PEARSON EDEXCEL IGCSE PHYSICS · 4PH1

PHYSICS



EXAM QUESTION PACK

SECTION 1: FORCES AND MOTION (PACK 3)

SCORE	PERCENTAGE
/138	%

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Q1.

This question is about scalar quantities and vector quantities.

(a) Give a similarity and a difference for scalar quantities and vector quantities.

(2)

similarity

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difference

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(b) The box gives some physical quantities.

Draw a circle around each physical quantity that is a scalar.

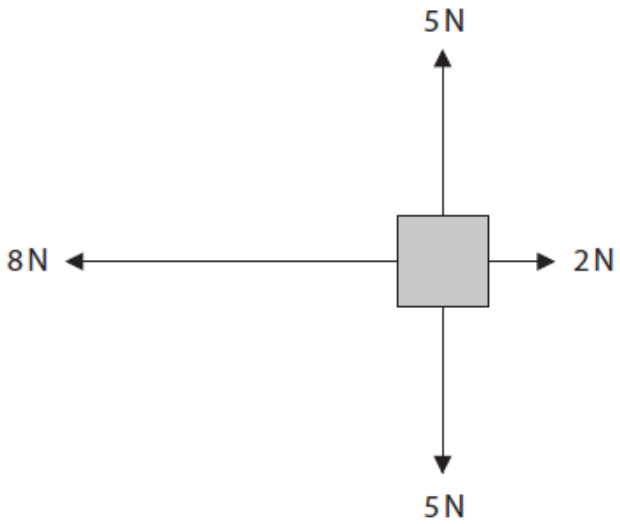
(3)

acceleration	charge	force	power
temperature	velocity	weight	

(c) The diagram shows four forces acting on an object.

Calculate the size and direction of the resultant force.

(2)



resultant force = ... N

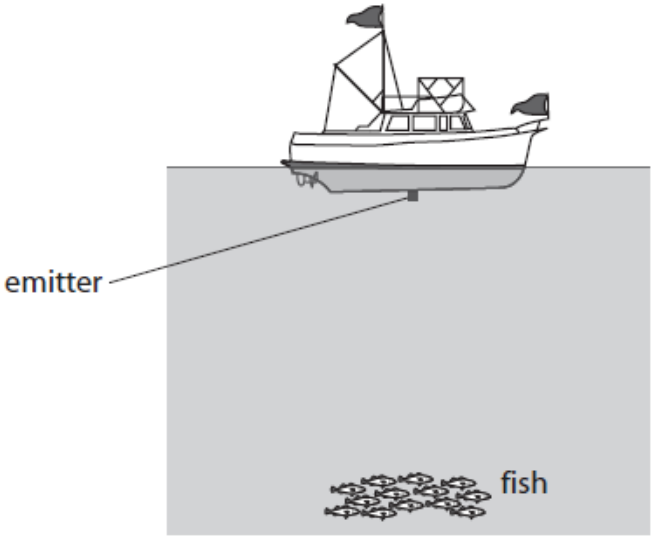
direction = ...

(Total for question = 7 marks)

Q2.

(a) The diagram shows a fishing boat fitted with a high frequency sound wave emitter.

The boat is above some fish.



The high frequency sound waves travel from the emitter to the fish and then back to the emitter, where they are detected.

(i) Name the wave behaviour that causes the sound waves to change direction when they reach the fish.

(1)

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(ii) The table gives some data about the sound waves used.

frequency of sound waves	4.0 MHz
speed of sound waves in water	1500 m/s
time between emission and detection of sound waves	43 ms

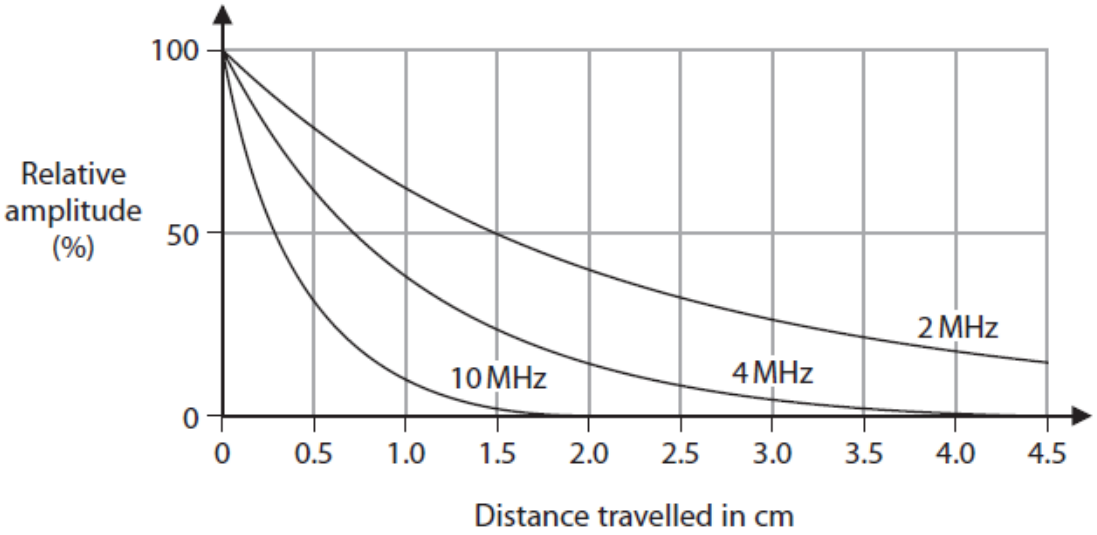
Calculate the distance between the sound wave emitter and the fish.

(4)

distance = ... m

(b) High frequency sound waves decrease in amplitude as they travel through soft tissue in the human body.

The graph shows this decrease in amplitude for three different high frequency sound waves.



(i) Estimate the distance travelled by a 2 MHz wave when its amplitude is 25% of its original value.

(1)

distance = ... cm

(ii) Describe what the graph shows about the penetrating ability of high frequency sound waves as they travel through soft tissue.

(3)

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(Total for question = 9 marks)

Q3.

When a meteor explodes, light waves and sound waves are produced at the same time.

(a) (i) State the formula linking average speed, distance moved and time taken.

(1)

(ii) A person standing 1860 m away from the site of a meteor explosion hears the sound of the explosion 5.6 s later.

Calculate the speed of sound in air.

(2)

speed of sound = ... m/s

(iii) A scientist stands a long way from the meteor explosion.

Explain why he hears the explosion at a different time to when he sees it.

(2)

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(b) Sound is a longitudinal wave.

Describe what is meant by the term **longitudinal wave**.

(2)

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(c) In 2013, a meteor exploded above Russia.

Just before the meteor exploded, it was travelling at a speed of 19.2 km/s.

The mass of the meteor was estimated to be 1.25×10^7 kg.

(i) State the formula linking kinetic energy, mass and speed.

(1)

(ii) Calculate the energy in the kinetic store of the meteor just before the meteor exploded.

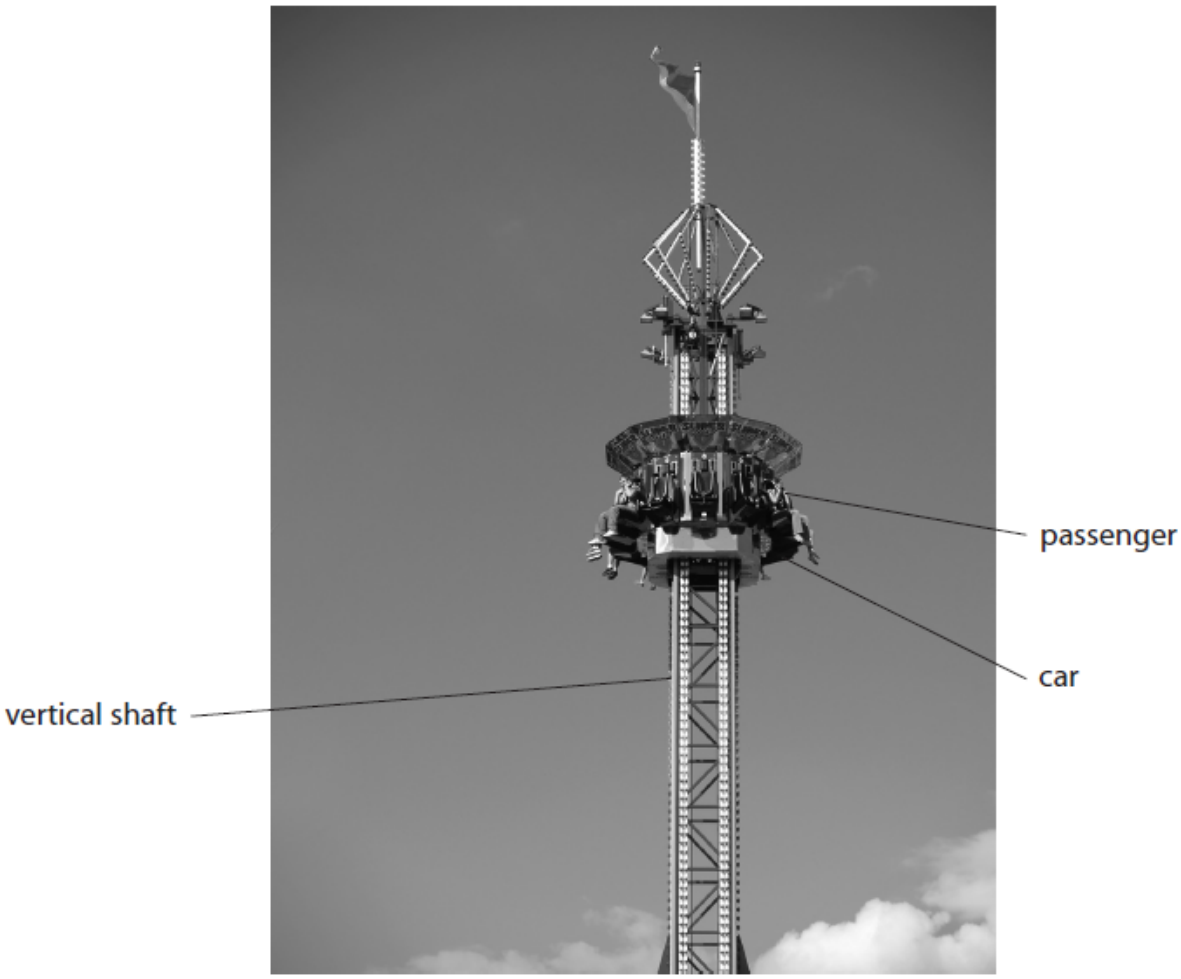
(2)

energy in kinetic store = ... J

(Total for question = 10 marks)

Q4.

The photograph shows a vertical drop ride at an amusement park.



(Source: Kenneth Sponsler/Shutterstock)

The car is pulled to the top of a vertical shaft and then released from rest.

The car then falls freely because of the force of gravity.

(a) Calculate the speed of the car when it has fallen 18 m.

(3)

speed = ... m / s

(b) (i) State the formula linking kinetic energy, mass and speed.

(1)

(ii) The mass of the car and its passengers is 2.1 tonnes.

Calculate the kinetic energy of the car when it has fallen 18 m.

[1 tonne = 1000 kg]

(2)

kinetic energy = ... J

(c) The actual speed of the car when it has fallen 18 m is lower than the value calculated in (a).

Describe the energy transfers occurring from immediately before the car was released to when the car has fallen 18 m.

Refer to stores and transfers in your answer.

(4)

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(Total for question = 10 marks)

Q5.

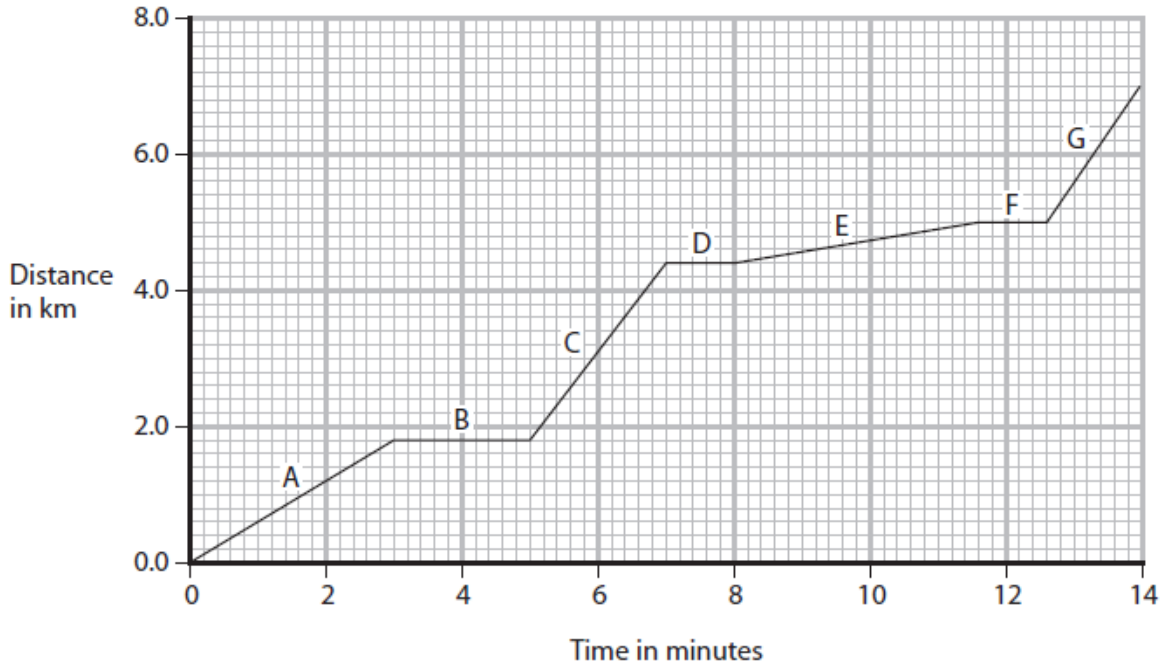
A bus transports passengers.



© Mikbiz/Shutterstock

(a) The bus stops at certain points in its journey to let passengers get on or off the bus.

The distance-time graph shows part of the bus journey, with sections labelled A to G.



(i) Give the letters of the sections where the bus is stationary.

(1)

.....

(ii) Calculate the speed of the bus during section C of the journey.

Give your answer in m / s.

(4)

speed = ... m / s

(iii) Explain what the graph shows about the speed of the bus in section E compared with the speed of the bus in section A.

(2)

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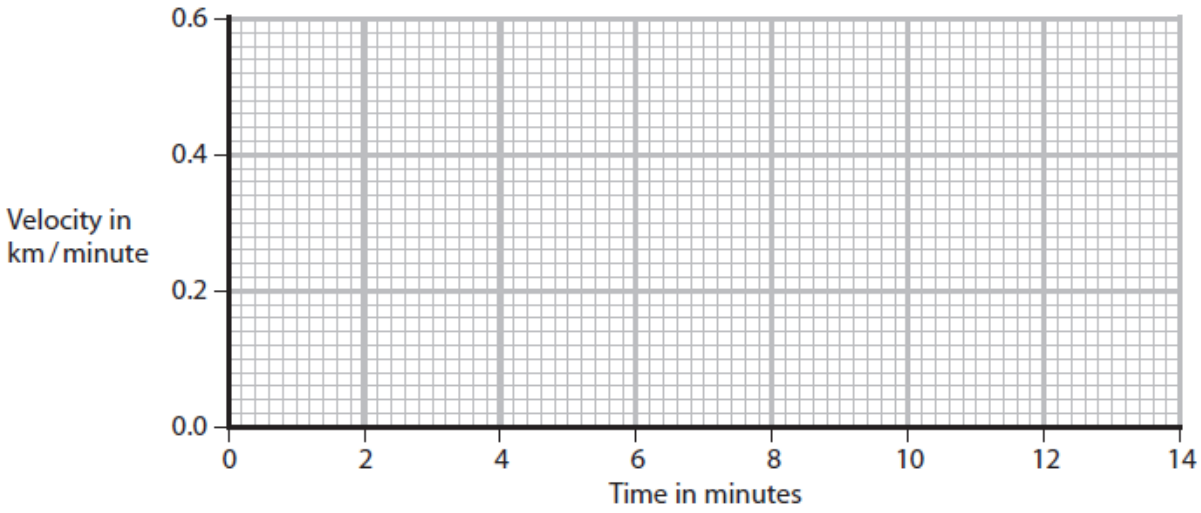
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(b) Another bus travels a distance of 7.0 km in a time of 14 minutes.

This bus travels at a constant velocity.

Complete the velocity-time graph to show the motion of this bus.

(2)



(Total for question = 9 marks)

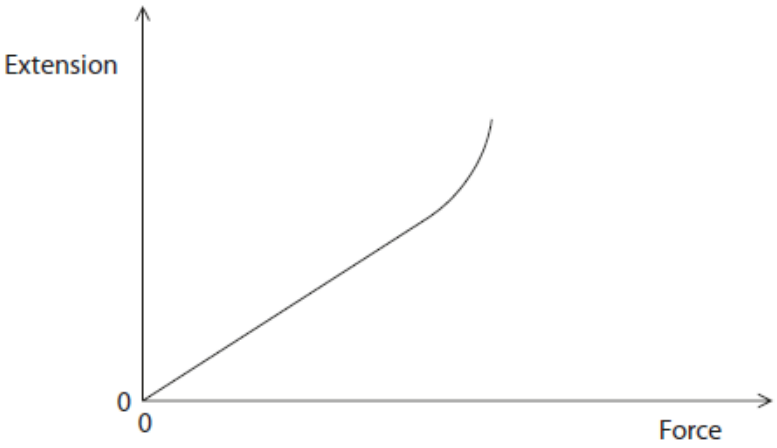
Q6.

This question is about stretching a spring.

(a) The graph shows how the extension of a spring varies when a force is applied to the spring.

The line on the graph shows that the spring has been extended past its elastic limit.

The line has a straight section and a curved section.



(i) Draw a cross on the line to show the elastic limit of the spring.

(1)

(ii) Sketch another line to show how the extension will change when the force is decreased from its maximum value back to 0.

(2)

(b) (i) State which energy store of the spring increases when it is stretched. Assume the spring does not reach its elastic limit.

(1)

.....

(ii) How is this energy transferred to the spring?

(1)

☒ **A** electrically

☒ **B** by heating

☒ **C** mechanically

☒ **D** by radiation

(Total for question = 5 marks)

Q7.

A student uses this apparatus, and a stopwatch, to investigate the motion of a ball rolling down a ramp.

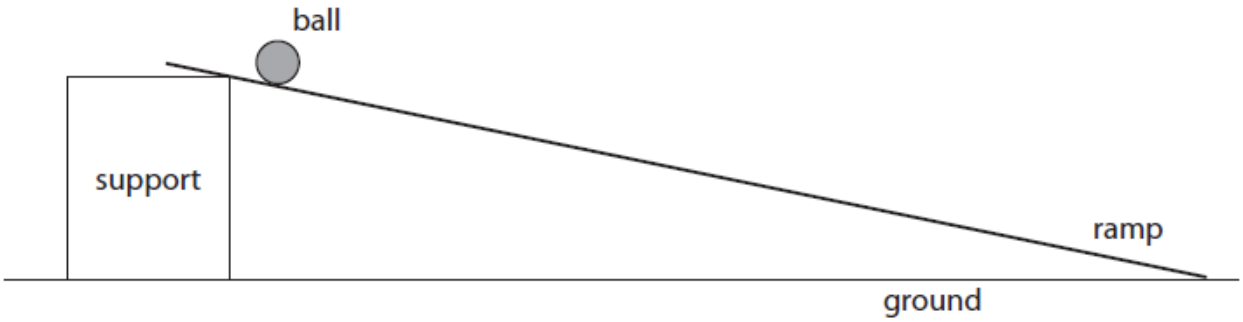


Diagram 1

Diagram 2 shows a section of the ramp when viewed from above.

The ramp has markings every 20 cm along its length.

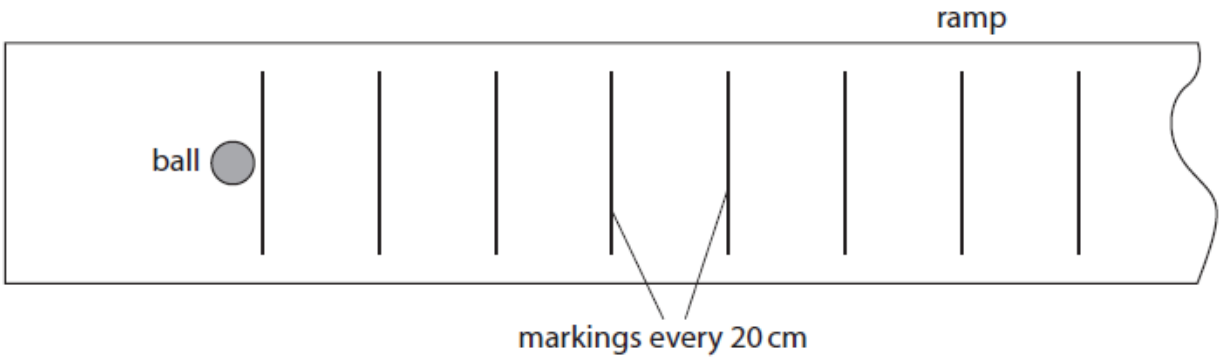


Diagram 2

(a) Describe how the student could use this apparatus, and a stopwatch, to determine the acceleration of the ball down the ramp.

In your answer describe

- the measurements required
- the graph that should be plotted
- how to use the graph to determine the acceleration

(5)

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(b) Suggest why this investigation may not give an accurate value for the acceleration of the ball.

(1)

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(Total for question = 6 marks)

Q8.

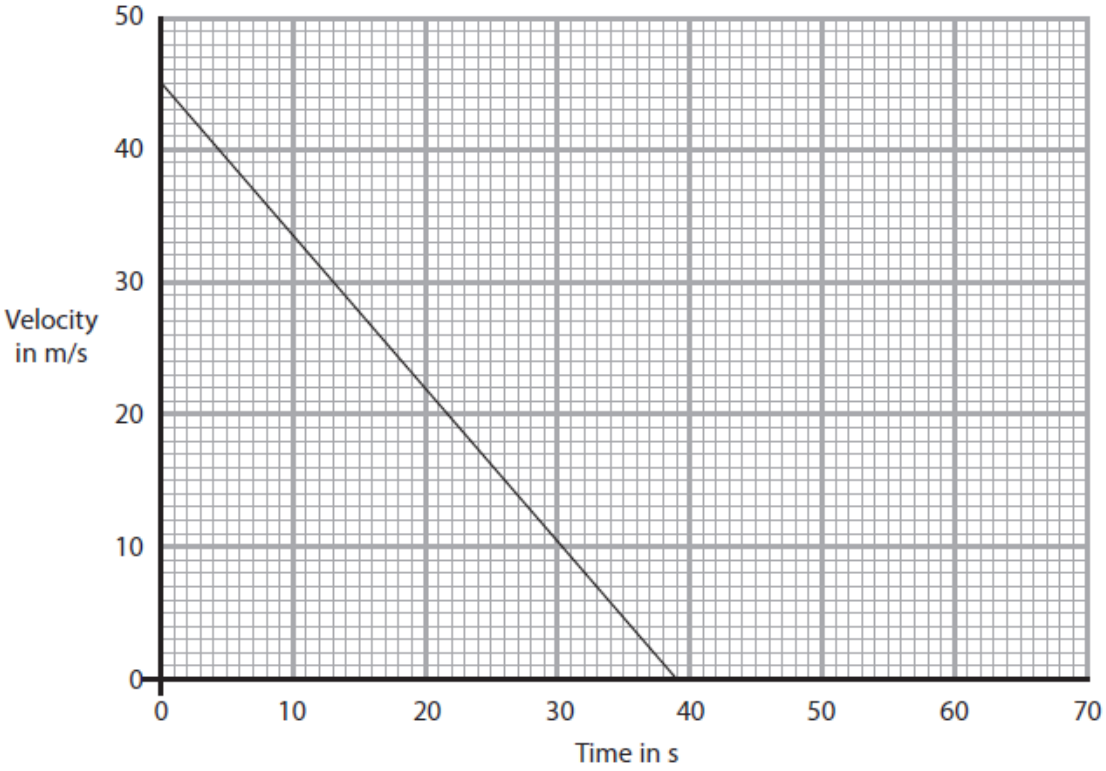
This question is about the movement of a train.

The diagram shows the train on a track.

The train starts braking at point P and stops moving at point Q.



The graph shows how the train's velocity changes with time as the train travels from P to Q.



(a) Calculate the acceleration of the train.

(3)

acceleration = ... m/s^2

(b) Calculate the distance travelled by the train from P to Q.

(3)

distance = ... m

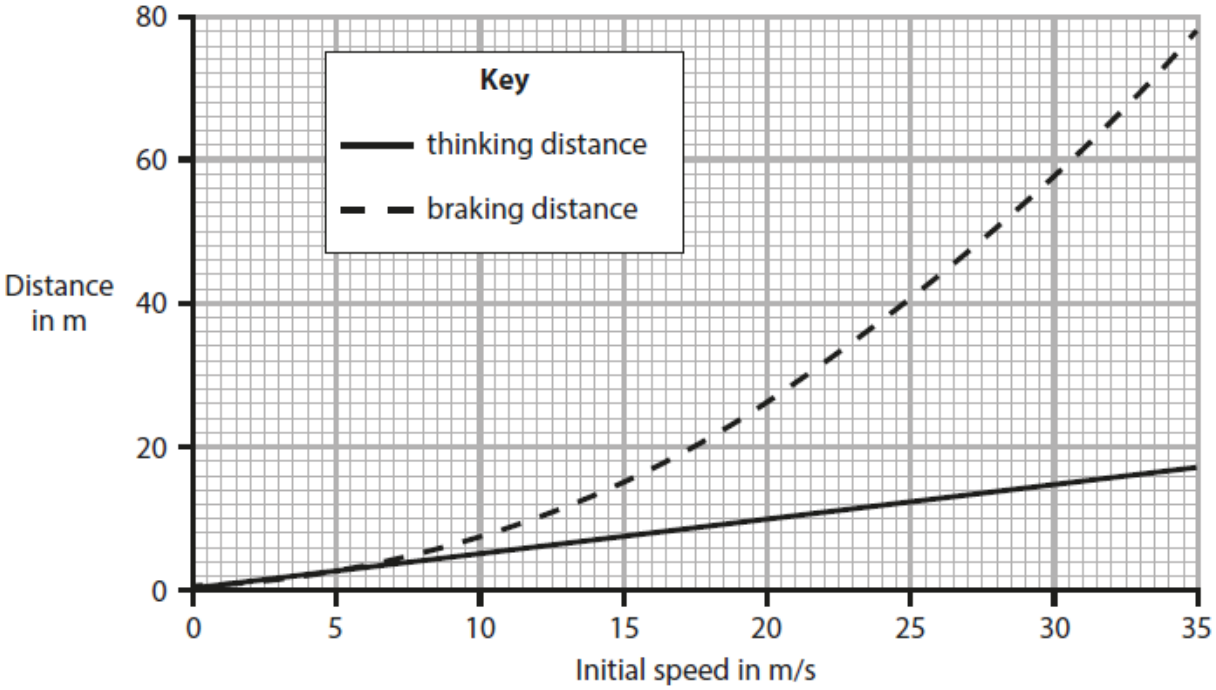
(c) Draw a line on the graph to show how the train's velocity will change if its initial velocity is the same but the braking force is lower.

(2)

(Total for question = 8 marks)

Q9.

The graph shows how the thinking distance and braking distance of a car vary with its initial speed.



(a) A car has an initial speed of 35 m/s.

The brakes are applied and the car comes to a complete stop in the braking distance shown by the graph.

Calculate the mean braking acceleration of the car.

(4)

braking acceleration = ... m/s^2

(b) Evaluate how the thinking distance and the braking distance vary for different values of initial speed.

Refer to information from the graph in your answer.

(5)

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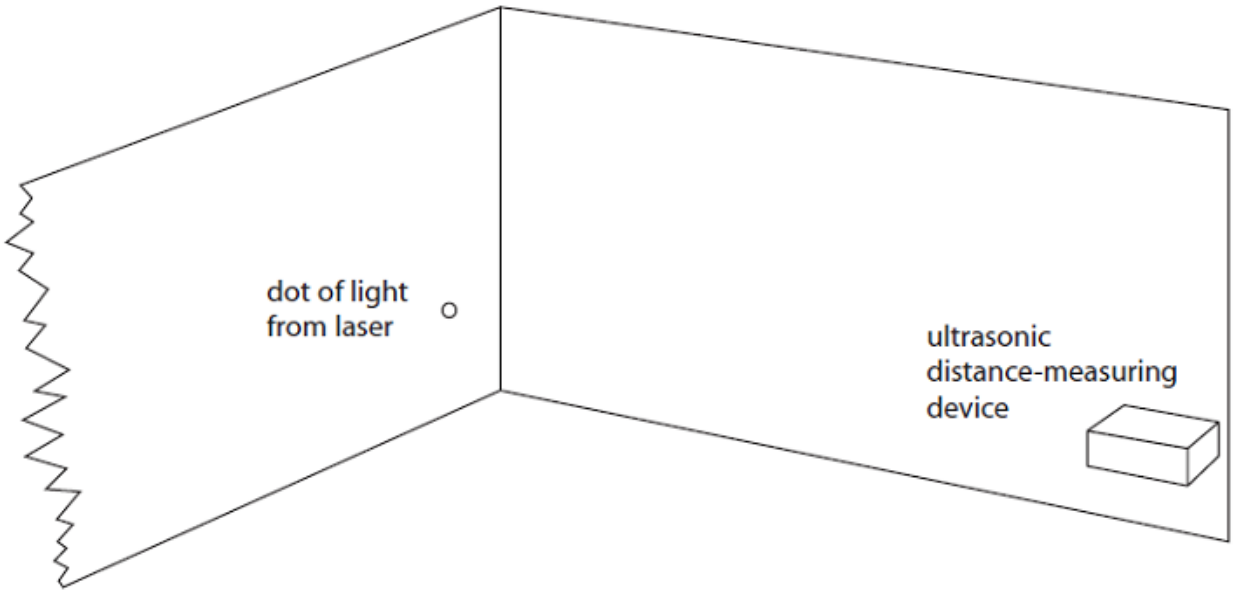
(Total for question = 9 marks)

Q10.

An ultrasonic distance-measuring device can be used to measure the length of a room.

The device emits a pulse of sound with a frequency of 40 kHz.

The device also emits a bright beam of red visible light.



(a) Explain what is meant by a frequency of 40 kHz.

(2)

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(b) A sound wave from the device travels at 345 m / s.

(i) State the formula linking wave speed, frequency and wavelength.

(1)

(ii) Calculate the wavelength of the sound wave.

(3)

wavelength = ... m

(iii) The device emits a sound wave.

The sound wave travels to the wall, reflects back to the device and is received by the device.

The distance from the device to the wall is 2.35 m.

Calculate the time between the sound wave being emitted and received by the device.

(4)

time = ... s

(c) Suggest why the device emits visible light.

(1)

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(d) Sound waves and light waves can have different frequencies and wavelengths.

Describe three other differences between sound waves and light waves.

You may draw diagrams to support your answer.

(3)

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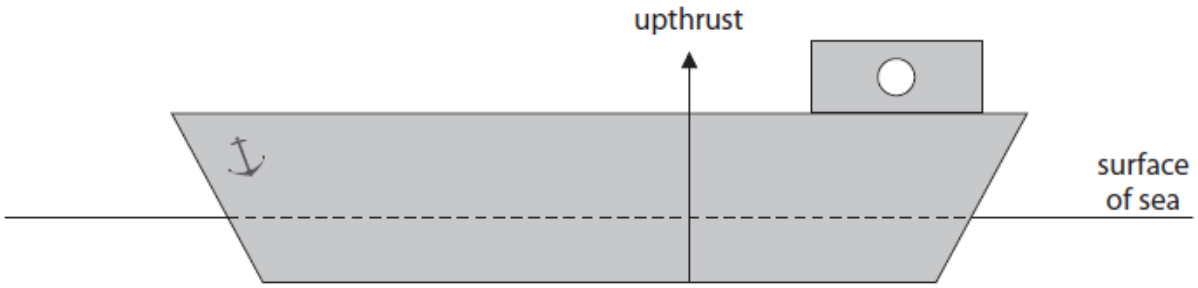
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(Total for question = 14 marks)

Q11.

A ship floats on the sea.



(a) The ship floats because of the forces acting on it.

(i) The upward force acting on the ship is called upthrust.

This force is shown on the diagram.

Draw another labelled arrow on the diagram to show the other vertical force acting on the ship.

(2)

(ii) Forces are vector quantities.

State what is meant by the term **vector quantity**.

(2)

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(iii) Give another example of a vector quantity.

(1)

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(b) The upthrust force acting on the ship is proportional to the pressure difference between the bottom of the ship and the surface of the sea.

The pressure acting on the ship at the surface of the sea is 100 kPa.

(i) State the formula linking pressure difference, height, density and gravitational field strength (g).

(1)

(ii) The bottom of the ship is 15.8 m below the surface of the sea.

Show that the pressure acting on the bottom of the ship is approximately 260 kPa.

[density of seawater = 1030 kg/m^3]

(3)

(iii) Explain why the bottom of the ship is deeper below the surface of the sea when the ship is fully loaded with cargo.

(2)

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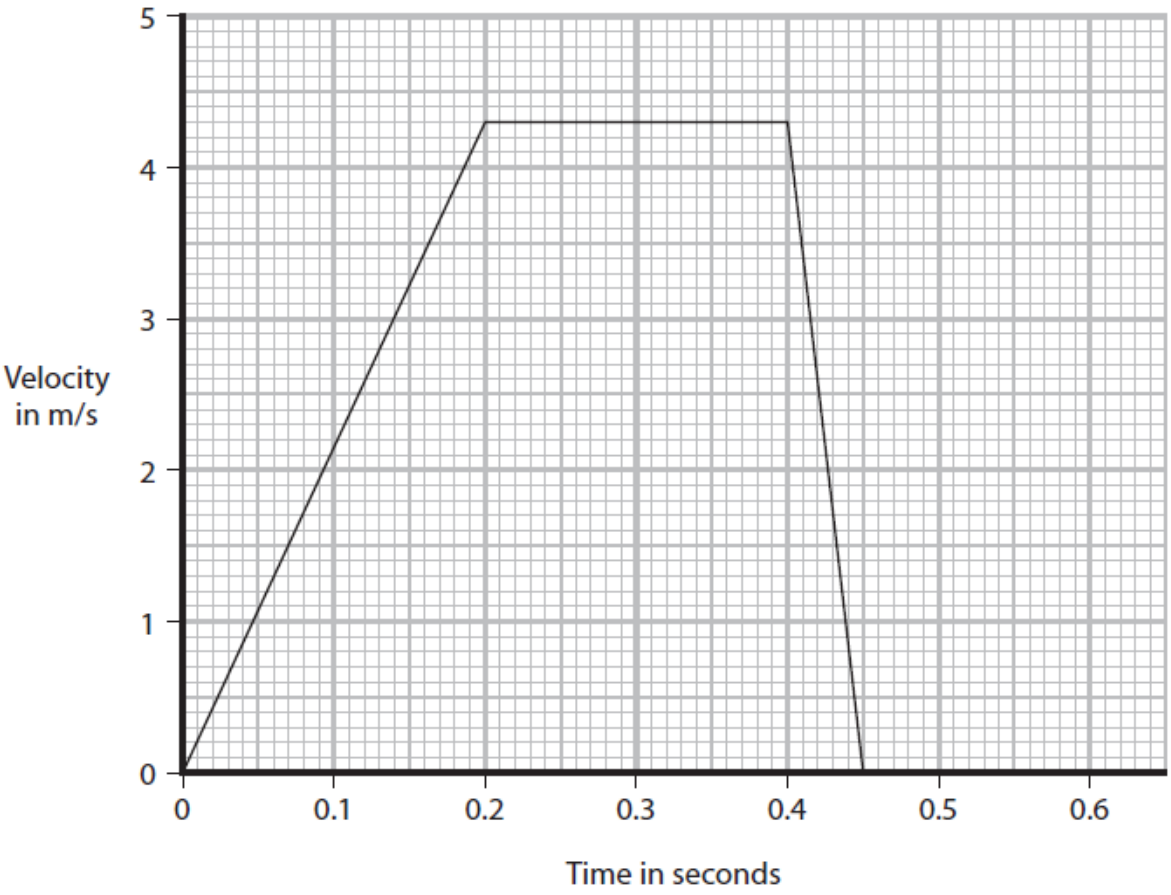
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(Total for question = 11 marks)

Q12.

A student does an investigation to show how the velocity of a toy car changes when the car rolls down a ramp onto a table and hits a wooden block.

The graph shows how the velocity of the toy car changes with time.



(a) Calculate the distance travelled by the car during the first 0.4 seconds.

(4)

distance = ... m

(b) (i) Calculate the acceleration of the car between 0.40 s and 0.45 s.

(3)

acceleration = ... m/s^2

(ii) State the formula linking resultant force, mass and acceleration.

(1)

(iii) The car has a mass of 0.13 kg.

Calculate the resultant force on the car as it slows down.

(2)

resultant force = ... N

(c) A piece of soft material is fixed to the front of the toy car.

Explain how this will affect the gradient of the velocity-time graph after the car hits the block.

(3)

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(Total for question = 13 marks)

Q13.

A car is moving along a road.

(a) The car has an initial velocity of 26 m / s.

The car then accelerates at 1. 2 m / s^2 until it reaches a velocity of 35 m / s.

(i) State the formula linking acceleration, change in velocity and time taken.

(1)

(ii) Calculate the time taken for the car to accelerate to 35 m/s.

(3)

time = ... s

(b) A radar speed gun is used to measure the speed of the moving car.



© Petar An/Shutterstock

The radar speed gun emits radio waves towards the moving car.

The moving car reflects the radio waves back to a detector on the gun.

The detected radio waves have a different frequency from the emitted radio waves.

This change in frequency is used to measure the speed of the moving car.

Explain this change in frequency when the car is moving towards the radar speed gun.

(4)

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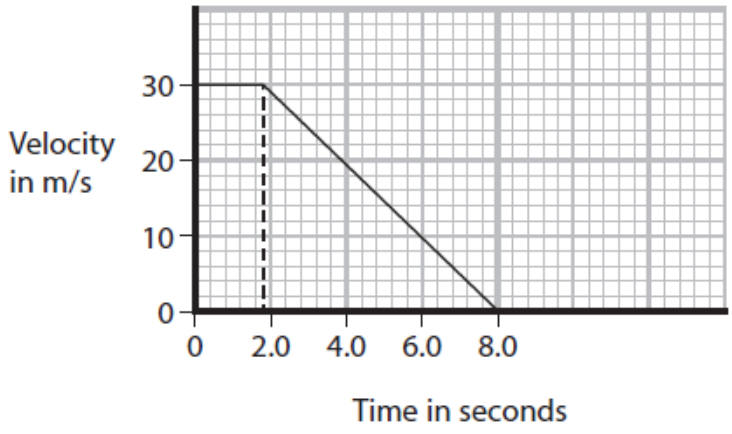
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(Total for question = 8 marks)

Q14.

The diagram shows a velocity-time graph for a car from the time the driver sees an obstacle in the road until the car comes to rest.



(a) (i) Calculate the acceleration of the car between 1.8 and 8.0 seconds.

(3)

acceleration = ... m/s^2

(ii) Calculate the braking distance of the car.

(3)

braking distance = ... m

(iii) Explain the effect, if any, of increased driver tiredness on the thinking distance and on the braking distance of
the car.

(4)

thinking distance

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braking distance

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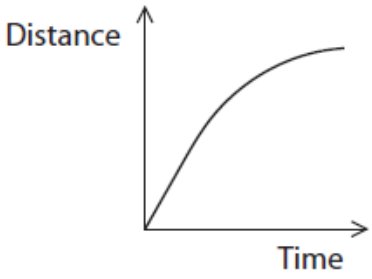
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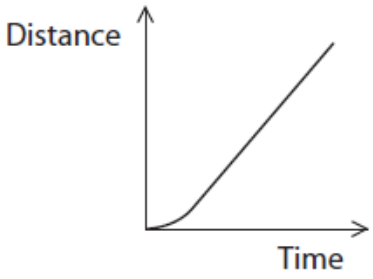
(b) Which of these represents the distance-time graph for the car?

(1)

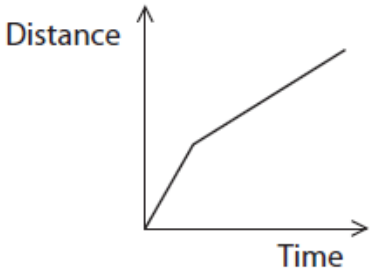
☒ **A**



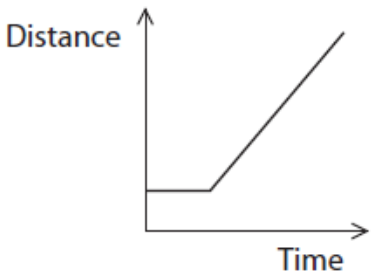
☒ **B**



☒ **C**



☒ **D**



(Total for question = 11 marks)

Q15.

The photograph shows a whale jumping out of the surface of the sea.



(Source: © Alexander Baumann/Shutterstock)

(a) At the top of the jump, the whale's velocity is 0 m/s.

The whale falls 2.2 m from the top of the jump to the surface of the sea.

Calculate the velocity of the whale when it hits the surface of the sea.

(4)

velocity = ... m/s

(b) A resultant force causes the whale to slow down when it hits the surface of the sea.

(i) Draw an arrow to show this resultant force.

(1)



(Source: © Eugenia Petrovskaya/Shutterstock)

(ii) The resultant force acting on the whale is 18 000 N.

The mass of the whale is 4100 kg.

Calculate the acceleration of the whale.

(3)

acceleration = ... m/s^2