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 25 May 2023

Morning (Time: 1 hour 10 minutes)

Paper reference **1SC0/1PH**

Combined Science

PAPER 3

Higher 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.

Turn over

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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 (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 1.

(Source: © Anton Starikov/Shutterstock)

Figure 1

The student drops a stack of cupcake cases with the base facing downwards, as shown in Figure 2.

(Source: © Elena Schweitzer/Shutterstock)

Figure 2

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

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P 7 2 5 5 9 A 0 2 2 0

(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 3 shows a cupcake case that is falling at a constant velocity.

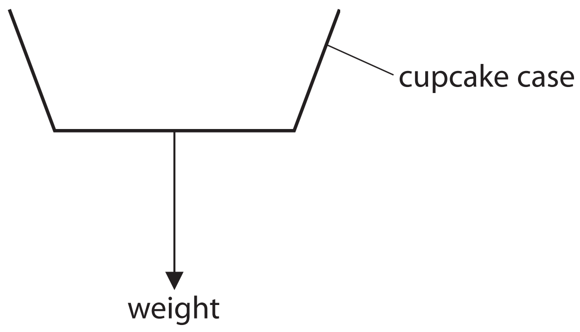

Figure 3

(iii) Draw an arrow on Figure 3 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)

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(Total for Question 1 = 9 marks)

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2 (a) Figure 4 shows a football kicked against a wall.

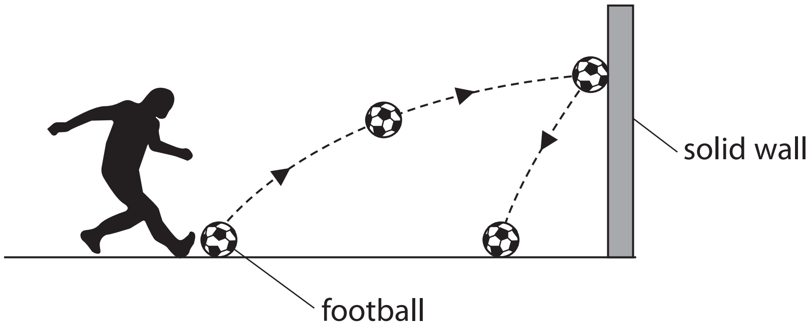

Figure 4

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

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

(2)

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(b) A stone is held at rest above the ground.

The stone is released and falls until its velocity is 17 m / s.

Calculate the distance the stone has fallen when its velocity has reached 17 m / s.

(2)

distance = ... m

(Total for Question 2 = 9 marks)

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3 Figure 5 is a velocity/time graph for a lift moving upwards in a tall building.

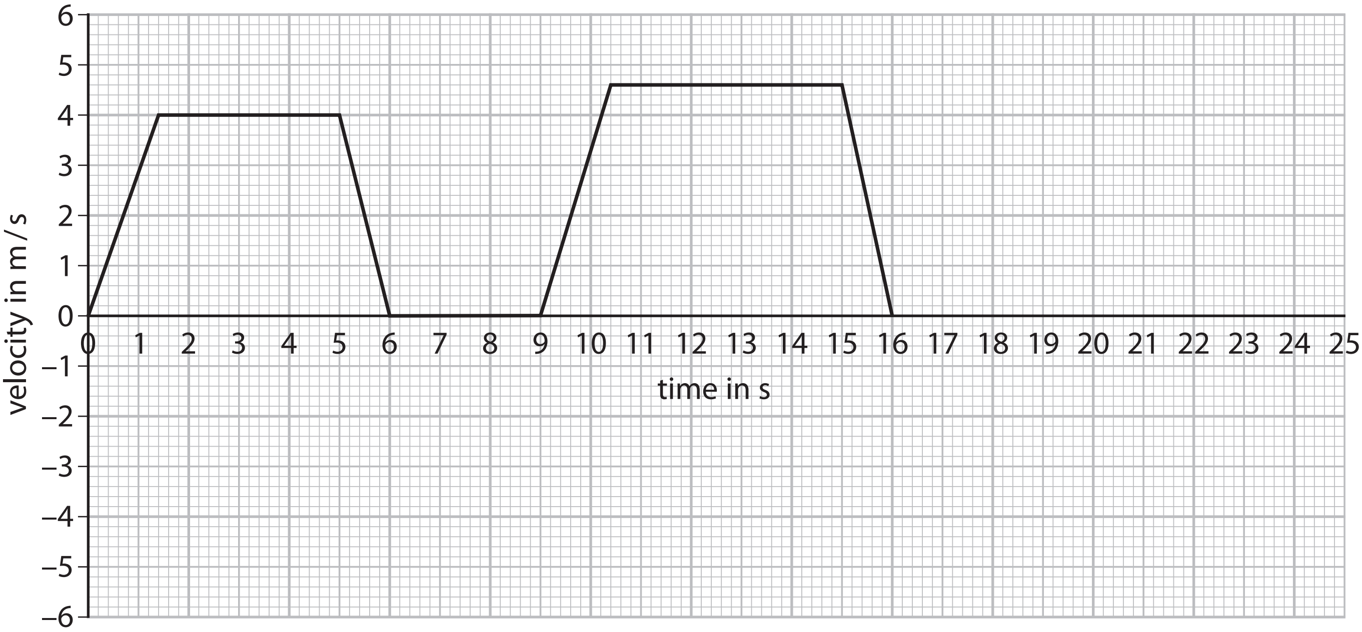

Figure 5

(a) For what length of time is the lift at rest during the first 16 s?

(1)

- ☒ **A** 1.4 s
- ☒ **B** 3.0 s
- ☒ **C** 3.6 s
- ☒ **D** 4.0 s

(b) Use the graph in Figure 5 to determine the maximum velocity of the lift during the first 16 s.

(1)

maximum velocity = ... m/s

(c) Use the graph in Figure 5 to determine the acceleration of the lift during the first 1.4 s.

(3)

acceleration = ... m/s^2

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(d) Use the graph in Figure 5 to determine the distance that the lift travelled during the first 6.0 s.

(3)

distance = ... m

(e) At 18 s, the lift starts to move downwards.

Sketch a line on the graph in Figure 5 to show the lift moving downwards after 18 s.

(1)

(Total for Question 3 = 9 marks)

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4 (a) Figure 6 shows two technicians, L and M, measuring the speed of sound in air.

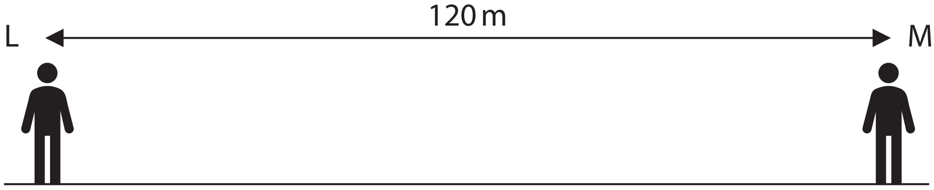

Figure 6

L fires a starting pistol.

M starts a stopwatch when first seeing the smoke from the starting pistol.

M stops the stopwatch when hearing the bang made by the starting pistol.

The distance between L and M is 120 m.

M's reaction time is 0.23 s.

The speed of sound in air is 330 m / s.

(i) Calculate M's reaction time as a percentage of the time sound takes to travel from L to M.

(3)

....%

(ii) Which of these would improve the technicians' measurement of the speed of sound?

(1)

☒ **A** Use a firework 'banger' instead of the starting pistol.

☒ **B** Use a stop clock that measures time in minutes.

☒ **C** Increase the distance between **L** and **M**.

☒ **D** Decrease the distance between **L** and **M**.

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(b) Figure 7 shows the difference in refraction of sound waves and light waves when these waves travel from air into water.

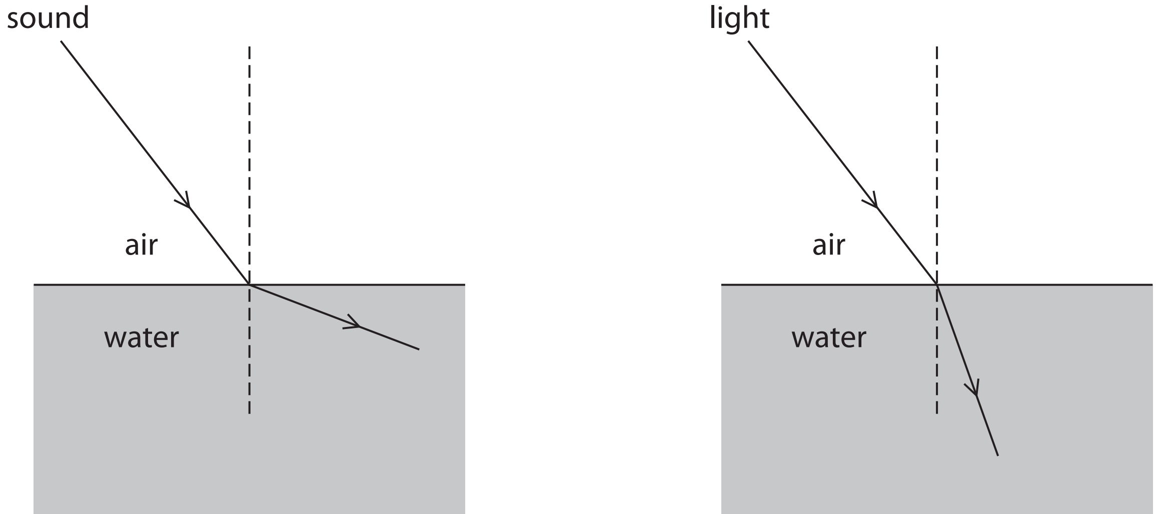

Figure 7

Explain why the refraction of the sound wave is different from the refraction of the light wave in Figure 7.

(3)

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(c) Light is one example of an electromagnetic wave.

Light can transfer energy from a lamp to the leaf of a plant, causing chemical reactions in the leaf.

Describe examples of **two** other electromagnetic waves transferring energy.

(4)

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(Total for Question 4 = 11 marks)

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5 (a) Figure 8 is the symbol for a nucleus of americium-241.

$$^{241}_{95}\text{Am}$$

Figure 8

Americium-241 is a radioactive isotope of americium.

Americium-241 decays by emitting alpha (α) particles.

(i) Which of these is the symbol for another radioactive isotope of americium?

(1)

☒ **A** $^{241}_{97}\text{Am}$

☒ **B** $^{243}_{96}\text{Am}$

☒ **C** $^{245}_{95}\text{Am}$

☒ **D** $^{247}_{94}\text{Am}$

(ii) Which of these is the approximate maximum distance that alpha particles can travel in air at normal atmospheric pressure?

(1)

☒ **A** 5 mm

☒ **B** 5 cm

☒ **C** 5 m

☒ **D** 5 km

(iii) Complete the equation in Figure 9 for americium-241 decaying into neptunium (Np).

(3)

$$^{241}_{95}\text{Am} \rightarrow \, ^{\ldots\ldots}_{\ldots\ldots}\alpha + \, ^{\ldots\ldots}_{\ldots\ldots}\text{Np}$$

Figure 9

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(b) The activity of a radioactive source is measured as 128 Bq.

This is shown as a point on the graph in Figure 10.

(3)

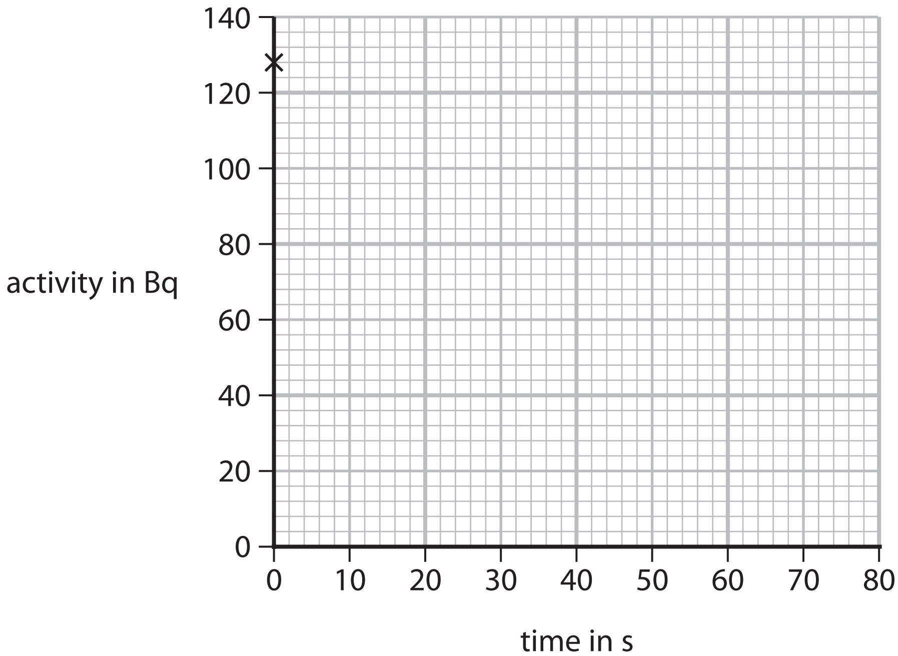

Figure 10

The half-life of this radioactive source is 17 s.

Use this information to plot three more points on the graph grid in Figure 10 to show how the activity of the source changes with time.

(c) Describe what happens in the nucleus of an atom when a positron is emitted.

(2)

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(Total for Question 5 = 10 marks)

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6 (a) An atom of mass 6.6×10^{-26} kg is moving with a velocity of 480 m/s.

Calculate the momentum of the atom.

(3)

momentum = ... kg m/s

(b) Figure 11 shows a ball before and after it collides with a wall.

The arrows show the direction of movement of the ball.

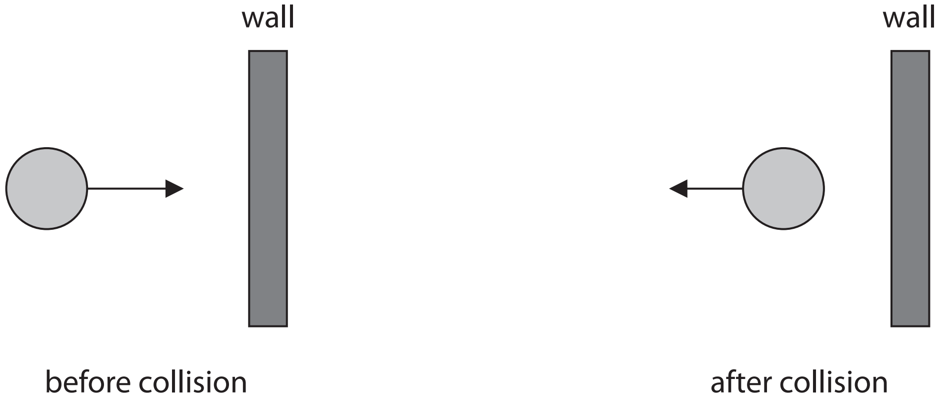

Figure 11

Before the collision, the momentum of the ball is 0.80 kg m/s.

After the collision, the momentum of the ball is 0.60 kg m/s in the opposite direction.

The ball is in contact with the wall for a time of 70 ms during the collision.

Calculate the force exerted on the ball by the wall.

(3)

Use an equation selected from the list of equations at the end of the paper.

force = ... N

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*(c) Newton's second law can be stated as

force = mass × acceleration

A student is provided with a trolley and a runway on a bench, as shown in Figure 12, and access to other equipment.

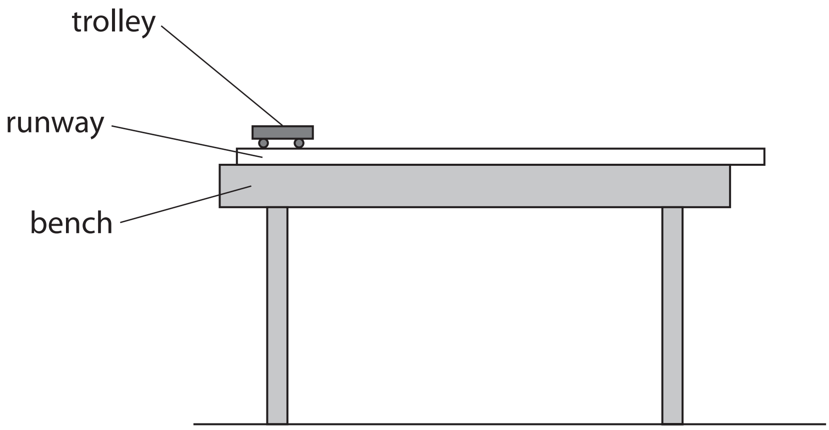

Figure 12

Describe a procedure the student could use to investigate how the acceleration of the trolley depends on the force applied to the trolley.

You may add to the diagram in Figure 12 to help your answer.

(6)

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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Equations

(final velocity)^2 − (initial velocity)^2 = 2 × acceleration × distance $v^2 - u^2 = 2 \times a \times x$
force = change in momentum ÷ time $F = \frac{(mv - mu)}{t}$
energy transferred = current × potential difference × time $E = I \times V \times t$
force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density × current × length $F = B \times I \times l$
$\frac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$ $\frac{V_p}{V_s} = \frac{N_p}{N_s}$
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 $E = \frac{1}{2} \times k \times x^2$
pressure due to a column of liquid = height of column × density of liquid × gravitational field strength $P = h \times \rho \times g$

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

May–June 2023 Assessment Window

Paper reference **1SC0/1PH**

Combined Science

PAPER 3

Higher 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	$W = m \times g$
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 × (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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