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)

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.

Turn over ▶

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 × (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

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) Figure 1 shows how the visible spectrum of white light is shown on a screen.

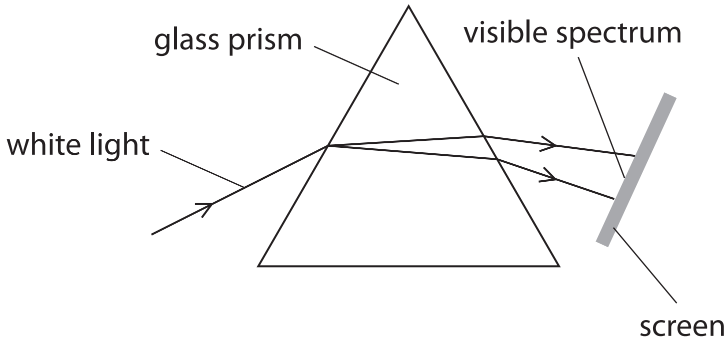

Figure 1

(i) Which of these is the best piece of equipment to produce the white light?

(1)

☒ **A** ray box

☒ **B** ruler

☒ **C** measuring cylinder

☒ **D** ammeter

(ii) Which colour is seen between yellow and blue in the spectrum on the screen?

(1)

☒ **A** red

☒ **B** orange

☒ **C** green

☒ **D** violet

(b) Figure 2 shows the main parts of the electromagnetic spectrum.

radio	microwaves	infrared	visible light	ultraviolet	x-rays	gamma rays

Figure 2

Complete the following sentences using information from Figure 2. Each part of the electromagnetic spectrum may be used once, more than once or not at all.

(i) The part of the electromagnetic spectrum used to detect broken bones is

(1)

(ii) The part of the electromagnetic spectrum used in thermal imaging is

(1)

(iii) The part of the electromagnetic spectrum that

- is used to cook food

AND

- has a shorter wavelength than microwaves is

(1)

(iv) The part of the electromagnetic spectrum that

- is used to sterilise medical equipment

AND

- has a shorter wavelength than x-rays is

(1)

(Total for Question 1 = 6 marks)

2 This question is about waves.

(a) Figure 3 is a diagram of a **water wave** in a ripple tank.

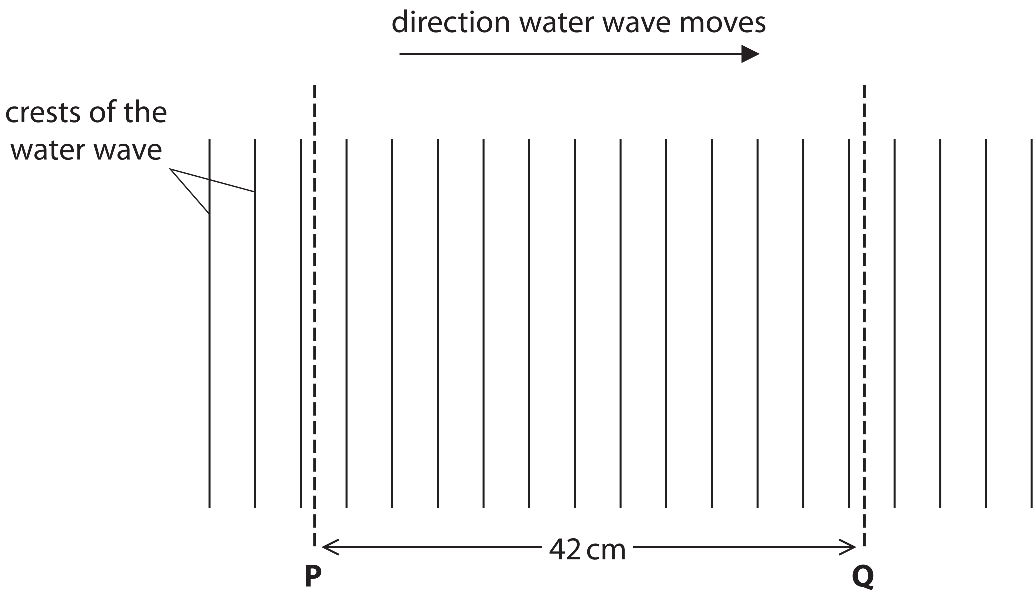

Figure 3

(i) State the number of crests of the wave between **P** and **Q**.

(1)

number of crests = ...

(ii) The distance between **P** and **Q** is 42 cm.

Calculate the wavelength of the water wave in Figure 3.

(2)

wavelength = ... cm

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(iii) Describe how a student could determine the wave speed of the water wave in Figure 3.

(3)

(b) (i) Which row of the table is correct for **sound waves**?

(1)

		sound waves are	can sound waves transfer energy?
☒	**A**	longitudinal	yes
☒	**B**	longitudinal	no
☒	**C**	transverse	yes
☒	**D**	transverse	no

(ii) A sound wave has a frequency of 440 Hz and a wavelength of 0.75 m.

Calculate the wave speed of the sound wave.

(2)

wave speed = ... m/s

(Total for Question 2 = 9 marks)

3 (a) Figure 4 shows a truck lifting a box.

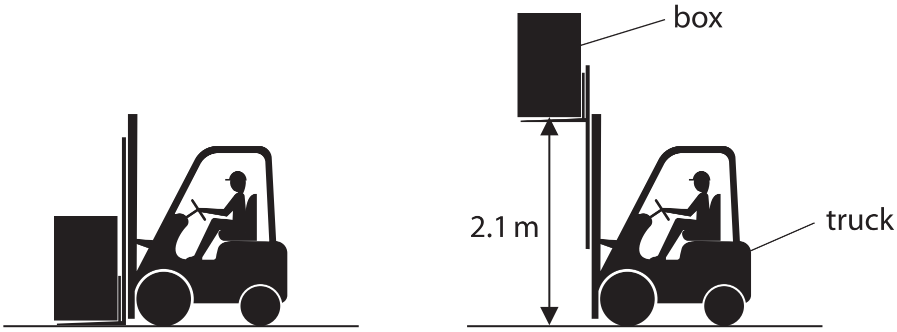

Figure 4

The box has a mass of 57 kg.

The truck lifts the box through a vertical height of 2.1 m.

The gravitational field strength, g = 10 N/kg

Calculate the change in the gravitational potential energy of the box.

Use the equation

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

(2)

change in gravitational potential energy = ... J

(b) A cyclist of mass 70 kg travels at a constant velocity of 8 m/s.

Calculate the kinetic energy of the cyclist.

(3)

kinetic energy of the cyclist = ... J

(c) Figure 5 shows a trolley at the top of a slope.

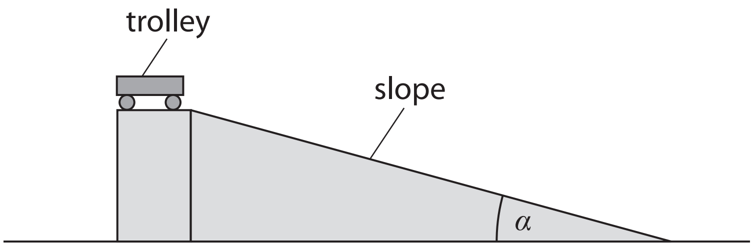

Figure 5

A student gently pushes the trolley until it just starts to roll down the slope.

The student measures the time it takes for the trolley to roll down the slope.

The student repeats this for different values of the angle α.

Figure 6 is a graph of the student's results.

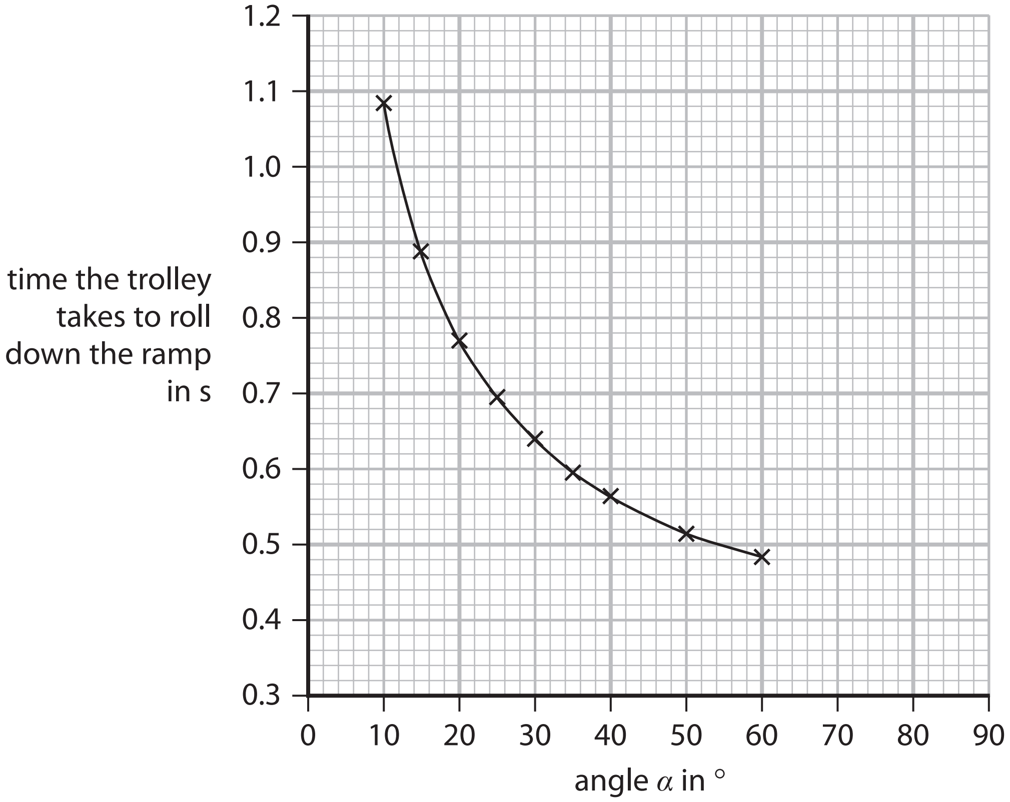

Figure 6

(i) Use the graph in Figure 6 to find the time the trolley takes to roll down the ramp when the angle $\alpha = 45°$.

(1)

time = ... s

(ii) Use the graph in Figure 6 to estimate the time the trolley takes to roll down the ramp when the angle $\alpha = 80°$.

Show your working on the graph.

(2)

time = ... s

(iii) The student had a choice of how to measure the time the trolley takes to roll down the ramp.

1. Use a hand-held stopwatch.

2. Use light gates at the top and bottom of the slope.

The student chose to use the light gates.

Explain why this was the correct choice.

You should refer to the data on the time axis of Figure 6 in your answer.

(2)

(Total for Question 3 = 10 marks)

4 (a) Figure 7 shows a safety sign on the door of a laboratory where radioactive materials are used.

Figure 7

(i) State **one** way that radioactivity can be dangerous to humans.

(1)

(ii) State **one** piece of equipment that can be used to measure radioactivity.

(1)

(iii) Alpha (α) radiation and ultraviolet (UV) radiation are ionising radiations.

Give **two** other ionising radiations.

(2)

1

2

(b) Sulfur-35 is a radioactive isotope of sulfur.

Figure 8 represents a nucleus of sulfur-35.

$$^{35}_{16}S$$

Figure 8

Draw one line from each type of particle to the number of that type of particle in a nucleus of sulfur-35.

(3)

type of particle	**number of particles**
	35
proton	
	16
neutron	
	51
nucleon	
	19

(c) A sample of a radioactive isotope has a mass of 520 g.

The half-life of the radioactive isotope is 18 days.

(i) Calculate the mass of the original radioactive isotope remaining after 18 days.

(1)

mass after 18 days .... g

(ii) Calculate the mass of the original radioactive isotope remaining after 54 days.

(2)

mass after 54 days .... g

(Total for Question 4 = 10 marks)

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5 (a) Which statement describes conservation of energy in a closed system?

(1)

☒ **A** when there are energy transfers, the total energy reduces

☒ **B** when there are energy transfers, the total energy does not change

☒ **C** when there are no energy transfers, the total energy reduces

☒ **D** when there are no energy transfers, the total energy increases

(b) A student uses the apparatus in Figure 9 to find out which of two materials, sand or sawdust, is the better insulator.

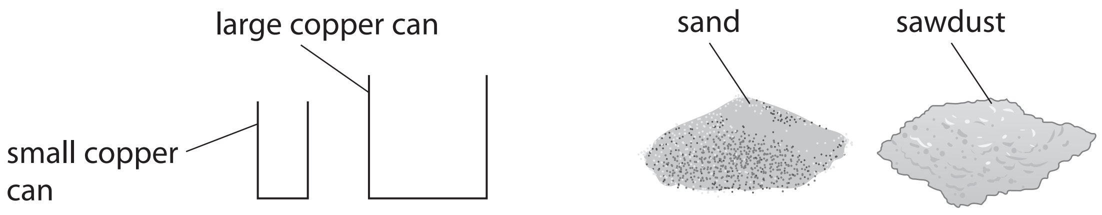

Figure 9

The student also has a kettle to boil water, a thermometer and a stop clock.

(i) Draw a labelled diagram to show how the student should set up the equipment to investigate which material is the better insulator.

(3)

(ii) Give **three** factors that the student must control in this investigation.

(3)

1

2

3

(c) Expanded polystyrene, used to insulate buildings, has different densities.

Figure 10 shows how the thermal conductivity of expanded polystyrene changes with the density of expanded polystyrene.

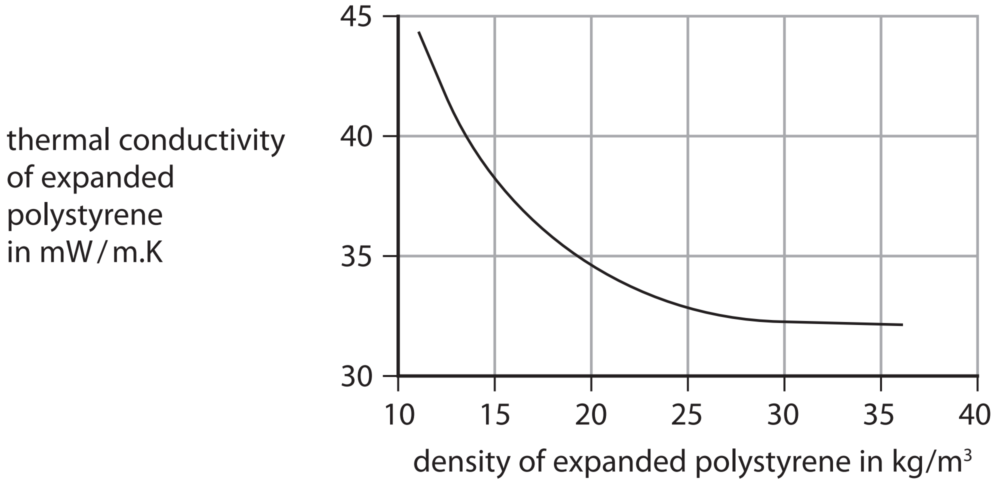

Figure 10

Using the graph in Figure 10, describe how the thermal conductivity of expanded polystyrene changes with the density of expanded polystyrene.

(2)

(d) Figure 11 is an energy diagram for an electric kettle, used to heat water.

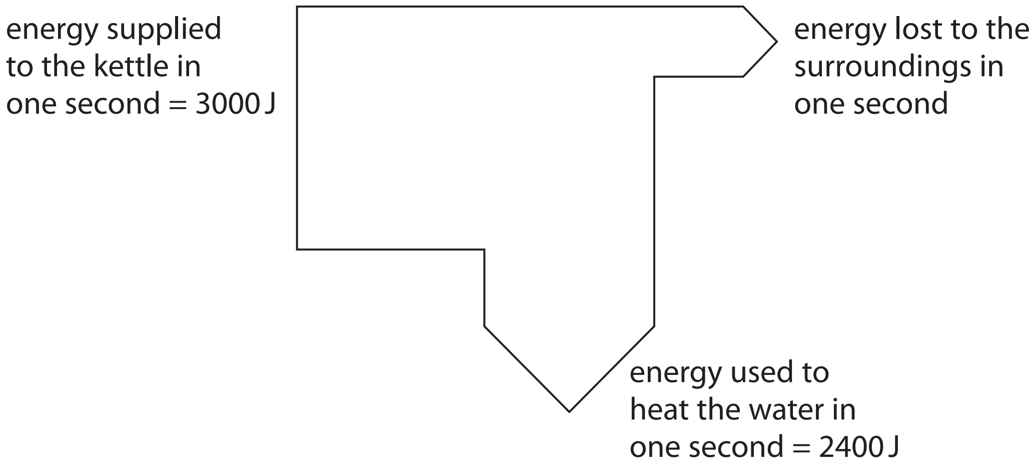

Figure 11

(i) Calculate the amount of energy lost to the surroundings in one second.

(1)

energy lost to the surroundings in one second = ... J

(ii) Calculate the efficiency of the kettle.

Use the equation

$$\text{efficiency} = \frac{\text{useful energy transferred by the kettle in one second}}{\text{total energy supplied to the kettle in one second}}$$

(2)

efficiency = ...

(Total for Question 5 = 12 marks)

6 (a) Figure 12 is a speed limit sign from a European motorway.

The speeds shown are in km/h (kilometres per hour).

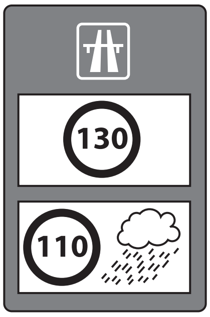

Figure 12

(i) The sign tells drivers to drive at a slower speed in wet weather.

Explain why it is safer for drivers to drive at a slower speed in wet weather.

(2)

(ii) Show that a speed of 31 m/s is less than a speed of 130 km/h.

(2)

(iii)

The driver's reaction time is the time between the driver seeing an emergency and starting to brake.

A car is travelling at a speed of 31 m/s.

The car travels 46 m between the driver seeing an emergency and starting to brake.

Calculate the driver's reaction time.

Give your answer to 2 significant figures.

(3)

driver's reaction time = ... s *(b) Figure 13 is a velocity/time graph for a toy train on a straight track for 7 seconds.

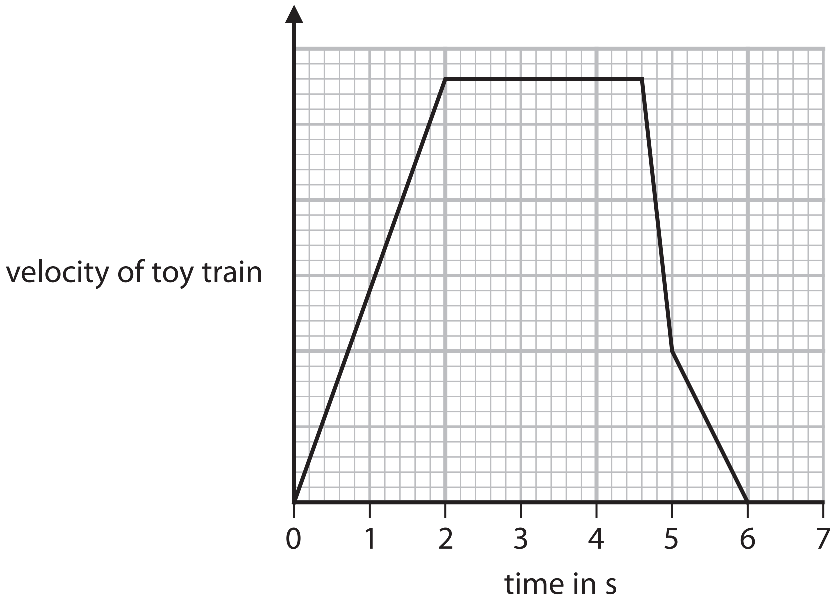

Figure 13

Using information from the graph, describe when and how the velocity and acceleration of the toy train change at different times during the 7 seconds shown on the graph.

(6)

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

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Equations

(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance $v^2 - u^2 = 2 \times a \times x$
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 $Q = m \times L$
to calculate pressure or volume for gases of fixed mass at constant temperature $P_1 V_1 = P_2 V_2$
energy transferred in stretching = 0.5 × spring constant × (extension)^2 $E = ½ \times k \times x^2$

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