

# Forces - AQA GCSE Physics and Combined Science Knowledge Questions

These questions cover the entire specification for forces. If you understand the answers to all of these questions you will be in a good place with this topic. Once you have the knowledge you should try out some past paper questions on the topic. I have indicated the topics needed for separate physics and combined physics. I hope that you find them useful.

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## Scalar and Vectors

What does a scalar have?

What two things do vectors have?

Explain how a vector can be represented by an arrow.

Write down three examples of vectors and three examples of scalars.

## Contact and Non-Contact Forces

Define a force by using the following words: push, pull and interaction.

What is meant by a contact force?

What is meant by a non-contact force?

Give some examples of contact and non-contact forces?

What is meant by a normal contact force?

Correct this sentence: Force is a scalar quantity.

## Gravity

What is weight?

What is the force of gravity close to the Earth due to?

What does the weight of an object depend on?

Write down an equation to calculate the weight of an object.

What are the units of gravitational field strength and what does it mean?

What is meant by the object's centre of mass?

What is the mathematical relationship between the weight of an object and its mass?

What device can be used to measure the weight of an object?

What is the mathematical expression for proportionality?

## Resultant Forces

Write down the definition of a resultant force.

How can the resultant force be calculated for two forces that act in a straight line?

Draw a diagram to show how the parallelogram rule can be used to find the resultant of two forces acting on an object at different angles.

Draw a diagram to show how a single force can be resolved into two component forces which have the same effect as the single force.

## Work Done and Energy Transfer

In terms of force when is work done on an object?

How is work done on an object in terms of force and displacement of an object?

Write down an equation to calculate the work done on a moving object.

What are the units of force?

What are the units of displacement?

What is the main unit for work done?

What is an alternative unit for work done in terms of the unit of force and the unit of displacement?

What is the symbol used for displacement and what is the symbol used for force?

Fill in the blanks for the following sentence: One \_\_\_\_\_ of work is done when a force of \_\_\_\_\_ newton causes a displacement of one \_\_\_\_\_.

Complete the following: 1 Joule =

Work done = Energy T\_\_\_\_\_.

What happens to temperature when work is done against frictional forces?

Can you give a real-life example of the situation described in the previous question?

## Forces and Elasticity

What is the difference between elastic deformation and inelastic deformation caused by stretching forces?

Springs: What is the mathematical relationship between the force applied on a spring and extension?

Make sure that you learn this equation.

*force = spring constant × extension*

$$[ F = k e ]$$

What are the units of force?

What are the units of extension?

What are the units of spring constant?

Can you explain what the spring constant tells you?

Can the 'e' in the equation also be how much the object has been compressed by?

Copy the paragraph below filling in the gaps. The specification will help you with this.

*A force that stretches (or compresses) a spring does \_\_\_\_\_ and \_\_\_\_\_ is stored in the spring. Provided the spring is not \_\_\_\_\_ deformed, the work done on the spring and the elastic potential energy stored are \_\_\_\_\_.*

What is the difference between a linear and non-linear relationship between force and extension?

How can the spring constant be calculated from a force-extension graph? Force on the y-axis and extension on the x-axis.

Can you rearrange this equation?

$$\text{elastic potential energy} = 0.5 \times \text{spring constant} \times (\text{extension})^2$$

$$[E_e = \frac{1}{2} k e^2]$$

Rearrange the equation for k.

Rearrange the equation for e. This involves a square root

## Moments, Leavers and Gears - Physics Only

What may a force or a system of forces do to an object?

What is the turning effect of a force called?

Look at this equation

*moment of a force = force × distance*

$$[ M = F d ]$$

What are the units of M, F and d?

Describe exactly what d is.

For an object to be balanced what can you say about the total clockwise moments and the total anticlockwise moments?

What are lever systems and gear systems designed to do?

Watch this video on how gears transmit rotational forces →

<https://www.youtube.com/watch?v=uwzhXL0vp1w>

## Pressure in a Fluid 1 - Physics Only

Can a fluid be a gas?

Draw a diagram to illustrate 'The pressure in fluids causes a force normal (at right angles) to any surface'.

Write down an equation to calculate the pressure at a surface.

What are the units of pressure?

Give an alternative unit for pressure?

What is the unit for the area?

What is the unit for force?

Rearrange the equation so the force is the subject of the equation.

Rearrange the equation so that area is the subject of the equation.

## Pressure in a Fluid 2 - Physics Only

How can the pressure due to a column of liquid be calculated?

What are the units of height?

What are the units of density?

What is the unit of pressure?

What are the units for gravitational field strength?

Can you rearrange the equation for density, height and gravitational field strength?

How does the pressure at the bottom of a column of liquid compare to the pressure at the top?

A partially (or totally) submerged object experiences a greater pressure on the bottom surface than on the top surface. What direction is the resultant force on the object?

Write down the definition of resultant force? Can you draw a diagram to show the situation described in the question above?

What is this resultant force called?

What are the factors that affect floating and sinking?

## Atmospheric Pressure - Physics Only

Write a sentence to explain what the atmosphere is?

What happens to the density of the atmosphere with increasing altitude?

How do air molecules cause atmospheric pressure?

Copy the following paragraph filling in the blanks. The specification will help you.

The number of air molecules (and so the \_\_\_\_\_ of air) above a surface \_\_\_\_\_ as the height of the surface above \_\_\_\_\_ level increases. So as \_\_\_\_\_ increases there is always \_\_\_\_\_ r above a surface than there is at a lower height. So atmospheric pressure decreases with an increase in \_\_\_\_\_.

## Describing Motion along a line

What is meant by the term distance?

Does distance need a direction? E.g. 4 m North East

What is meant by the term 'scalar'?

Write down a description of the term 'displacement'?

Displacement is a vector quantity. What is a vector?

Why is speed a scalar quantity?

Why is the speed of a moving object rarely constant?

What does the speed a person can walk, run or cycle depend on?

State a typical walking speed.

State a typical running speed.

State the typical speed of a car.

Is the speed of the wind and the speed of sound constant?

What is the typical speed of sound in air?

In the lab how are distances and times typically measured?

How can speed be calculated using distance and time?

What equation can be used to calculate the distance travelled for a moving object?

Explain what is meant by average speed and how can it be calculated.

What is the definition of velocity?

Which ones are scalar quantities and which ones are vector quantities: distance; displacement; speed

How can an object that is moving at constant speed in a circle have changing velocity?

What does the gradient of a distance-time graph represent?

How can you calculate the speed from a curved distance-time graph using a tangent?

Write down an equation to calculate the average acceleration of a moving object?

What are the units of acceleration?

What is meant by a change in velocity?

What word can be used to describe an object that is slowing down?

Research some typical accelerations using the units given in Q2. For instance, an aeroplane taking off or a train decelerating

What does the gradient of a velocity-time graph tell us?

What does the area underneath a velocity-time graph tell us? The area is often a triangle.

The area underneath a graph can be sometimes calculated using a method of counting squares. What is meant by this?

Do you know this equation?

$$(final\ velocity)^2 - (initial\ velocity)^2 = 2 \times acceleration \times distance$$

$$[ v^2 - u^2 = 2 a s ]$$

What are units of velocity? What are the units of distance? What are the units of acceleration?

What is the value of gravity near the Earth's surface for any object falling freely under gravity?

*An object falling through a fluid initially accelerates due to the force of gravity. Eventually, the resultant force will be zero and the object will move at its terminal velocity. Sketch a graph of velocity against time for a skydiver. Label all the important points and explain what is happening at each point in terms of forces. Air resistance and weight are important forces to consider. (The Graph is for Physics Only)*

## Newton's First Law

Write a few sentences to explain what this law is about. Maybe diagrams will help.

If a vehicle is travelling at a constant speed then what can you say about the resistive forces and the driving force.

When does the velocity (speed or direction) of an object change?

What is meant by **inertia**?

## Newton's Second Law

Write down the definition of Newton's Second Law

The law as an equation is

*resultant force = mass × acceleration*

$$F = m a$$

force,  $F$ , in newtons, N

mass,  $m$ , in kilograms, kg

acceleration,  $a$ , in metres per second squared,  $m/s^2$

Rearrange this equation so that  $m =$  and  $a =$

What is inertial mass and how is it defined?

Estimate some values for speed, accelerations and forces for everyday road transport.

What is the symbol for an approximate answer or approximate value?

## Newton's Third Law

Copy and complete this sentence: Whenever two objects interact, the forces they exert on each other are \_\_\_\_\_ and \_\_\_\_\_.

## Stopping Distance

What is meant by the stopping distance of a vehicle?

What is meant by thinking distance?

What is meant by the braking distance?

Complete the following sentence.

For a given braking force the greater the \_\_\_\_\_ of the vehicle, the greater the \_\_\_\_\_ distance.

Sketch a graph of velocity against time for a stopping car. Include regions of thinking distance and braking distance.

## Reaction Time

State some typical values of a person's reaction time.

How can a driver's reaction time be affected?

## Factors Affecting Braking Distance 1 and 2

Copy and Complete the following paragraph - there is quite a bit of writing here.

The braking distance of a vehicle can be affected by \_\_\_\_\_ road and weather conditions and poor condition of the vehicle. Adverse road conditions include \_\_\_\_\_ or \_\_\_\_\_ conditions. Poor condition of the vehicle is limited to the vehicle's brakes or tyres.

When a force is applied to the brakes of a vehicle, \_\_\_\_\_  
\_\_\_\_\_ by the friction force between the brakes and the wheel reduces the \_\_\_\_\_ of the vehicle and the temperature of the brakes increases. The greater the speed of a vehicle the greater the \_\_\_\_\_ needed to

stop the vehicle in a certain distance. The greater the braking force the greater the \_\_\_\_\_n of the vehicle. Large decelerations may lead to brakes \_\_\_\_\_ and/or loss of \_\_\_\_\_l.

## Momentum

Learn this equation to calculate the momentum of a moving object.

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$p = m v$$

What are units of mass?

What are the units of velocity?

What are the units of momentum?

Finish the sentence: In a closed system..... (page 58 of specification)

What is meant by the conservation of momentum?

Can you perform calculations involving collisions and explosions?

## Changes in Momentum - Physics Only

1. In terms of momentum what happens when a force acts on an object?
2. Study this snippet of information.

The equations  $F = m \times a$  and  $a = \frac{v-u}{t}$

combine to give the equation  $F = \frac{m \Delta v}{\Delta t}$

where  $m\Delta v =$  change in momentum

ie force equals the rate of change of momentum.

3. Can you combine the two equations in the first line to get the equation in the second line?
4. What are the units for change in momentum?
5. Explain in terms of the rate of change of momentum the following safety features. How do these reduce impact forces?
  - a. Airbags
  - b. Seat belts
  - c. Cycle helmets and cushioned surfaces.
  - d. Gymnasium crash mats
6. Can you apply equations relating to force, mass, velocity and acceleration to explain how the changes involved are interrelated?

