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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)

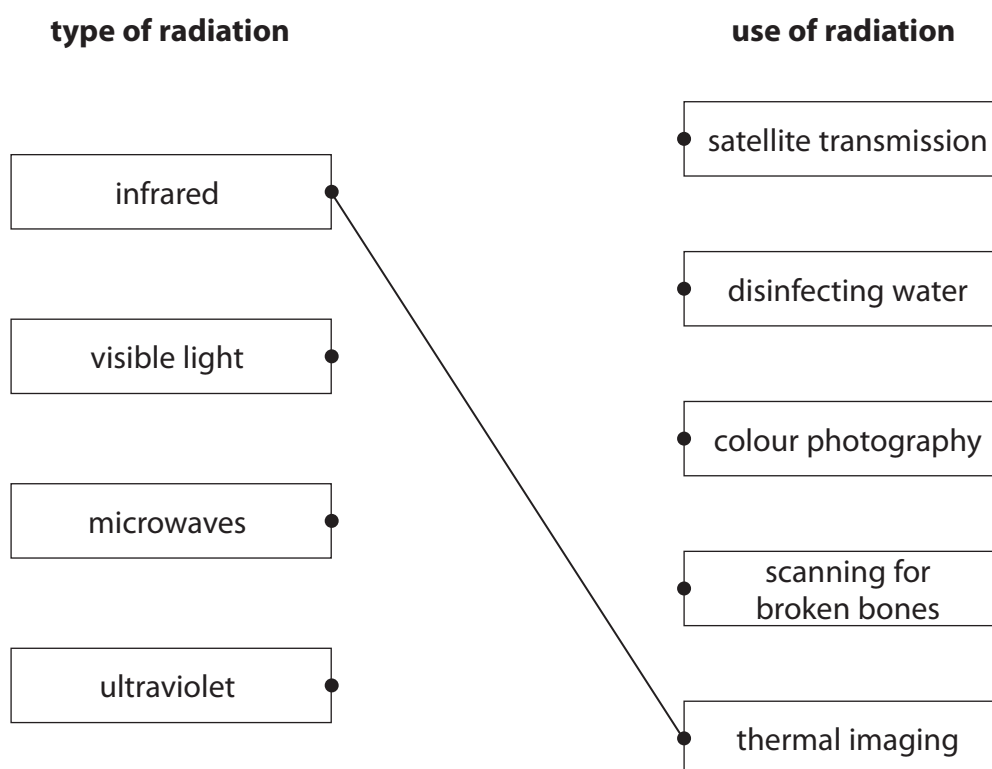


Figure 1

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

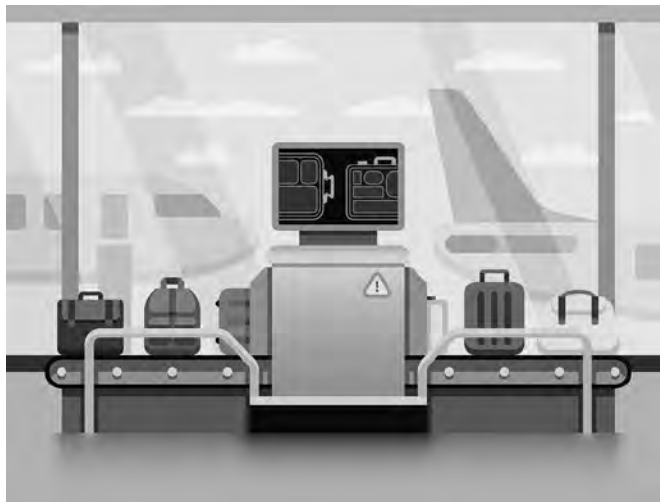
(1)

- 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)

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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.

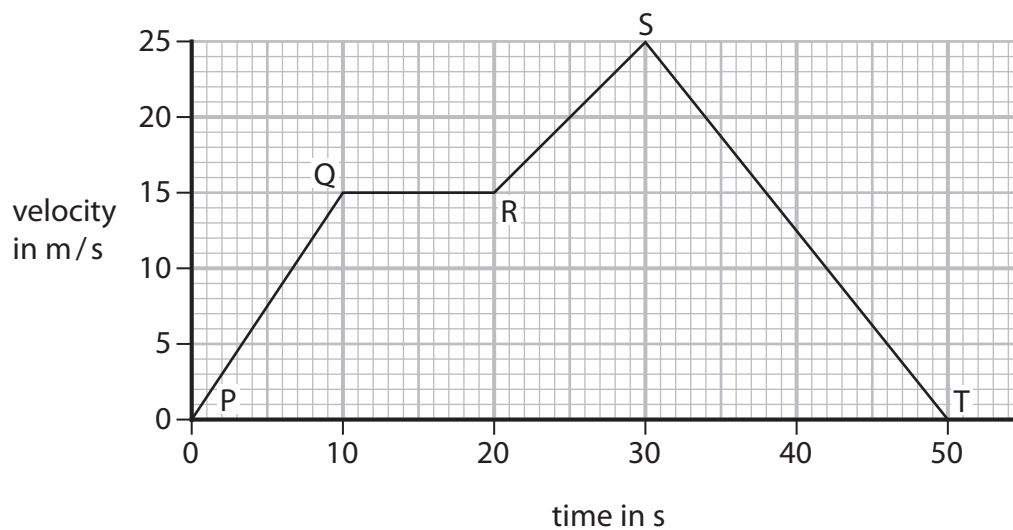


Figure 3

(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



- (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 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/s². (2)

Use the equation

$$F = m \times a$$

force = N

(Total for Question 2 = 9 marks)

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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"/> A	0	+1
<input type="checkbox"/> B	0	-1
<input type="checkbox"/> C	1	+1
<input type="checkbox"/> 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.



(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.

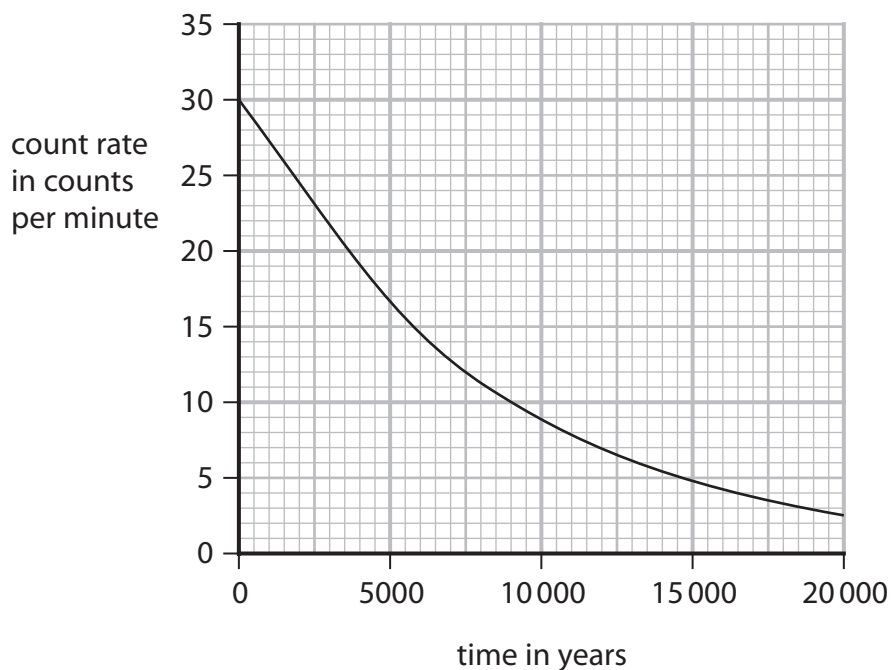


Figure 4

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.

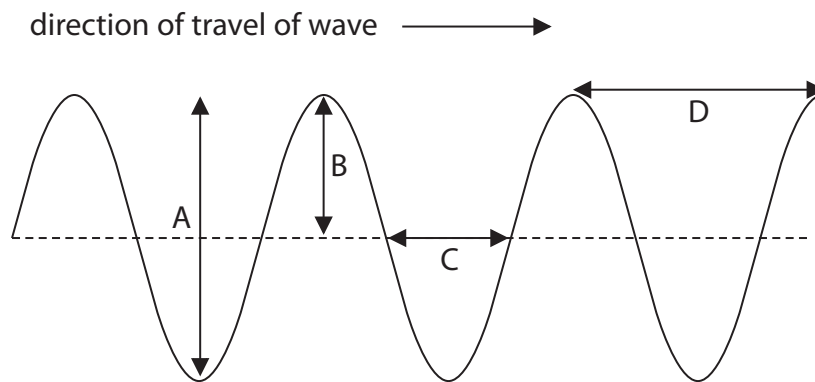


Figure 5

- (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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(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.

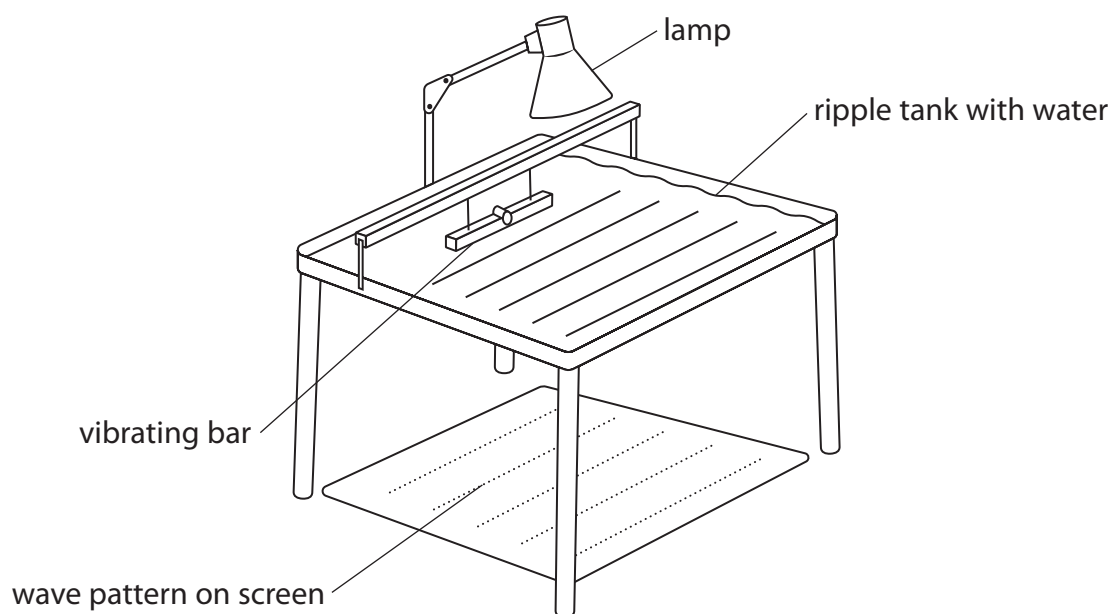


Figure 6

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)

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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)

- (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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P 7 2 5 5 8 A 0 1 3 2 0

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

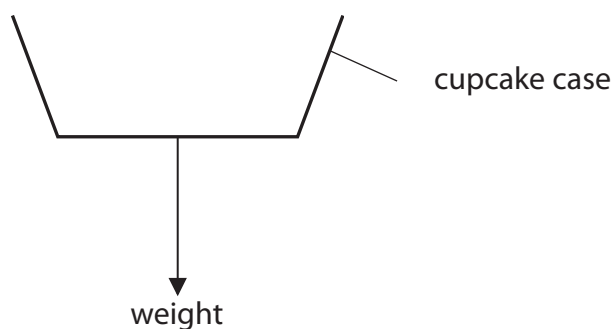


Figure 9

- (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 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)

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

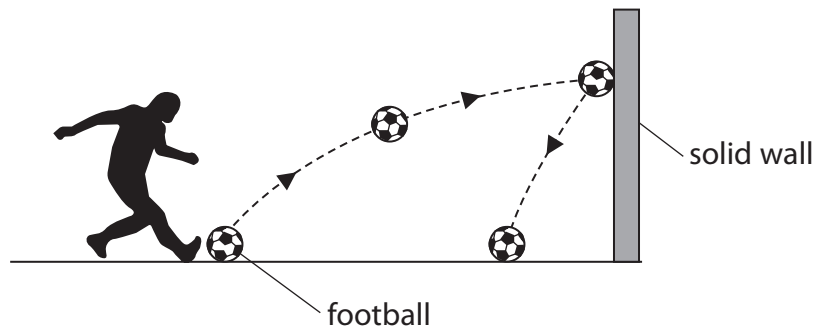


Figure 10

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.

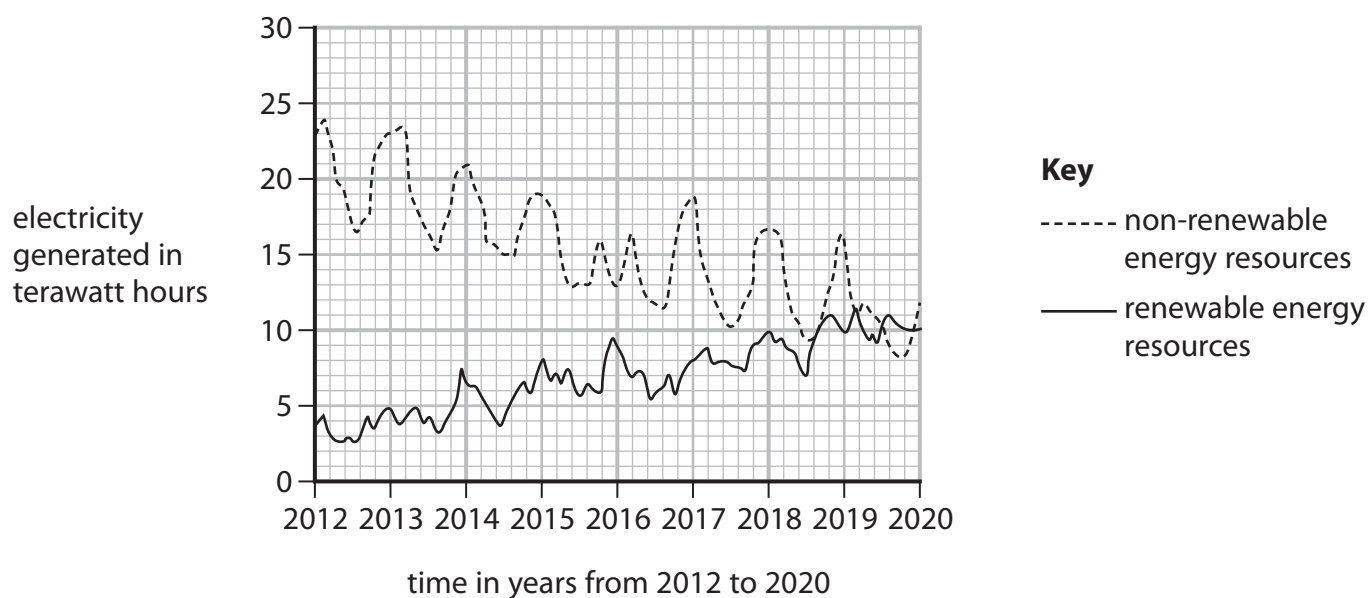


Figure 11



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

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

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May–June 2023 Assessment Window

Paper
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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 \times time	
acceleration = change in velocity \div time taken	$a = \frac{(v-u)}{t}$
force = mass \times acceleration	$F = m \times a$
weight = mass \times gravitational field strength	$W = m \times g$
HT momentum = mass \times velocity	$p = m \times v$
change in gravitational potential energy = mass \times gravitational field strength \times change in vertical height	$\Delta GPE = m \times g \times \Delta h$
kinetic energy = $\frac{1}{2} \times$ mass \times (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 \times wavelength	$v = f \times \lambda$
wave speed = distance \div time	$v = \frac{x}{t}$
work done = force \times distance moved in the direction of the force	$E = F \times d$
power = work done \div time taken	$P = \frac{E}{t}$
energy transferred = charge moved \times potential difference	$E = Q \times V$
charge = current \times time	$Q = I \times t$
potential difference = current \times resistance	$V = I \times R$
power = energy transferred \div time taken	$P = \frac{E}{t}$
electrical power = current \times potential difference	$P = I \times V$
electrical power = (current) ² \times resistance	$P = I^2 \times R$
density = mass \div volume	$\rho = \frac{m}{V}$



	force exerted on a spring = spring constant \times extension	$F = k \times x$
	(final velocity) ² – (initial velocity) ² = 2 \times acceleration \times distance	$v^2 - u^2 = 2 \times a \times x$
HT	force = change in momentum \div time	$F = \frac{(mv - mu)}{t}$
	energy transferred = current \times potential difference \times 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 \times current \times length	$F = B \times I \times l$
	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) 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 \times distance normal to the direction of the force	
	pressure = force normal to surface \div area of surface	$P = \frac{F}{A}$
HT	$\frac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$	$\frac{V_p}{V_s} = \frac{N_p}{N_s}$
	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 \times density of liquid \times gravitational field strength	$P = h \times \rho \times g$

END OF EQUATION LIST

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