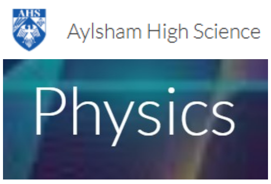
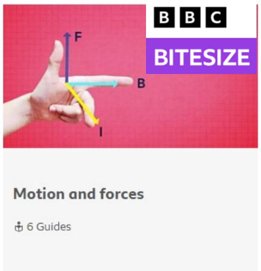
name .... class ....

Combined Sciences: Physics Topics 1 → 4 Quick Revision Questions.

Useful Online Revision Resources





Topic 1: Key Concepts in Physics

1.2 Recall and use multiples and sub-multiples of units, including giga (G), mega (M), kilo (k), centi (c), milli (m), micro (μ) and nano (n)

Which of these is the same as 0.30 km?

☐ **A:** 3000 mm
☐ **B:** 3000 m
☐ **C:** 30 μm
☐ **D:** 30 000 cm

1.3 Be able to convert between different units, including hours to seconds

Draw one line from each time in hours or minutes to its matching time in seconds

2.6 hours	9600 s
160 minutes	9360 s
2 hours and 34 minutes	9240 s

Experimental skills and strategies

b Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.

Scientific vocabulary, quantities, units, symbols and nomenclature

a Use scientific vocabulary, terminology and definitions.

Draw one line matching each scientific term to its definition

independent variable	Everything that *could* affect the results but is kept the same each times a measurement is taken to ensure that it doesn't
dependent variable	The thing that is measured after a change to see if the change affected it
control variables	The thing that is changed or allowed to change to see if that change has an effect on something else

2.3 Explain the difference between vector and scalar quantities

2.4 Recall vector and scalar quantities, including:

Scalar quantities include magnitude (size) but *not* direction
Circle all of the **scalar** quantities ↓

acceleration	speed	displacement
mass	velocity	temperature
momentum	distance	force

Topic 2 part 1: Motion and Forces

(a) If it takes 4 seconds for an aeroplane to fly 980 m. What is the speed of the aeroplane?

speed = ... m/s

2.8 Recall and use the equation:

acceleration (metre per second squared, m/s^2) = change in velocity (metre per second, m/s) ÷ time taken (second, s)

(b) A cyclist was travelling at 7 m/s when they applied their brakes. Four seconds later they were at rest. What was the acceleration of the cyclist?

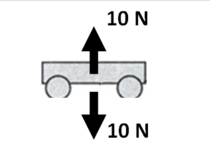
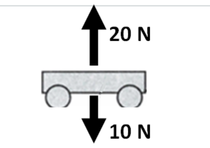
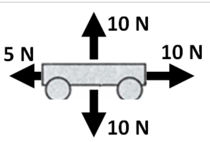
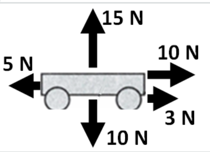
acceleration = ... m/s^2

2.14 Recall Newton's first law and use it in the following situations:

a where the resultant force on a body is zero, i.e. the body is moving at a constant velocity or is at rest

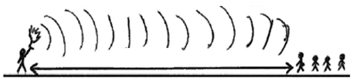
b where the resultant force is not zero, i.e. the speed and/or direction of the body change(s)

For each object, calculate the resultant force acting on it and describe its motion.

	Resultant force Motion
	Resultant force Motion
	Resultant force Motion
	Resultant force Motion

2.11 Describe a range of laboratory methods for determining the speeds of objects such as the use of light gates

(a) A teacher stands at the other end of a field to some students before pulling the trigger on a blank-firing pistol. Describe what measurements would need to be taken for the students to be able to calculate the speed of sound. Suggest suitable equipment and what the students should do with their measurements.



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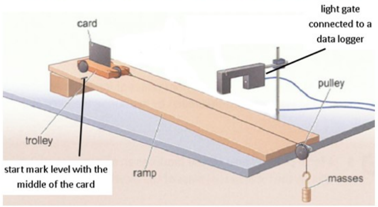
(b) Draw one line from each scenario to the appropriate equipment for measuring the speeds involved in that scenario.

Two snails race along a desk.	Light gate. Ruler.
A toy car quickly rolls down a 10 cm ramp	Stopwatch. Trundle wheel.
A student walks from one end of the school to the other	Stopwatch. Tape measure.

2.19 *Core Practical: Investigate the relationship between force, mass and acceleration by varying the masses added to trolleys*



Equipment set up to investigate the effect of force on acceleration

(a) Why was the ramp tilted slightly?

☐ **A:** To compensate for the effects of frictional forces acting on the trolley

☐ **B:** To cause acceleration of the trolley

☐ **C:** So that the mass remains constant

(b) How could the mass of the moving system be kept constant?

☐ **A:** Add an equal mass to the trolley when one is added to the hook

☐ **B:** Move masses between the trolley and the hook

☐ **C:** Change the ramp angle each time mass is added to the hook

Topic 2 part 2: Motion and Forces

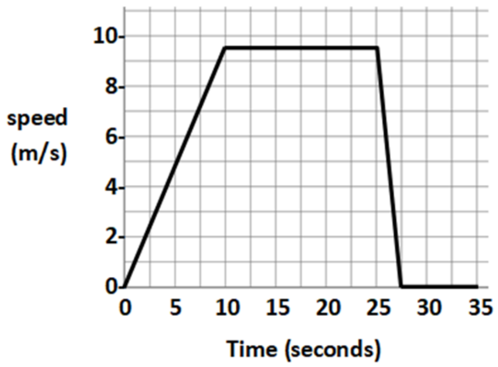
2.10 Analyse velocity/time graphs to:

a compare acceleration from gradients qualitatively

b calculate the acceleration from the gradient (for uniform acceleration only)

c determine the distance travelled using the area between the graph line and the time axis (for uniform acceleration only)

(a) How the speed of a car changes over the course of thirty five seconds is plotted on the graph below.



(i) Describe the car's motion between 0 s and 10 s.

....

(ii) How long was the car stationary for?

....

(iii) Calculate the **acceleration** the car at the start of the journey

acceleration = ... m/s^2

(iv) What was the total distance the car travelled in the first 25 seconds?

distance = ... m

2.9 Use the equation:

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

(a) A cyclist starts from rest, accelerates at a constant 1.5 m/s^2 and reaches a speed of 6 m/s. How far do they travel in this time?

distance = ... m

Topic 3: Conservation of Energy

3.5 Analyse the changes involved in the way energy is stored when a system changes, including:

a an object projected upwards or up a slope

b a moving object hitting an obstacle

c an object being accelerated by a constant force

d a vehicle slowing down

e bringing water to a boil in an electric kettle

A teacher goes to work in their petrol-fuelled car.

light	elastic potential	thermal (heat)	gravitational potential	kinetic
sound		chemical		electrical

Use words from the box above to complete the table below. You can use words once, more than once or not at all. The first one has been done for you.

Part of car	The energy is transferred from...	The useful energy this is transferred
Petrol engine	Chemical	Kinetic
Brakes		
Headlight		
Stereo speakers		

3.4 Explain what is meant by conservation of energy

All of the energy supplied to another device is transferred into other forms. This is an example of

- ☐ **A:** renewable energy
- ☐ **B:** non-renewable energy
- ☐ **C:** conservation of energy
- ☐ **D:** catalysis

3.1 Recall and use the equation to calculate the change in gravitational PE when an object is raised above the ground:

change in gravitational potential energy (joule, J) = mass (kilogram, kg) × gravitational field strength (newton per kilogram, N/kg) × change in vertical height (metre, m)

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

(a) What is the magnitude of the gravitational field strength at the surface of the Earth?

- ☐ **A:** 1000 N/kg
- ☐ **B:** 10 N/kg
- ☐ **C:** 1 N/kg
- ☐ **D:** 0.1 N/kg

(a) How much potential energy is gained by a 1.2 kg book when it is lifted upwards onto a shelf 1.4 m higher than it originally was?

Potential energy = ... J

3.6	Explain that where there are energy transfers in a closed system there is no net change to the total energy in that system
3.7	Explain that mechanical processes become wasteful when they cause a rise in temperature so dissipating energy in heating the surroundings

(a) The image below is an energy transfer diagram for a battery-operated fan.

(i) How much useful energy is transferred from the store of chemical energy?

.... J

(ii) Useful energy is stored in the movement of air pushed by the fan blades.
Suggest what form the useful energy is in

....

3.11	Recall and use the equation: $\text{efficiency} = \dfrac{\text{(useful energy transferred by the device)}}{\text{(total energy supplied to the device)}}$

(a) What is the efficiency of the fan whose energy transfers are shown in the diagram in the previous question?

Efficiency = ... %

3.12	**Explain how efficiency can be increased**

Draw one line from each method of increasing efficiency to the explanation of how it works.

Oiling a bicycle chain	Thermal radiation (infrared waves) are absorbed or reflected back rather than escaping to the surroundings
Double-glazing windows	A layer of trapped air reduces energy transferred by conduction
Closing the curtains in a room	Less kinetic energy is transferred to thermal energy due to friction between moving parts

3.2	Recall and use the equation to calculate the amounts of energy associated with a moving object: kinetic energy (joule, J) = $\frac{1}{2}$ × mass (kilogram, kg) × (speed)^2 ((metre/second)^2, (m/s)^2) $KE = \frac{1}{2} \times m \times v^2$

(a) A cyclist and their bike combined gains 4.75 kJ of potential energy when they reach the top of a 5 m tall hill.

The total kinetic energy of the cyclist and bike combined is measured as 4.00 kJ at the bottom of the hill.

(i) If the mass of the cyclist and the bike combined is 95 kg then what was the velocity of the cyclist at the bottom of the hill? Give your answer to two significant figures.

Velocity = ... m/s

(ii) Explain why the total kinetic energy stored in the cyclist and the bike at the bottom of the hill was less than the change in gravitational potential energy.

....

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Topic 4: Waves

4.1	Recall that waves transfer energy and information without transferring matter

Waves can transfer

- ☐ **A:** matter and energy
- ☐ **B:** energy and information
- ☐ **C:** information and matter
- ☐ **D:** none of the above

4.5	Describe the difference between longitudinal and transverse waves by referring to sound, electromagnetic, seismic and water waves

Sound is an example of a longitudinal wave.
Explain what is meant by the term 'longitudinal wave'

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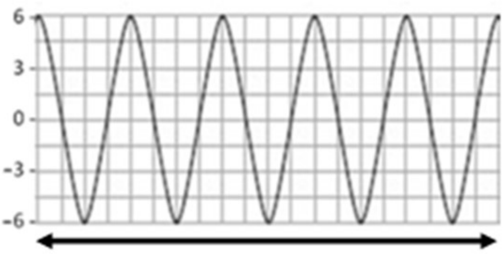
4.3	Define and use the terms frequency and wavelength as applied to waves
4.4	Use the terms, amplitude, period and wave velocity as applied to waves

The waveform diagram below is a for a sound wave.



a) State the amplitude of the wave

volume = ... Db

b) Calculate the wavelength of the wave, give your answer in metres (m)

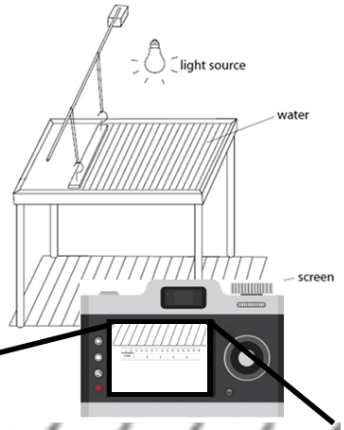
wavelength = ... m

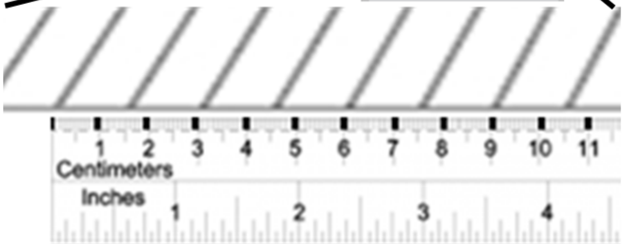
c) The wave shown in the diagram took 2.5 s to produce. What is the frequency of the wave?

frequency .... unit ....

(b) A water wave is produced in a ripple tank like the one shown.

The waves were too fast to measure directly so a student placed a ruler beside the screen and took a photo.





(i) What is the wavelength of the wave produced in the ripple tank?

.... m

(ii) The answer to part (i) is found to be a lot larger than the actual true wavelength of the wave, even though all of the calculations and measurements were performed correctly.
Suggest the most likely reason for this inaccuracy.

....

....

(iii) The students also records a 10 second video, slows it down and is able to count 50 waves pass the end of the ruler. What is the frequency of the wave?

frequency = ... Hz

Answers and explanations can be accessed here →

https://tinyurl.com/4uhfutft

Combined Sciences: Physics
Equation Grid 10

Answer these questions in any order.
You may need to use any of the equations learned in GCSE physics so far, not just ones taught recently.

Find your answers in this list to check that they are correct (they are in a random order)

33.3	2520
80	4.5
3	1.95
4.3×10^{14}	4.2
10.5	3000
6.3	15
4.8	40.8

(i) A person begins moving after initially being stationary, the person accelerates at 0.5 m/s^2 over a distance of 9 m, what is their final speed?

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

final velocity .... m/s

(iv) A car accelerates at 2 m/s^2 constantly for 7 seconds. If the car has a mass of 1500 kg, what was the magnitude of the resultant force that caused this acceleration?

resultant force .... N

(vii) How far will a person walk if they travel at a speed of 1.4 m/s for 30 minutes?

distance .... m

(viii) A train accelerates at 0.25 m/s^2 It starts at 3 m/s and ends up at 7 m/s. How far does it travel during this time?

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

displacement .... m

(xi) A motor is 12 % efficient. If it is supplied with 40 kJ of chemical energy, how much kinetic energy does the motor provide? Give your answer in kilojoules.

kinetic energy .... kJ

(xii) A planet has a gravitational field strength at the surface of 8.2 N/kg. A force meter reads 16 N when a tool is hung on it. What is the mass of the tool? Give your answer to three significant figures.

mass .... kg

(ii) What is the acceleration of a rocket if it reaches a velocity of 30 m/s two seconds after lift off? acceleration .... m /s^2	(iii) A cyclist rides in a 1 km downhill race. He passes the start line at a speed of 8 m/s and accelerates constantly at 0.8 m/s^2 during the race. What speed does he possess when he crosses the finish line? Give your answer to three significant figures. final velocity .... m/s
(v) How much extra gravitational potential energy is stored in a 1.5 kg bag of sugar when it is lifted up onto a shelf 70 cm higher than the one it was on? gravitational potential energy.............................. J	(vi) A motorbike reaches a speed of 20 m/s over 60 m, whilst accelerating at 3 m/s^2, determine the bike's initial speed to 2 significant figures. Use $v^2 - u^2 = 2 \times a \times x$ initial velocity .... m/s
(ix) Calculate the velocity of a 450 g football while it is storing 250 J of kinetic energy. Give your answer to three significant figures. velocity .... m/s	(x) Red light from our sun has a wavelength of 700 nm and travels at a speed of 3.0×10^8 m/s. What is the frequency of red light to 2 significant figures? frequency .... Hz
(xiii) A child travels down a slide, at the top the child is initially at rest, at the bottom the child is travelling at a speed of 3 m/s, the child's acceleration is 1 m/s^2, how long is the slide?3 Use $v^2 - u^2 = 2 \times a \times x$ displacement .... m	(xiv) A light gate records that it takes 24 ms for a piece of card that is 10 cm wide to pass through it. How fast was the piece of card moving? Give your answer to 2 significant figures. velocity .... m/s

Don't just calculate...

HEIST

Highlight – Identify what any number with units is measuring and show them being converted to standard units.

Equation – Write out the equation (as words or symbols) that includes the measurements that you have and the one that you want.

Insert values – Rewrite the equation with the numbers in the place of the words or symbols

Solve – Rearrange the equation by doing the same operation to both sides of the equals sign so all of the numbers end up on one side.

Top it off – Round your answer to a sensible number of **significant figures** and write the correct unit at the end.

Top Tip: Unless you are told otherwise, round long answers to three significant figures.

Worked example

How long does it take a car moving at 10.5 m/s to travel 3.2 km? Give your answer in seconds to three significant figures.

H 3.2 km x 1000 = 3200 m

E Speed = distance ÷ time

I 10.5 = 3200 ÷ ?

S 10.5 × ? = 3200 [× ?]

[÷ 10.5]

? = 3200 ÷ 10.5

T time = 304.7619

time = 305 s

km has been circled to remind us to convert it to the standard unit of m before inserting it into the equation

Conversions are shown clearly and include units

The equation is written such that it is spread out across the page so that when values are inserted they line up neatly with the words or symbols above that they replace

If there is a '÷' get rid of it first by multiplying both sides of the equation by whatever comes after it.

If there is a '×' you can get rid of it by dividing both sides of the equation by the value on either side of it.

The 4th digit is greater than 5 so rounding up is required.

Metric prefixes

how to convert	abbreviation	prefix
x 1000 ↓	**T**	tera-
x 1000 ↓	**G**	giga-
x 1000 ↓	**M**	mega-
x 1000 ↓	**k**	kilo-
	no prefix	
÷ 1000 ↑	**m**	milli-
÷ 1000 ↑	**µ**	micro-
÷ 1000 ↑	**n**	nano-
÷ 1000 ↑	**p**	pico-

Time

how to convert	abbreviation	prefix
x 7 ↓	**wk**	week
x 24 ↓	**d**	day
x 60 ↓	**h or hr**	hour
x 60 ↓	**min**	minute
	s, seconds	
÷ 1000 ↑	**ms**	millisecond
÷ 1000 ↑	**µs**	microsecond
÷ 1000 ↑	**ns**	nanosecond
÷ 1000 ↑	**ps**	picosecond

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	$v = \frac{x}{t}$

	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2 \times a \times x$
HT	**force = change in momentum ÷ time**	$\boldsymbol{F = \frac{(mv - mu)}{t}}$