Excel in Key Subjects

AQA Physics assessment

Paper 2

Topic 5 – Forces

Name:……..

Class:……...

Time allowed: 50 minutes

Total marks: 50

Marks obtained:……

Grade:……

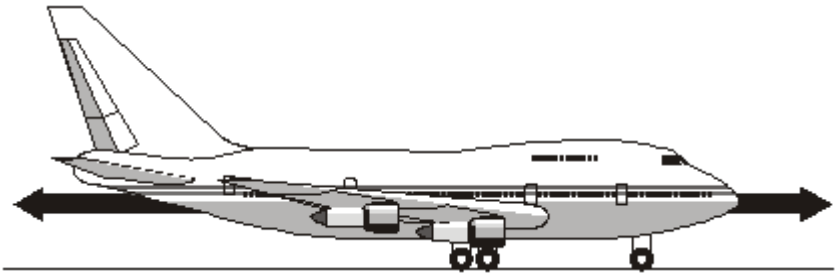
Marked by:……

Data/formulae sheet

1	**pressure due to a column of liquid = height of column × density of liquid × gravitational field strength (g)**	$p = h \rho g$
2	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2 a s$
3	**force = change in momentum / time taken**	$F = \frac{m \Delta v}{\Delta t}$
4	elastic potential energy = 0.5 × spring constant × (extension)^2	$E_e = \frac{1}{2} k e^2$
5	change in thermal energy = mass × specific heat capacity × temperature change	$\Delta E = m c \Delta \theta$
6	period = 1 / frequency	
7	magnification = image height / object height	
8	**force on a conductor (at right angles to a magnetic field) carrying a current = magnetic flux density × current × length**	$F = B I l$
9	thermal energy for a change of state = mass × specific latent heat	$E = m L$
10	**potential difference across primary coil / potential difference across secondary coil = number of turns in primary coil / number of turns in secondary coil**	$\frac{V_p}{V_s} = \frac{n_p}{n_s}$
11	potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_p I_p = V_s I_s$
12	For gases: pressure × volume = constant	$p V = constant$

Q3.

(a) The diagram shows an aircraft and the horizontal forces acting on it as it moves along a runway. The *resultant force* on the aircraft is zero.



(i) What is meant by the term *resultant force*?

_____

_____

(1)

(ii) Describe the movement of the aircraft when the resultant force is zero.

_____

_____

(1)

(b) The aircraft has a take-off mass of 320 000 kg. Each of the 4 engines can produce a maximum force of 240 kN.

Calculate the maximum acceleration of the aircraft.

Show clearly how you work out your answer and give the unit.

_____

_____

_____

Acceleration = _____

(3)

(c) As the aircraft moves along the runway to take off, its acceleration decreases even though the force from the engines is constant.

Explain why.

_____

_____

_____

_____

(2)

(Total 7 marks)

Q4.

(a) In any collision, the total momentum of the colliding objects is usually conserved.

(i) What is meant by the term 'momentum is conserved'?

_____

_____

(1)

(ii) In a collision, momentum is **not** always conserved.

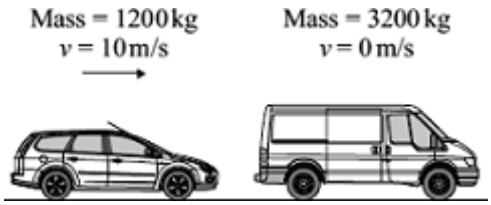
Why?

_____

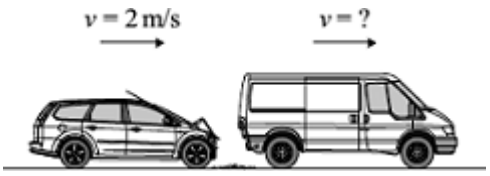
_____

(1)

(b) The diagram shows a car and a van, just before and just after the car collided with the van.



Before collision



After collision

(i) Use the information in the diagram to calculate the **change** in the momentum of the car.

Show clearly how you work out your answer and give the unit.

_____

_____

_____

_____

Change in momentum = _____

(3)

(ii) Use the idea of conservation of momentum to calculate the velocity of the van when it is pushed forward by the collision.

Show clearly how you work out your answer.

_____

_____

_____

Velocity = _____ m/s forward

(2)

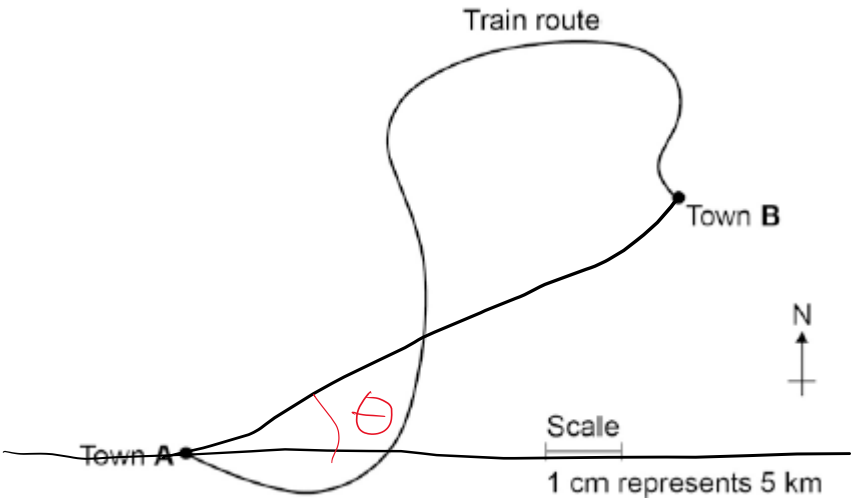
(Total 7 marks)

Q5.

A train travels from town **A** to town **B**.

Figure 1 shows the route taken by the train.
Figure 1 has been drawn to scale.

Figure 1



(a) The distance the train travels between **A** and **B** is not the same as the displacement of the train.

What is the difference between distance and displacement?

_____

_____

_____

(1)

(b) Use **Figure 1** to determine the displacement of the train in travelling from **A** to **B**.

Show how you obtain your answer.

_____

_____

Displacement = _____ km

Direction = _____

(2)

(c) There are places on the journey where the train accelerates without changing speed.

Explain how this can happen.

_____

_____

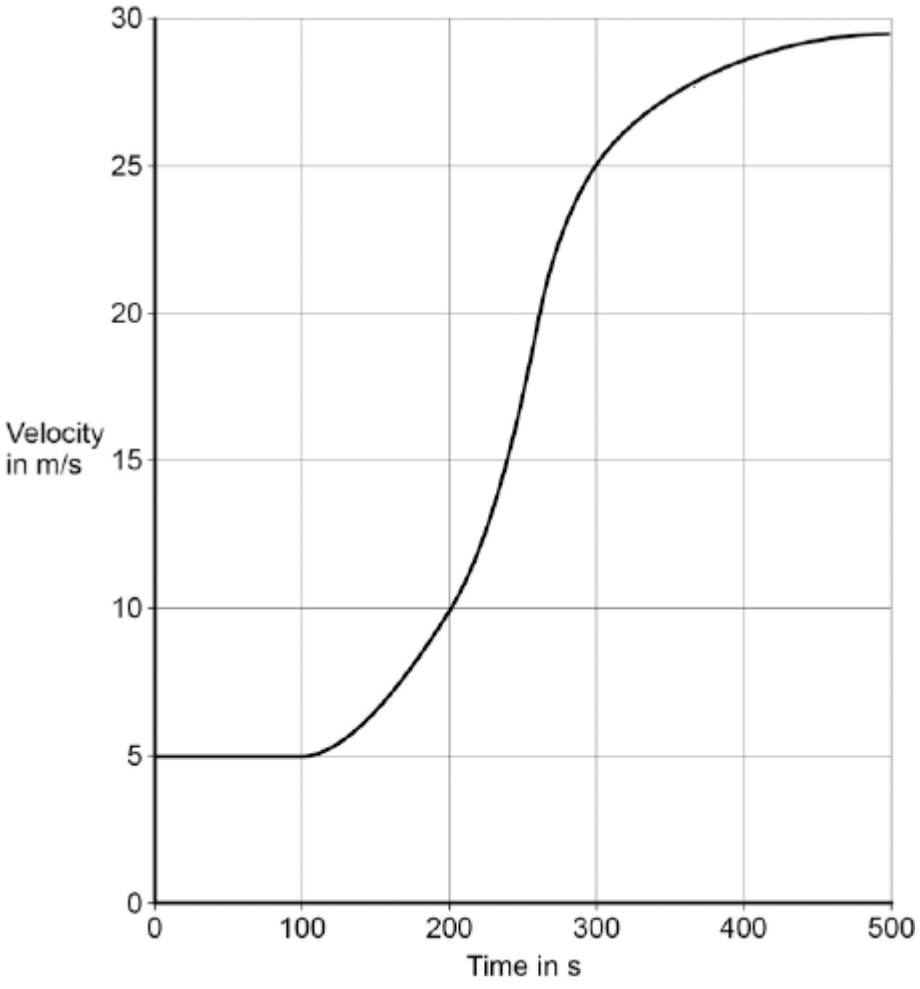
_____

_____

(2)

(d) **Figure 2** shows how the velocity of the train changes with time as the train travels along a straight section of the journey.

Figure 2



Estimate the distance travelled by the train along the section of the journey shown in **Figure 2**.

To gain full marks you must show how you worked out your answer.

_____

_____

_____

_____

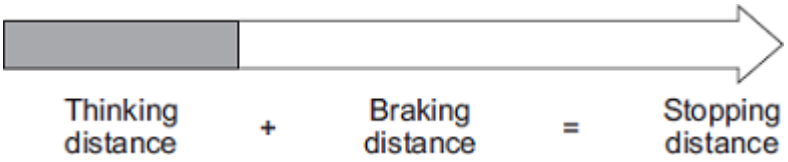
Distance = _____ m

(3)

(Total 8 marks)

Q6.

The diagram shows how the thinking distance and braking distance of a car add together to give the stopping distance of the car.



(a) Use words from the box to complete the sentence.

distance	**energy**	**force**	**time**

The stopping distance is found by adding the distance the car travels during the driver's reaction _____ and the distance the car travels under the braking _____ .

(2)

(b) Which **one** of the following would **not** increase the thinking distance?

Tick (✓) **one** box.

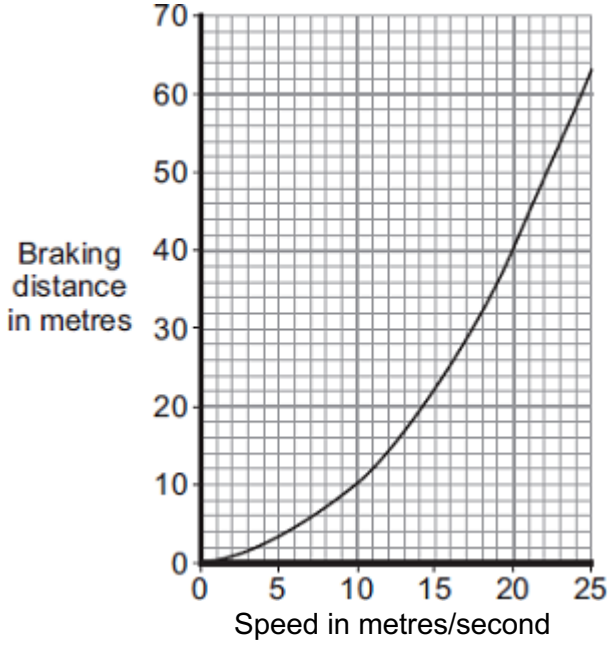
The car driver being tired. ☐

The car tyres being badly worn. ☐

The car being driven faster. ☐

(1)

(c) The graph shows how the braking distance of a car changes with the speed of the car.
The force applied to the car brakes does not change.



(i) What conclusion about braking distance can be made from the graph?

_____

_____

_____

_____

(2)

(ii) The graph is for a car driven on a dry road.

Draw a line on the graph to show what is likely to happen to the braking distance at different speeds if the same car was driven on an icy road.

(1)

(d) A local council has reduced the speed limit from 30 miles per hour to 20 miles per hour on a few roads. The reason for reducing the speed limit was to reduce the number of accidents.

(i) A local newspaper reported that a councillor said:

"It will be much safer because drivers can react much faster when driving at 20 miles per hour than when driving at 30 miles per hour."

This statement is wrong. Why?

_____

_____

(1)

(ii) The local council must decide whether to introduce the lower speed limit on a lot more roads.

What evidence should the local council collect to help make this decision?

_____

_____

_____

_____

(2)

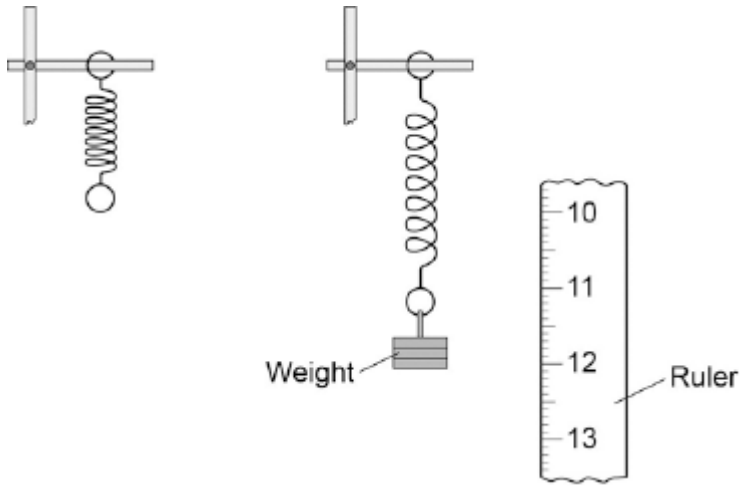
(Total 9 marks)

Q7.

A student suspended a spring from a laboratory stand and then hung a weight from the spring.

Figure 1 shows the spring before and after the weight is added.

Figure 1



(a) Measure the extension of the spring shown in **Figure 1**.

Extension = _____ mm

(1)

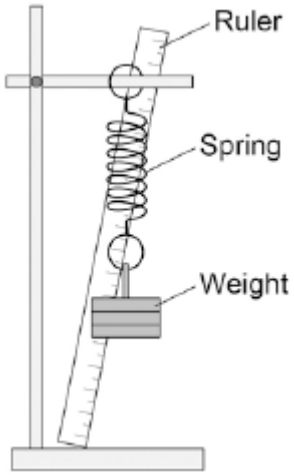
(b) The student used the spring, a set of weights and a ruler to investigate how the extension of the spring depended on the weight hanging from the spring.

Before starting the investigation the student wrote the following prediction:

The extension of the spring will be directly proportional to the weight hanging from the spring.

Figure 2 shows how the student arranged the apparatus.

Figure 2



Before taking any measurements, the student adjusted the ruler to make it vertical.

Explain why adjusting the ruler was important.

_____

_____

_____

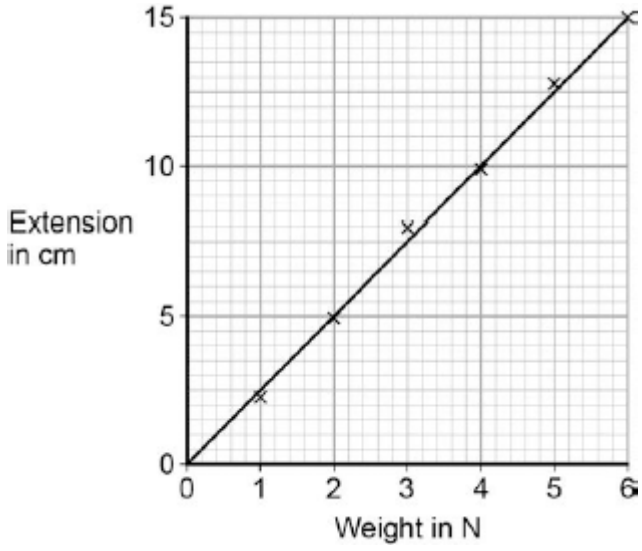
_____

(2)

(c) The student measured the extension of the spring using a range of weights.

The student's data is shown plotted as a graph in **Figure 3**.

Figure 3



What range of weight did the student use?

_____

(1)

(d) Why does the data plotted in **Figure 3** support the student's prediction?

_____

_____

(1)

(e) Describe **one** technique that you could have used to improve the accuracy of the measurements taken by the student.

_____

_____

_____

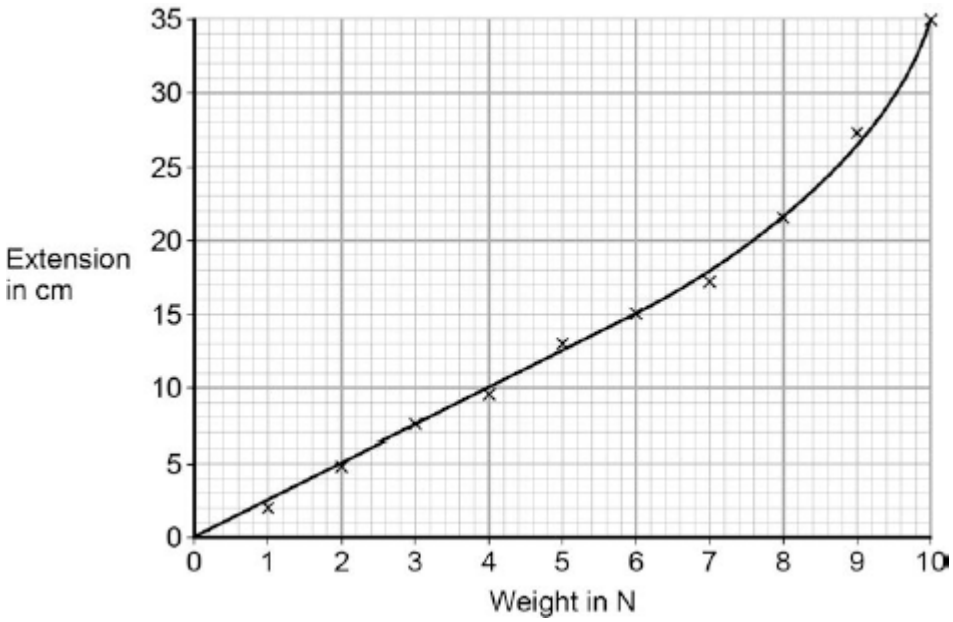
_____

(2)

(f) The student continued the investigation by increasing the range of weights added to the spring.

All of the data is shown plotted as a graph in **Figure 4**.

Figure 4



At the end of the investigation, all of the weights were removed from the spring.

What can you conclude from **Figure 4** about the deformation of the spring?

_____

_____

Give the reason for your conclusion.

_____

(2)
(Total 9 marks)

End of the test