Please check the examination details below before entering your candidate information

Candidate surname	Other names

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

Centre Number | Candidate Number

Wednesday 20 May 2020

Afternoon (Time: 1 hour 10 minutes) | Paper Reference **1SC0/1PH**

Combined Science

Paper 3

Higher Tier

You must have:
Calculator, ruler

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.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

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

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 student lifts a toy car from a bench and places the toy car at the top of a slope as shown in Figure 1.

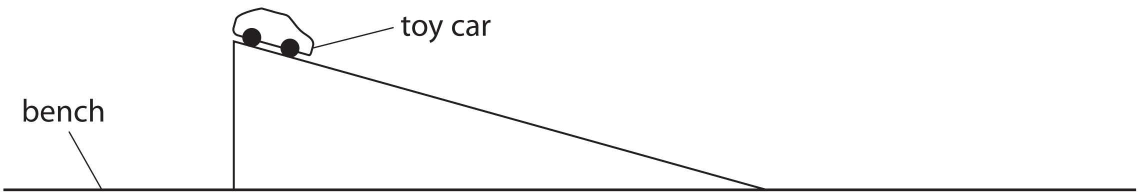

Figure 1

(a) Describe an energy transfer that occurs when the student lifts the toy car from the bench and places the toy car at the top of the slope.

(2)

....

....

....

....

(b) The student lets the toy car roll down the slope.

Describe how the student could find, by experiment, the speed of the toy car at the bottom of the slope.

(4)

....

....

....

....

....

....

....

....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c) The student needs to develop the experiment to determine the loss in potential energy and the gain in kinetic energy as the toy car is rolling down the slope.

State the other measurements the student must make.

(2)

....

....

....

....

(d) When the toy car rolls down the slope, some energy is transferred to the surroundings as thermal energy.

State how the student could calculate the amount of energy transferred to the surroundings.

(1)

....

....

(Total for Question 1 = 9 marks)

2 (a) Which of these is a vector?

(1)

- ☒ **A** energy
- ☒ **B** force
- ☒ **C** mass
- ☒ **D** work

(b) (i) State the equation that relates acceleration to change in velocity and time taken.

(1)

(ii) A van accelerates from a velocity of 2 m/s to a velocity of 20 m/s in 12 s.

Calculate the acceleration of the van.

(2)

acceleration = ... m/s^2

(c) Figure 2 is a velocity / time graph for 15 s of a cyclist's journey.

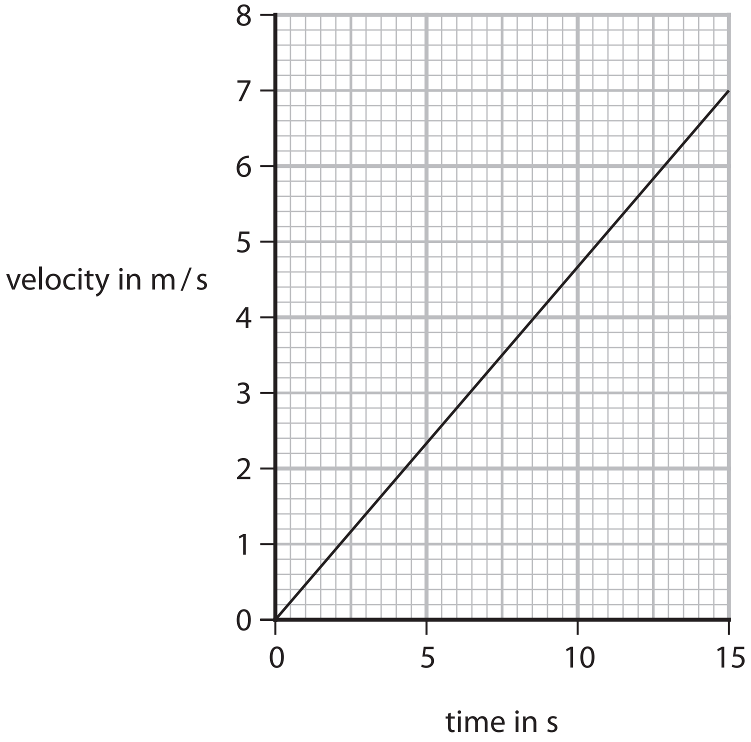

Figure 2

(i) Calculate the distance the cyclist travels in the 15 s.

(3)

distance = ... m

(ii) Another cyclist starts from rest, but his acceleration decreases as time increases.

Sketch the velocity / time graph for this cyclist on Figure 2.

(2)

(Total for Question 2 = 9 marks)

3 (a) A radio station transmits on 97.4 MHz.

To receive the waves an aerial needs a length equal to half the wavelength of the radio waves being transmitted.

Calculate the length of the aerial needed.

The speed of the radio waves is 3.00×10^8 m/s.

(3)

length of aerial = ... m

(b) To investigate refraction in a rectangular glass block a student uses the apparatus shown in Figure 3.

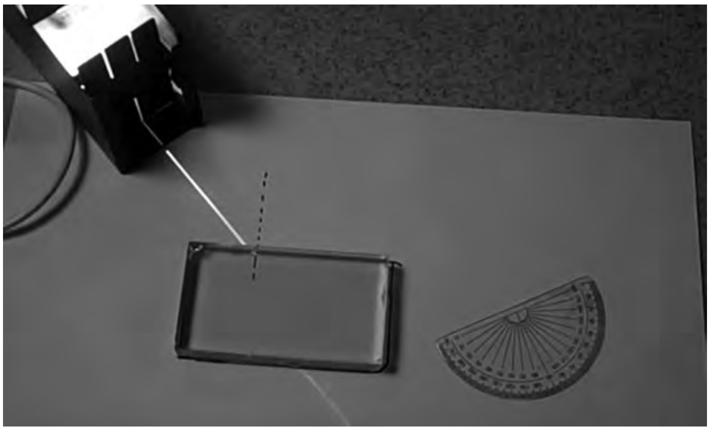

Figure 3

Describe how the student should measure the angle of refraction.

(2)

....

....

....

....

(c) Figure 4 is a simplified diagram to show radio waves from a transmitter moving upwards, then meeting a boundary between lower and upper layers of the atmosphere.

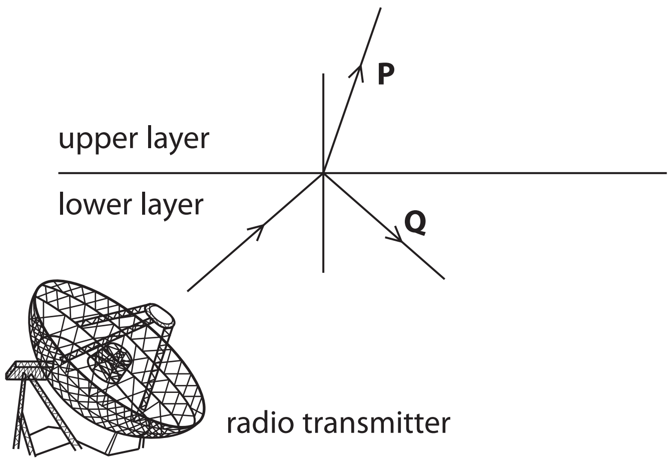

Figure 4

Explain what happens to the radio waves after they meet the boundary between the lower and upper layers as shown in Figure 4.

Your explanation should refer to changes in direction and speed of the waves.

(4)

....

....

....

....

....

....

....

....

(Total for Question 3 = 9 marks)

4 (a) Four students and their teacher do an experiment to measure the speed of sound in air.

The teacher stands at a distance and fires a starting pistol into the air.
The students see the flash when the pistol is fired.
They measure the time from when they see the flash to when they hear the bang.

A student drew a diagram of the arrangement as shown in Figure 5.

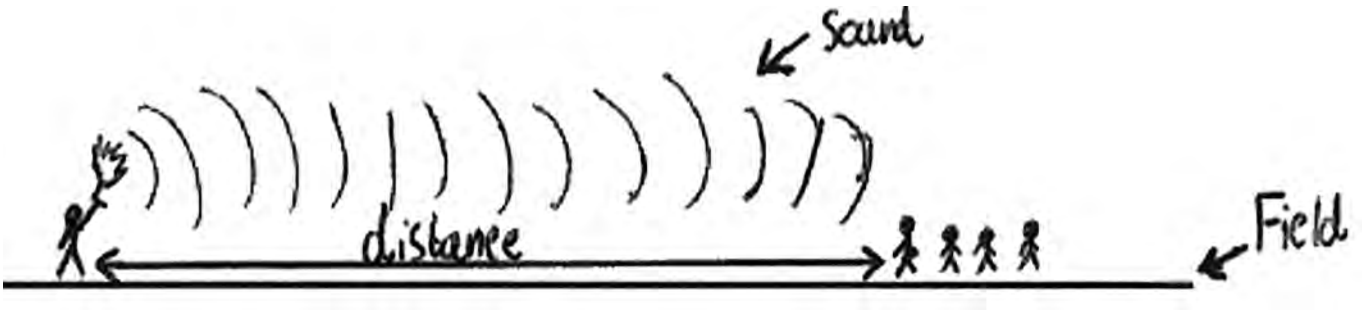

Figure 5

The students obtained a value of 240 m/s for the speed of sound.

The accepted value, in a science data book, is 343 m/s.

(i) Calculate the difference between the students' value and the accepted value as a percentage of the accepted value.

(2)

percentage difference = ... %

(ii) When the distance was 100 m, the students measured the following times:

0.43 s 0.35 s 0.50 s 0.38 s

Explain why their times vary so much.

(2)

....

....

....

....

DO NOT WRITE IN THIS AREA

(iii) Explain **one** way the students might improve this experiment.

(2)

....

....

....

....

(b) Figure 6 represents a sound wave coming from a loudspeaker and shows the effects on particles of the air at one instant in time.

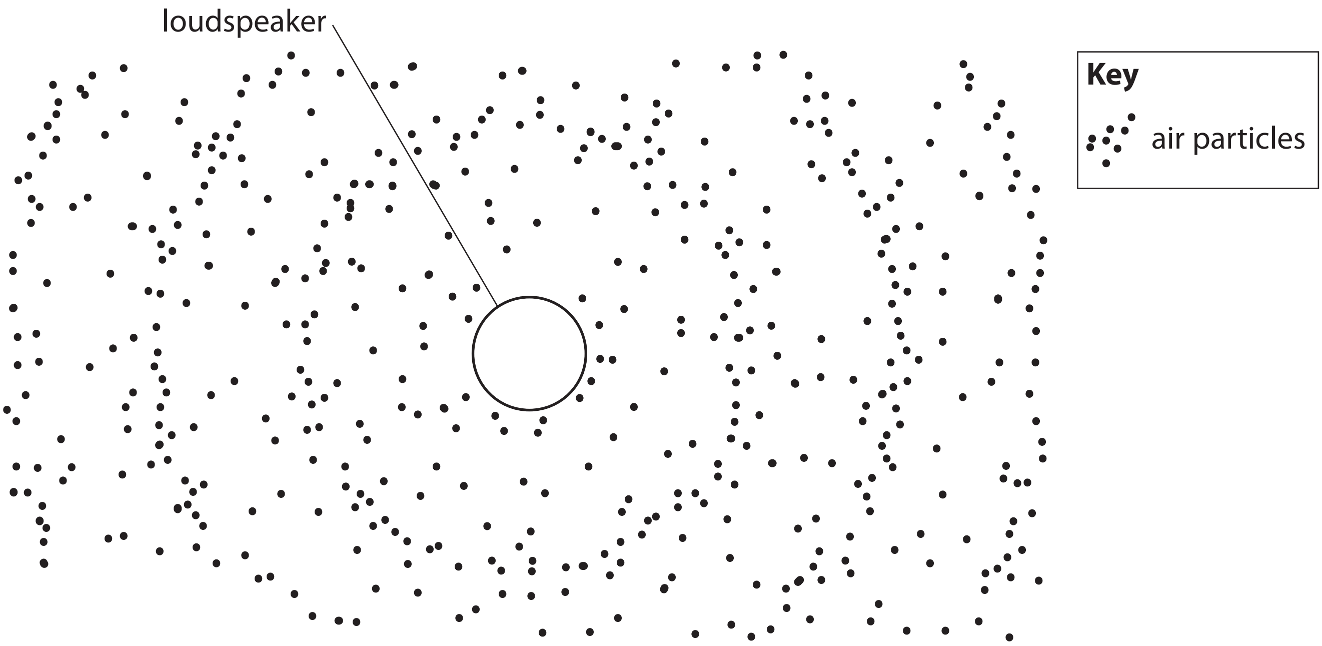

Figure 6

(i) Draw and label a distance of one wavelength in Figure 6.

(1)

(ii) Describe the motion of the particles as the wave travels through the air.

(2)

....

....

....

....

(Total for Question 4 = 9 marks)

BLANK PAGE

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

5 (a) Which of these describes isotopes of an element?

(1)

☒ **A**	same atomic number	different number of neutrons
☒ **B**	same atomic number	different number of protons
☒ **C**	same mass number	different number of neutrons
☒ **D**	same mass number	different number of protons

(b) Figure 7 represents a decay that can happen inside the nucleus of an atom.

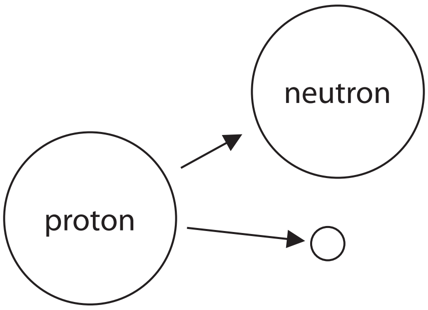

Figure 7

Which decay is represented in Figure 7?

(1)

☒ **A** alpha

☒ **B** beta minus

☒ **C** beta plus

☒ **D** gamma

(c) The half-life of cobalt-60 is 5 years.

A school cobalt source had an activity of 38.5 kBq in the year 2000.

Estimate the activity of this source in the year 2020.

(3)

activity = ... kBq

(d) Explain what can happen to the body if a person has a prolonged exposure to gamma rays.
(2)

....

....

....

....

(e) A G-M tube is connected to a counter.
A teacher places the G-M tube near to a radioactive source.
A student starts the counter and clock at the same time and writes down the readings shown on the counter every 15 s.

The student plots the readings with a line of best fit, as shown in Figure 8.

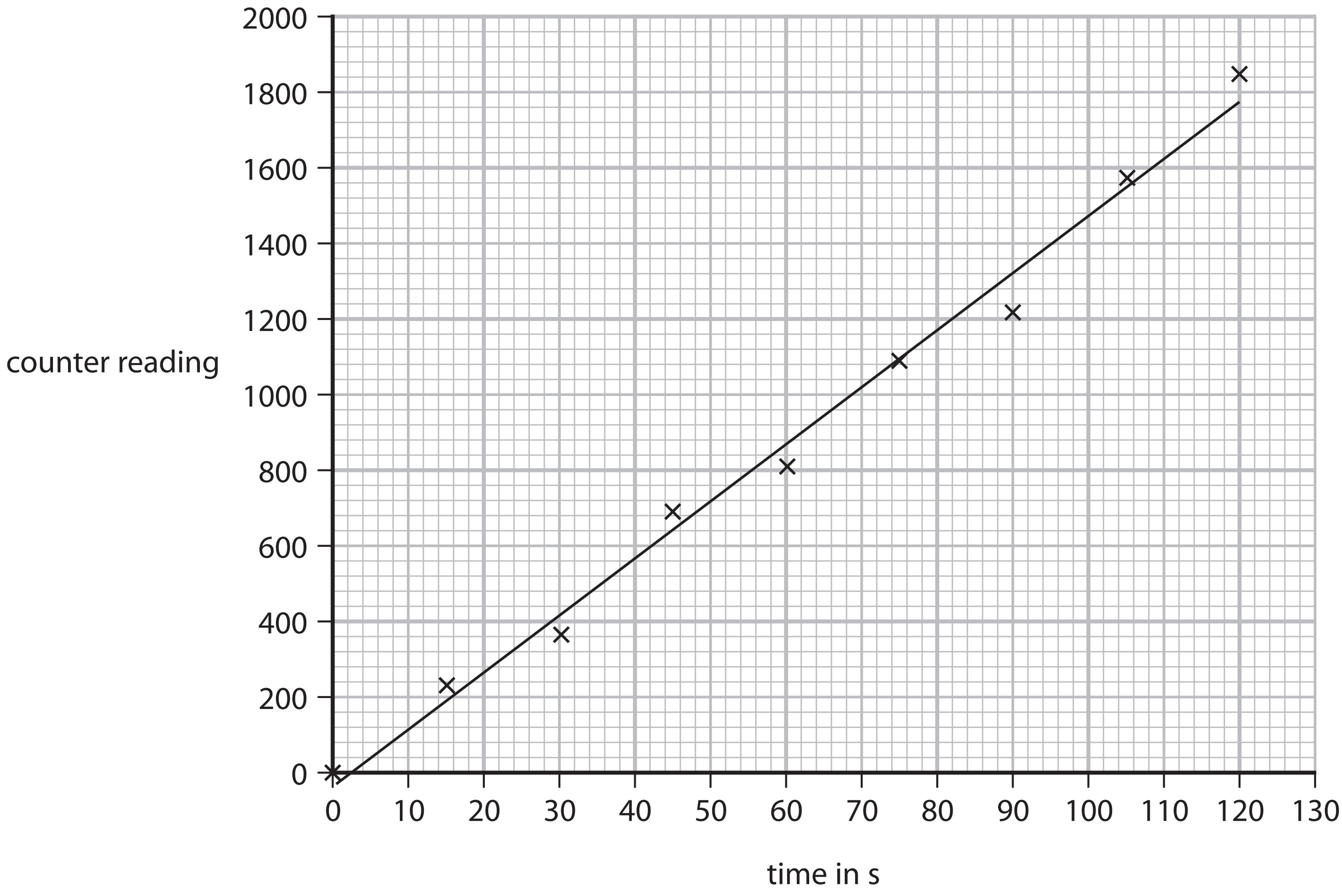

Figure 8

(i) Calculate the average count rate, in counts / s, from the graph.

Show your working on the graph.
(2)

average count rate = ... counts / s

(ii) The student says that the experiment must have been done carelessly because the data seemed quite scattered away from the best fit line.

The teacher claims such results should be expected in radioactivity experiments.

Justify the teacher's claim.

(2)

....

....

....

....

(Total for Question 5 = 11 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

6 (a) Figure 9 is a diagram showing a rocket that is sent into space to try and change the path of a small asteroid.

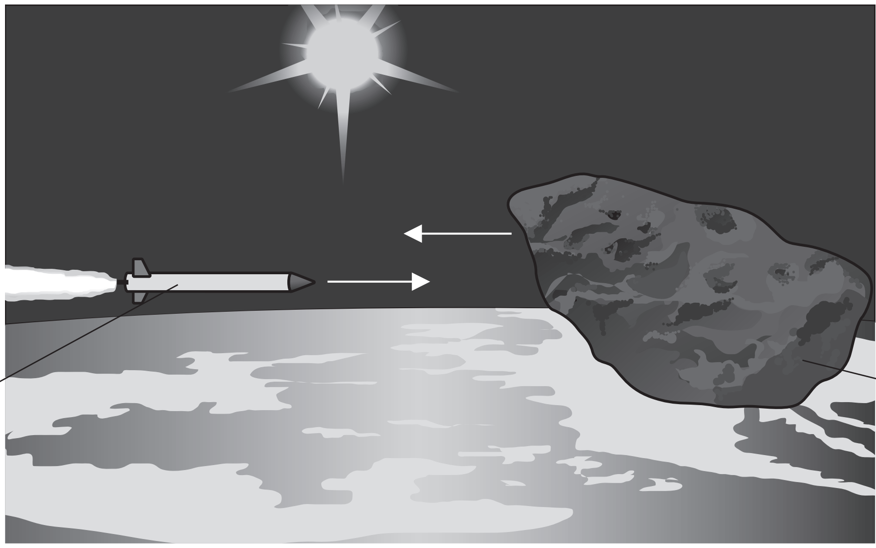

Figure 9

(i) The rocket has a mass of 5.5×10^5 kg and is travelling to the right at 14 km/s.

Which of these is a correct calculation of the momentum of the rocket in kg m/s?

Use the equation

$$p = m \times v$$

(1)

- ☒ **A** 7.7×10^3 kg m/s
- ☒ **B** 7.7×10^6 kg m/s
- ☒ **C** 7.7×10^9 kg m/s
- ☒ **D** 7.7×10^{12} kg m/s

(ii) The asteroid has a momentum of 7.5×10^{10} kg m/s and a mass of 8.0×10^6 kg.

Calculate the speed of the asteroid.

(2)

speed of the asteroid = ... m/s *(b) A student investigates the effect of a crumple zone on the force exerted during a collision.

The student has one trolley with a spring at the front and another trolley without a spring.

The student uses the arrangement in Figure 10.

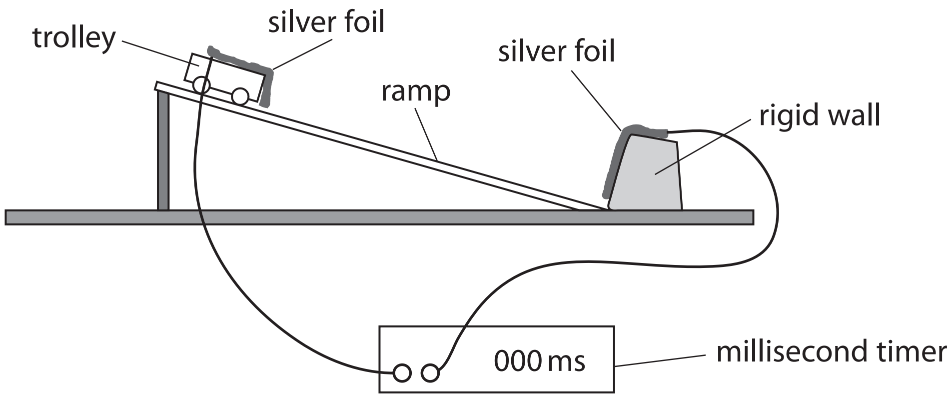

Figure 10

After a trolley is released, it accelerates down a slope and bounces off a rigid wall.

The speed of a trolley can be measured just before a collision with the wall and just after a collision with the wall.

The silver foils are connected to a millisecond timer.

The silver foils make contact with each other during the collision, so the time they are in contact can be read from the millisecond timer.

Explain how the student could investigate the effect of a crumple zone on the average force exerted during the collision.

Your explanation should include:

- how to determine the force (you may wish to refer to an equation from the list of equations at the end of this paper)
- how the effect of crumple zones may be shown in the investigation
- precautions that may be necessary to achieve accurate results.

(6)

(c) Newton's third law, when applied to the collision of the rocket and the asteroid as shown in Figure 9, can be stated as follows:

The force exerted by the rocket on the asteroid is equal and opposite to the force exerted by the asteroid on the rocket.

Explain how this statement links to the conservation of momentum in the collision.

(4)

....

....

....

....

....

....

....

....

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

BLANK PAGE

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 $F = B \times I \times l$
$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$ $\frac{V_p}{V_s} = \frac{N_p}{N_s}$
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 $P = h \times \rho \times g$