wavelength

(c) The speed of a sound wave in air is 330 m/s.

The wavelength of this wave is 0.75 m.

Calculate the frequency of this wave.

Use the equation

$$v = f \times \lambda$$

(3)

frequency = ... Hz

(d) Figure 4 shows a water wave.

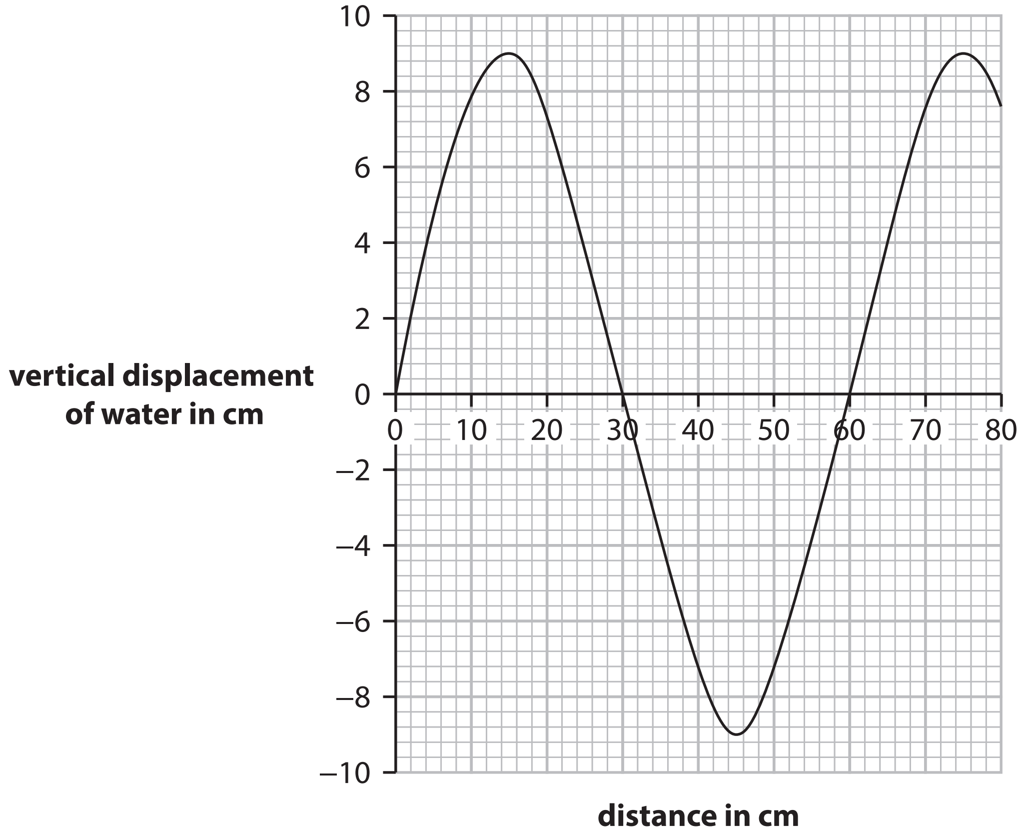

Figure 4

Which of these is the amplitude of the wave shown in Figure 4?

(1)

☒ **A** 9 cm

☒ **B** 18 cm

☒ **C** 30 cm

☒ **D** 60 cm

(e) Ripples travel out from the centre of a small circular pond to its edge.

(i) Describe how a student could determine the wave speed of the ripples.

(3)

....

....

....

....

....

....

(ii) Figure 5 shows a duck floating on the pond.

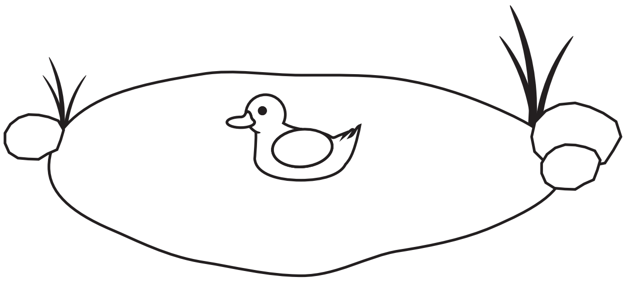

Figure 5

The ripples cause the duck to move.

Draw arrows on Figure 5 to show how the duck moves due to the ripples.

(1)

(Total for Question 3 = 10 marks)

4 Figure 6 is a diagram representing an atom.

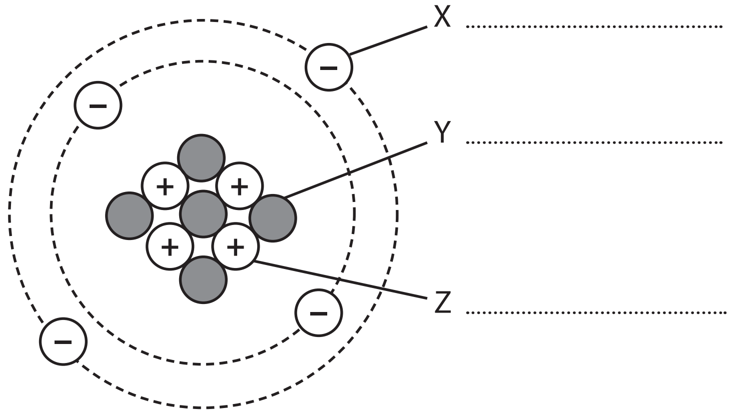

Figure 6

(a) Write the names of the particles X, Y and Z on the lines next to each letter in Figure 6.

(3)

(b) The nucleus of a different atom emits a gamma ray.

What happens to the number of particles in the nucleus?

(1)

☒ **A** it decreases by one

☒ **B** it decreases by two

☒ **C** it decreases by four

☒ **D** it does not change

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P 7 4 4 7 9 R A 0 1 0 2 4

(c) A teacher demonstrates a radioactivity experiment to a class of students.

The teacher places a radioactive source in front of a radiation detector.

(i) State **one** safety precaution the teacher should take.

(1)

....

....

(ii) The teacher uses the detector to measure the activity of the source several times.

Figure 7 shows the results.

	1st measurement	**2nd measurement**	**3rd measurement**	**4th measurement**
activity in Bq	21	23	19	22

Figure 7

The teacher tells the class that radioactive decay is random.

State how the data in Figure 7 supports this statement.

(1)

....

....

(iii) Calculate the mean of the **four** measurements in Figure 7.

(1)

mean = ... Bq

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(d) The teacher moves the radiation detector to different distances from the radioactive source.

The teacher determines the mean detector reading at each distance from the source.

The teacher plots the results on graph paper, as shown in Figure 8.

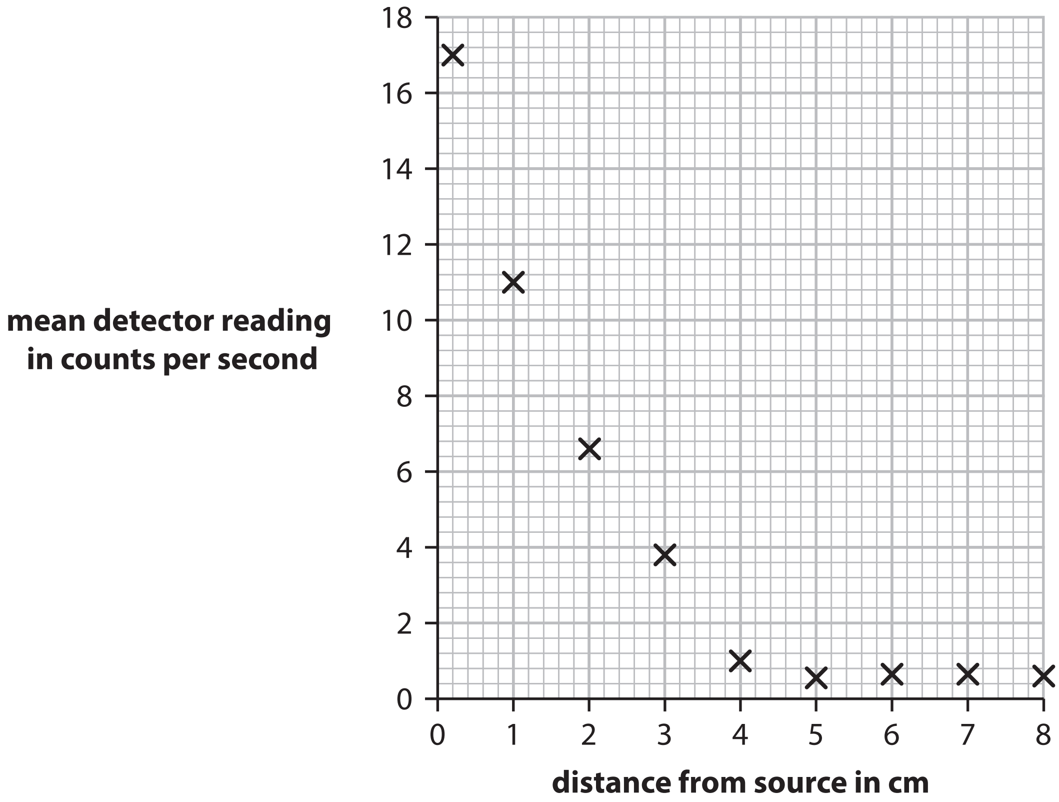

Figure 8

(i) The source emits alpha radiation **only**.

Explain how the graph in Figure 8 shows that the source only emits alpha radiation.

(2)

....

....

....

(ii) Give a reason why the mean detector reading in Figure 8 does not fall to zero in this experiment.

(1)

....

....

(Total for Question 4 = 10 marks)

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5 Figure 9 shows a person on a skateboard at the top of a ramp.

At P, the person is not moving.

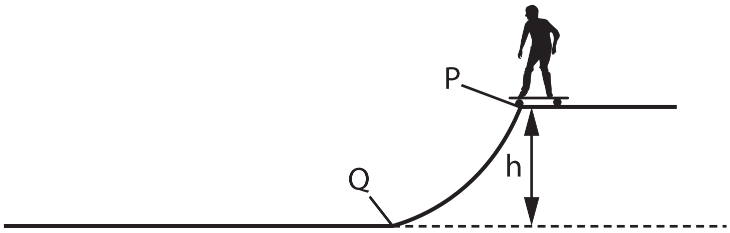

Figure 9

(a) The person rides the skateboard down the ramp from P to Q.

The gravitational potential energy of the person decreases by 980 J.

The mass of the person is 35 kg.

Calculate h, the height of the ramp.

Use g = 10 N/kg.

Use the equation

$$\text{change in gravitational potential energy} = m \times g \times h$$

(2)

h = ... m

(b) The kinetic energy, KE, of the person at Q is 950 J.

The mass of the person is 35 kg.

Calculate the velocity of the person at Q.

Use the equation

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

(3)

velocity = ... m/s

(c) Figure 10 is a diagram that represents energy changes from P to Q.

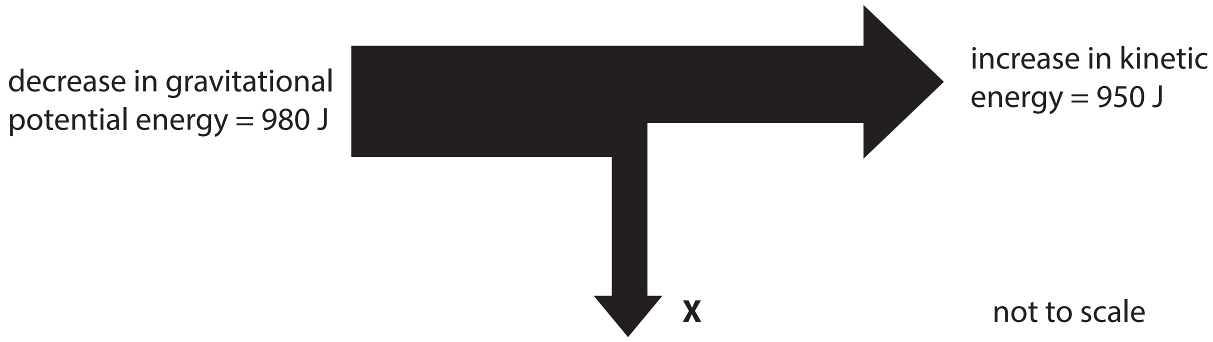

Figure 10

(i) State what is represented by **X**.

(1)

....

....

(ii) Calculate the value of **X**.

(1)

value of **X** = ... J

(iii) Calculate the efficiency of the system represented in Figure 10.

(2)

efficiency = ...

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P 7 4 4 7 9 R A 0 1 6 2 4

(d) The person would like to start from P again but have a greater velocity at Q.

Suggest **two** ways that this can be achieved.

(2)

1 ....

....

2 ....

....

(Total for Question 5 = 11 marks)

6 (a) Two people, L and M, have a 100 m race.

L starts running before M.

Figure 11 shows a distance/time graph of the race.

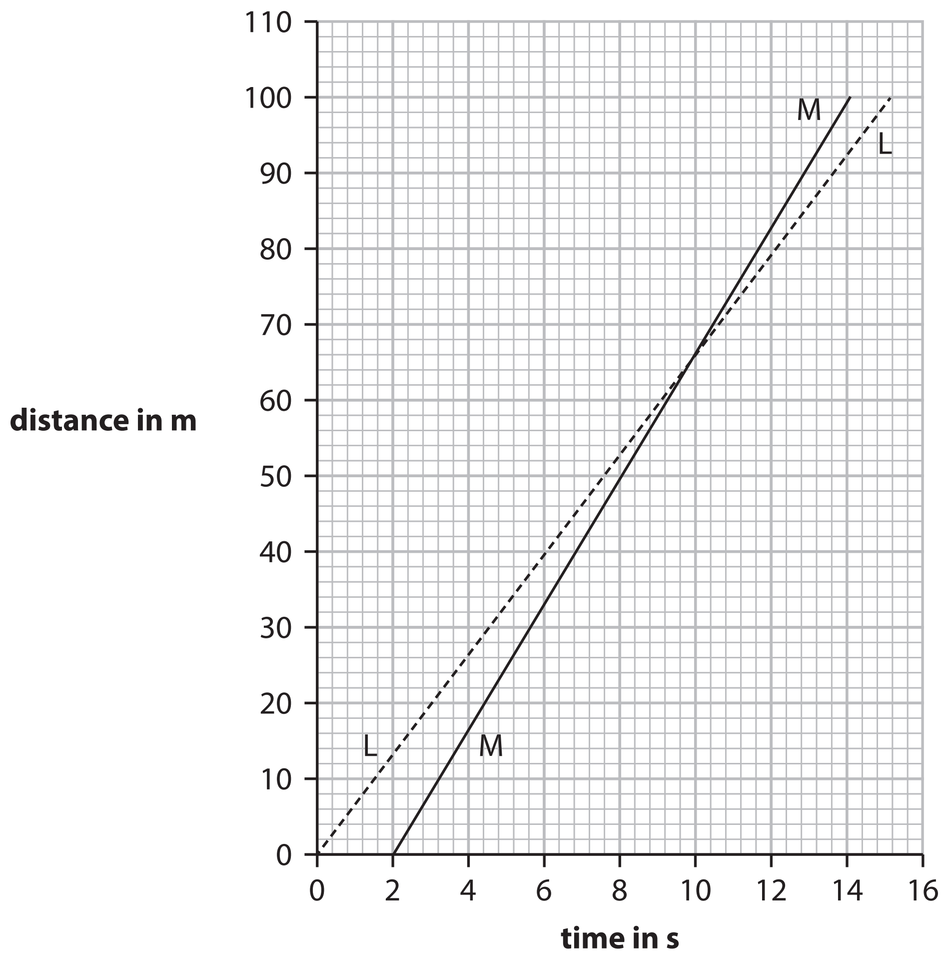

Figure 11

(i) State the **distance** that L has run when M overtakes.

(1)

distance = ... m

(ii) Calculate the velocity of L when running the 100 m race.

(2)

velocity = ... m/s

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(b) A motorcycle is travelling at a velocity of 6.2 m/s.

The motorcycle accelerates at 2.5 m/s^2 until its velocity is 10 m/s.

(i) Calculate the time taken for this acceleration.

Use the equation

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

(2)

time taken = ... s

(ii) The motorcycle now decelerates (slows down) from 10 m/s to a stop.

The deceleration is at a constant rate of 4.4 m/s^2 .

Calculate the distance the motorcycle travels as it slows down to a stop.

Use the equation

$$v^2 - u^2 = 2 \times a \times x$$

(2)

distance = ... m *(c) A student has a trolley and a ramp, as shown in Figure 12.

The height, H, of one end of the ramp can be adjusted.

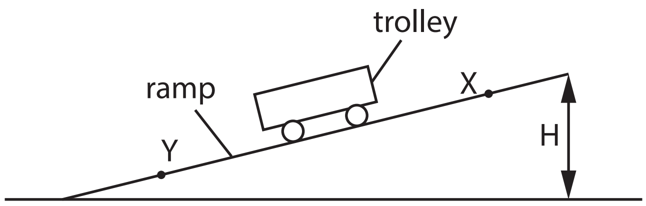

Figure 12

The student investigates how the average speed of the trolley between X and Y depends on the height, H, of the ramp.

Describe

- the additional equipment that the student needs
- how that equipment is used to obtain the measurements needed.

(6)

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(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

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

Wednesday 22 May 2024

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Equation Booklet

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P 7 4 4 7 9 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**	$\boldsymbol{p} = \boldsymbol{m} \times \boldsymbol{v}$
	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 × (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)^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	$\boldsymbol{\frac{\textit{potential difference across primary coil}}{\textit{potential difference across secondary coil}} = \frac{\textit{number of turns in primary coil}}{\textit{number of turns in secondary coil}}}$	$\boldsymbol{\frac{V_p}{V_S} = \frac{N_p}{N_S}}$
	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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