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Surname ________

Other Names ________

Centre Number ________

Candidate Number ________

Candidate Signature ________

# GCSE
# COMBINED SCIENCE: TRILOGY

# H

**Higher Tier**
**Physics Paper 2H**

## 8464/P/2H

**Friday 15 June 2018 Morning**

**Time allowed: 1 hour 15 minutes**

**For this paper you must have:**
- a ruler
- a scientific calculator
- a protractor
- the Physics Equations Sheet (enclosed).

**At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.**

**[Turn over]**

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## INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Answer ALL questions in the spaces provided.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **In all calculations, show clearly how you work out your answer.**

## INFORMATION

- **The maximum mark for this paper is 70.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

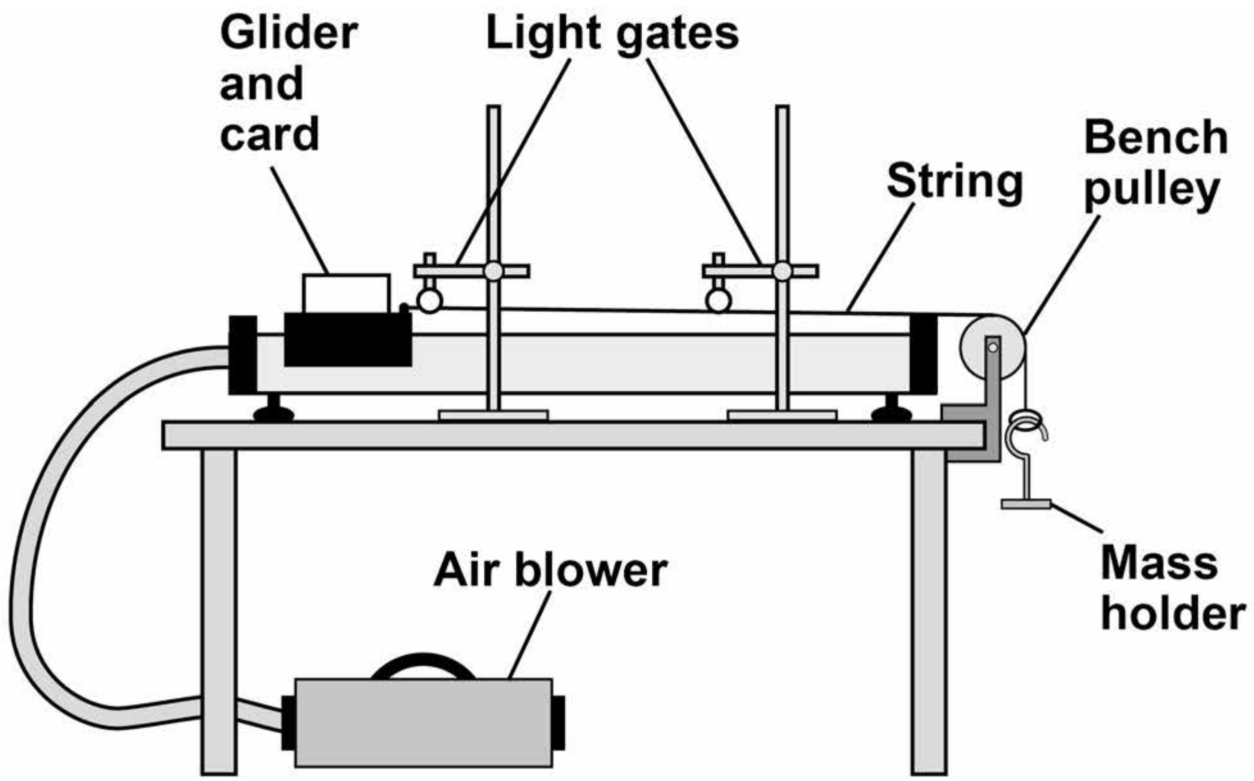
**DO NOT TURN OVER UNTIL TOLD TO DO SO**

**0 1** A student investigated acceleration using gliders, an air track and light gates.

The air track reduces friction between the glider and the track to zero.

FIGURE 1 shows the apparatus.

FIGURE 1




The glider was released from rest and moved along the track.

The mass holder hit the ground before the card passed through the second light gate.

**0 1 . 1** **Which TWO statements describe the effect this would have on the glider? [2 marks]**

**Tick TWO boxes.**

☐ **Its acceleration would decrease to zero.**

☐ **Its acceleration would increase.**

☐ **The resultant force on it would decrease to zero.**

☐ **The resultant force on it would increase.**

☐ **Its speed would increase.**

**0 1 . 2** **The mass holder should NOT hit the ground before the card passes through the second light gate.**

**Suggest ONE way that the student could stop this happening. [1 mark]**

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**[Turn over]**

The student increased the resultant force acting on the glider by adding more masses to the mass holder.

She calculated the acceleration of the glider for each resultant force.

Each test was done three times.

TABLE 1 shows the results.

TABLE 1

| Resultant force in N | Acceleration in $m/s^2$ | | | Mean acceleration in $m/s^2$ |
|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | |
| 0.20 | 1.3 | 1.2 | 1.3 | 1.26667 |
| 0.39 | 2.6 | 2.5 | 2.6 | 2.6 |
| 0.59 | 3.8 | 3.8 | 3.9 | 3.8 |
| 0.78 | 5.1 | 5.1 | 5.1 | 5.1 |
| 0.98 | 6.4 | 7.2 | 6.4 | 6.7 |

0 1 . 3 The student made TWO mistakes in the mean acceleration column.

Identify the mistakes the student made.

Suggest how each mistake can be corrected.
[4 marks]

Mistake ______________________________

______________________________

______________________________

Correction ______________________________

______________________________

______________________________

Mistake ______________________________

______________________________

______________________________

Correction ______________________________

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**0 1 . 4** **Write a conclusion for this investigation.**

**Use the data in TABLE 1. [1 mark]**

______________________________

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**0 1 . 5** The student used a constant resultant force to accelerate the glider.

The student changed the mass of the glider and calculated the new acceleration.

She repeated this for different masses of the glider, keeping the resultant force constant.

The results are shown in TABLE 2

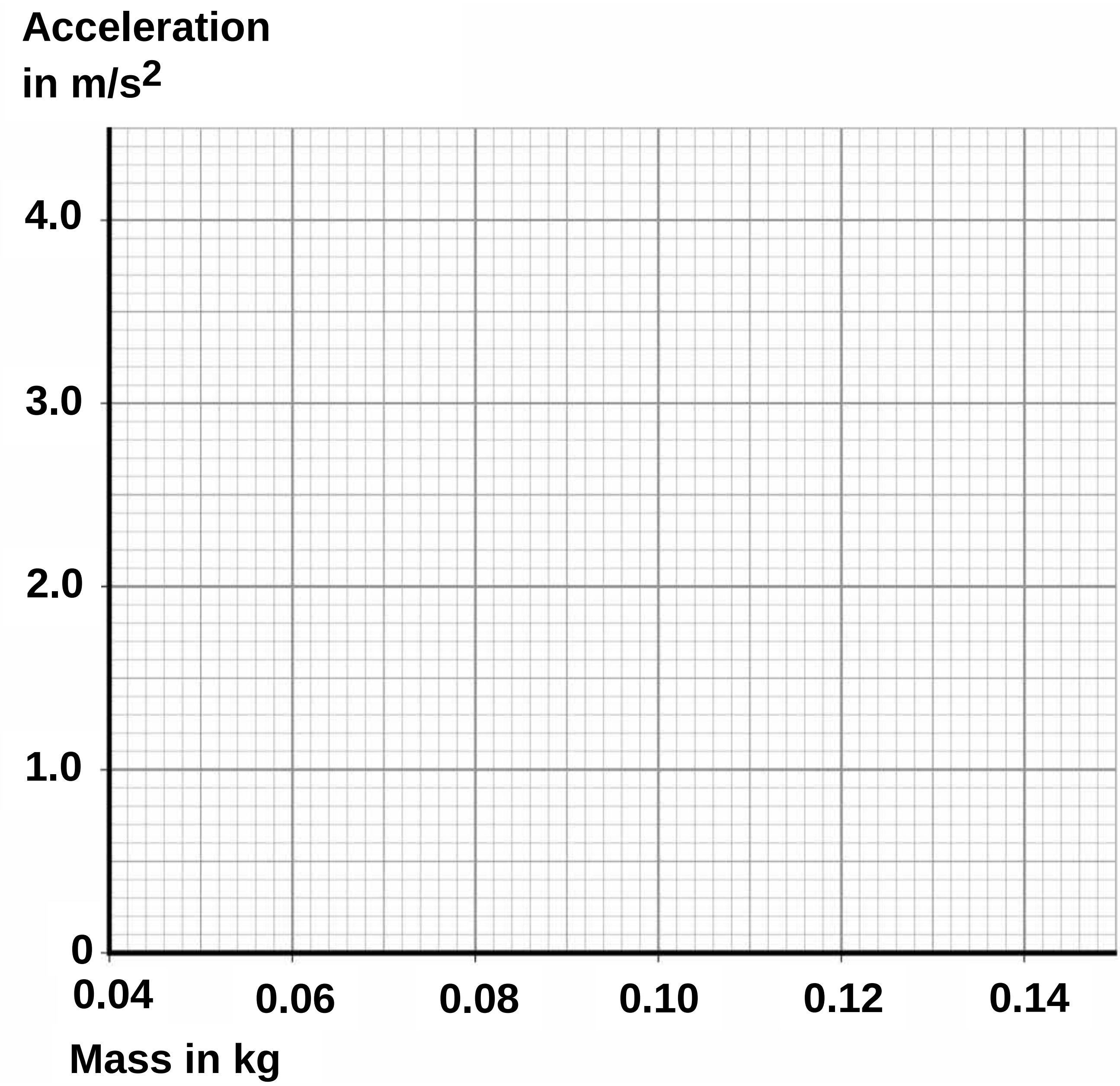
TABLE 2

| Mass of the glider in kg | Acceleration in $m/s^2$ |
|---|---|
| 0.060 | 3.5 |
| 0.080 | 2.6 |
| 0.10 | 2.0 |
| 0.12 | 1.7 |
| 0.14 | 1.4 |

Plot the results on FIGURE 2

Draw a line of best fit. [3 marks]

**FIGURE 2**




**0 1 . 6** **Describe the relationship between mass and acceleration. [1 mark]**

______________________________________________

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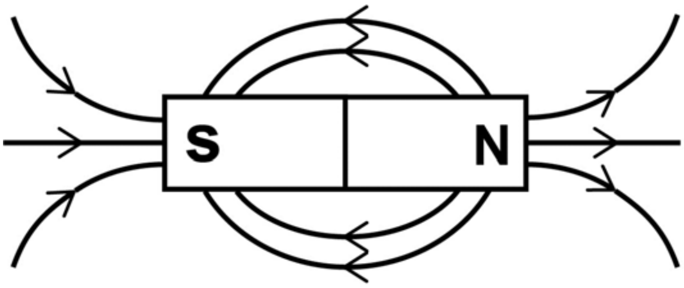
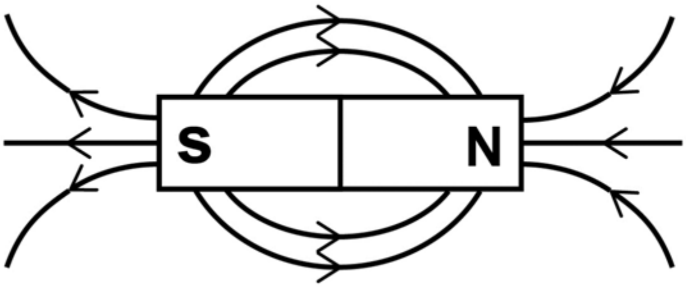
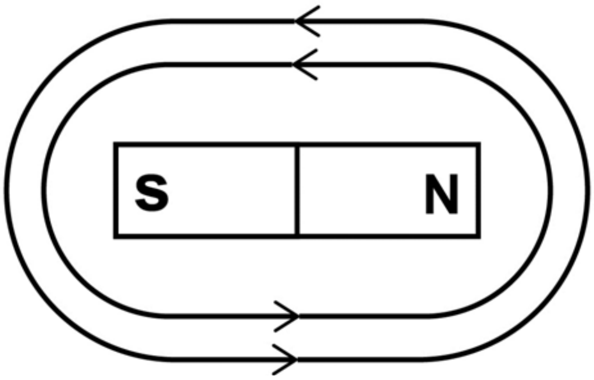
**0 2** A magnet produces a magnetic field.

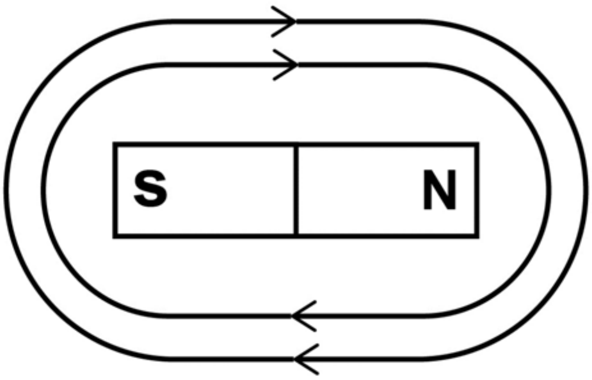
**0 2 . 1** Which diagram shows the magnetic field pattern around a bar magnet? [1 mark]

Tick ONE box.

☐ 


☐ 


☐ 


☐ 

**0 2 . 2** **FIGURE 3 shows three metal blocks.**

**The blocks are not labelled.**

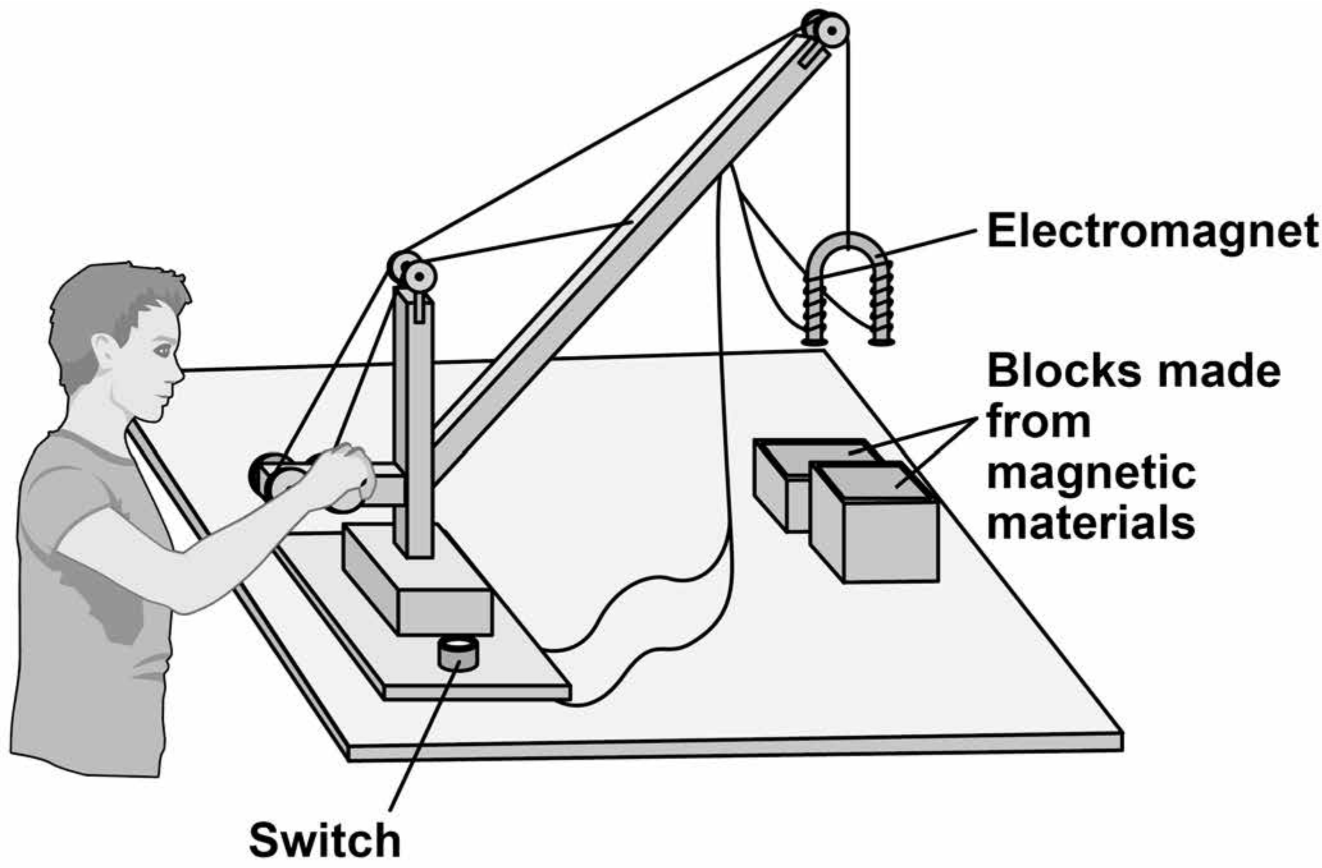
**One block is a permanent magnet, one is iron and one is aluminium.**

**FIGURE 3**

**Describe how another permanent magnet can be used to identify the blocks. [3 marks]**

**0 2 . 3** **FIGURE 4 shows a toy crane.**

**FIGURE 4**




**The toy crane uses an electromagnet to pick up and move the blocks.**

**Explain how this electromagnet is able to pick up and move the blocks. [6 marks]**

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**0 3** FIGURE 5 shows an ice skater, Skater A.

**FIGURE 5**


**0 3 . 1** Write down the equation that links mass, momentum and velocity. [1 mark]

______________________________________________

______________________________________________

**0 3 . 2** Skater A travels with a velocity of 3.2 m/s and has a momentum of 200 kg m/s

Calculate the mass of Skater A. [3 marks]

______________________________________________

______________________________________________

______________________________________________

Mass = ____________________ kg

0 3 . 3 **Skater A bumps into another skater, Skater B. Skater B is stationary.**

**The skaters move off together in a straight line.**

**Explain what happens to the velocity of each of the skaters.**

**Use the idea of conservation of momentum.**
**[3 marks]**

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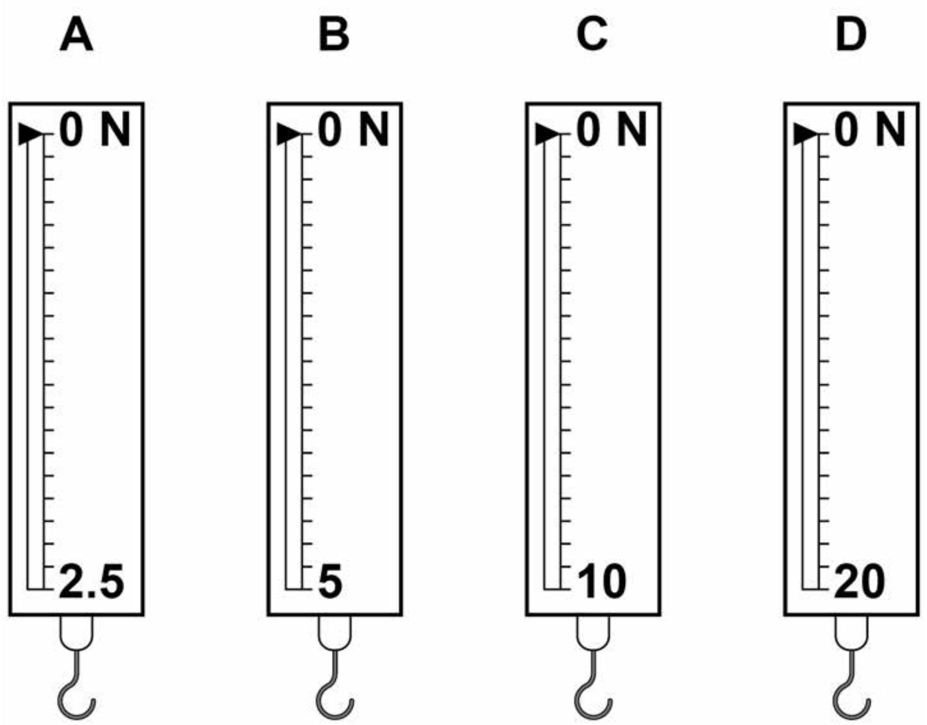
**7**

**0 4 . 1** **FIGURE 6 shows four newtonmeters.**

**Each newtonmeter contains a spring.**

**FIGURE 6**




**Which newtonmeter has the spring with the greatest spring constant?**

**Give a reason for your answer. [2 marks]**

**Newtonmeter** ______________

**Reason** ________________________________

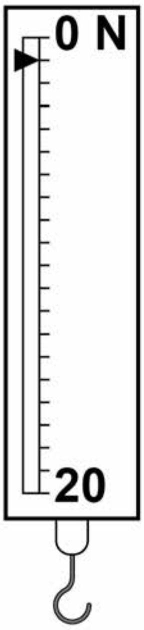
________________________________________

________________________________________

________________________________________

**0 4 . 2** **The newtonmeter in FIGURE 7 will give an error when used to make a measurement.**

**FIGURE 7**




**The arrow on the newtonmeter does not point to zero on the scale.**

**Name the type of error.**

**Describe how this error can be corrected.**
**[2 marks]**

**Type of error** ________________________________

________________________________________

**Correction** ________________________________

________________________________________

________________________________________

**0 4 . 3** **A student hangs a weight on a newtonmeter.**

**The energy now stored in the spring in the newtonmeter is $4.5 \times 10^{-2}$ J**

**The student then increases the weight on the newtonmeter by 2.0 N**

**Calculate the total extension of the spring.**

**Spring constant = 400 N/m [6 marks]**

Total extension = ____________________ m

10

[Turn over]

**0 5** **A car aerial receives radio waves from a radio transmitter.**

**Radio waves are transverse waves.**

**Sound waves are longitudinal waves.**

**0 5 . 1** **Describe the difference between transverse waves and longitudinal waves. [2 marks]**

**0 5 . 2** **The radio waves have a frequency of $4.8 \times 10^9$ Hz**

**Wave speed of electromagnetic waves = $3.0 \times 10^8$ m/s**

**Calculate the wavelength of the radio waves.**

**Give your answer to 2 significant figures.**
**[3 marks]**

**Wavelength = __________________ m**

**[Turn over]**

**0 5 . 3** **Describe how the radio waves reaching the car aerial produce signals in the electrical circuit of the car radio. [3 marks]**

**8**

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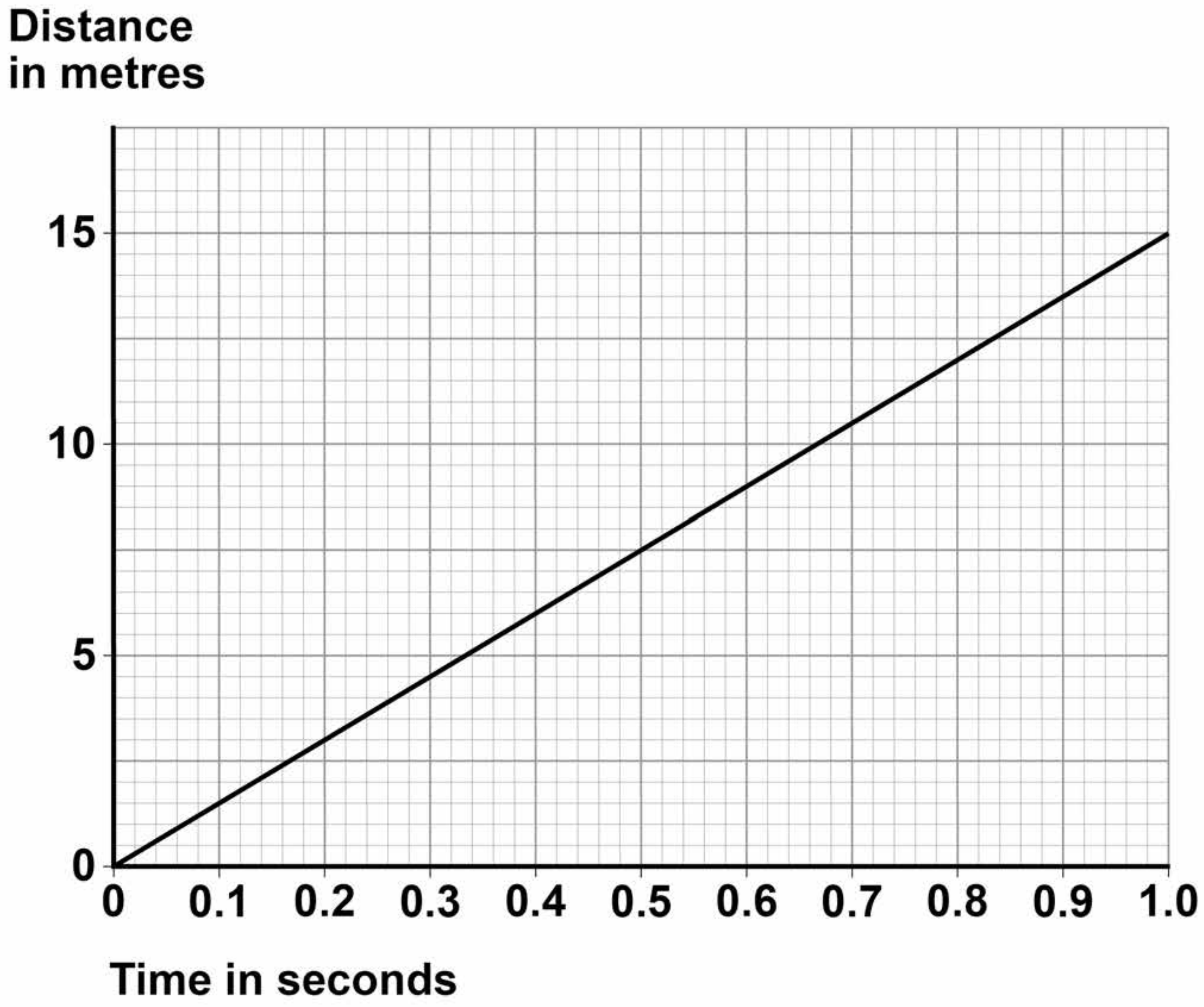
**[Turn over]**

**0 6 . 1** **FIGURE 8 shows the distance-time graph for a car travelling at 15 m/s**

**FIGURE 8**




**When the driver is tired, his reaction time increases from 0.50 seconds to 0.82 seconds.**

**Determine the EXTRA distance the car would travel before the driver starts braking.**
**[2 marks]**

Distance = ____________________ m

**0 6 . 2** **When the brakes are used, the temperature of the brakes increases.**

**Explain why. Use ideas about energy in your explanation. [2 marks]**

0 6 . 3 A lorry travels 84 m with a constant acceleration of 2.0 $m/s^2$ to reach a velocity of 19 m/s

Calculate the initial velocity of the lorry.

Use the Physics Equations Sheet. [3 marks]

Initial velocity = ____________________ m/s

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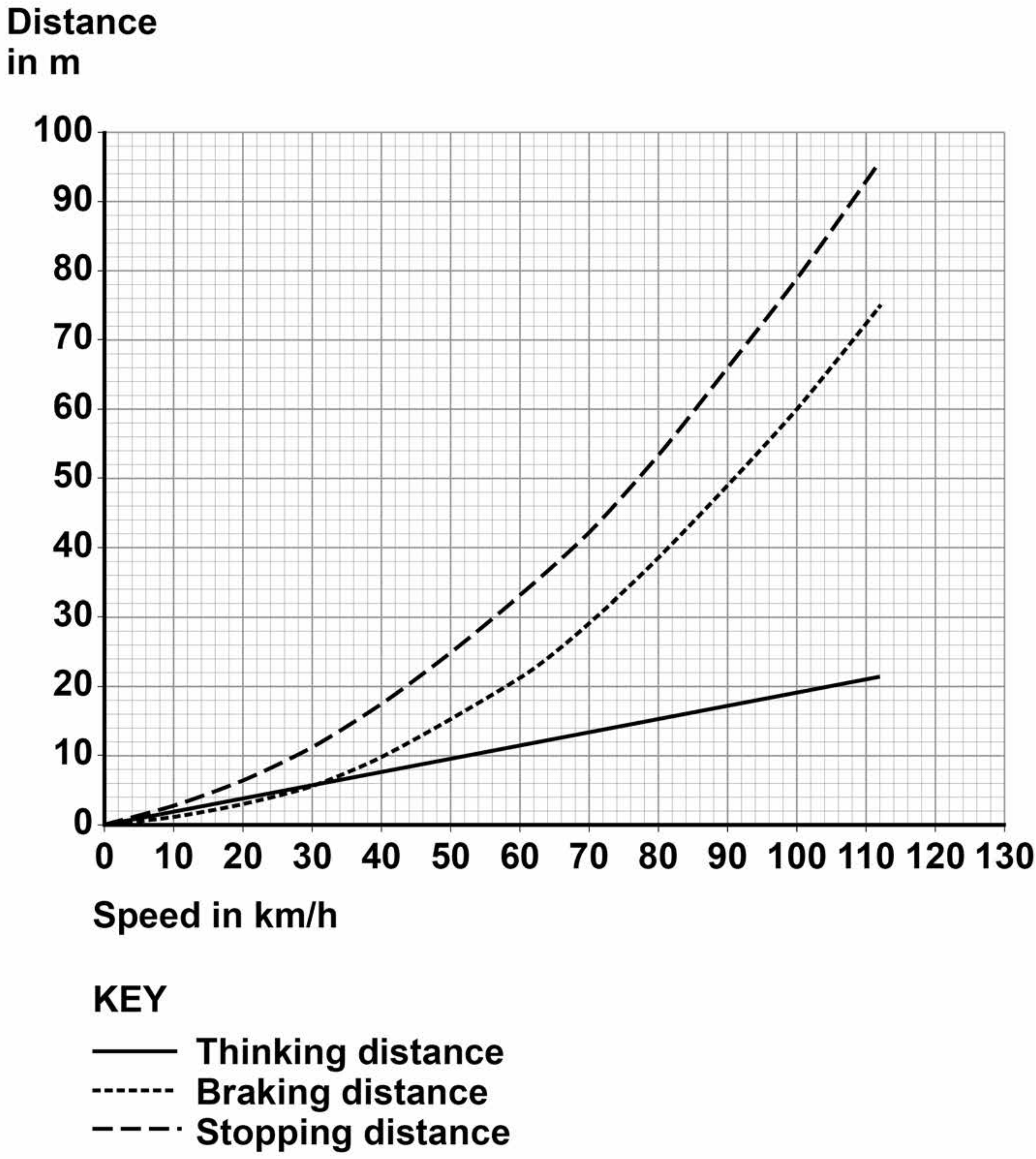
[Turn over]

**0 6 . 4** **FIGURE 9 shows how the thinking distance, braking distance and stopping distance for a car vary with the speed of the car.**

**FIGURE 9**



**Describe the relationships shown in FIGURE 9**

**You should include factors that would affect the gradient of the lines. [6 marks]**

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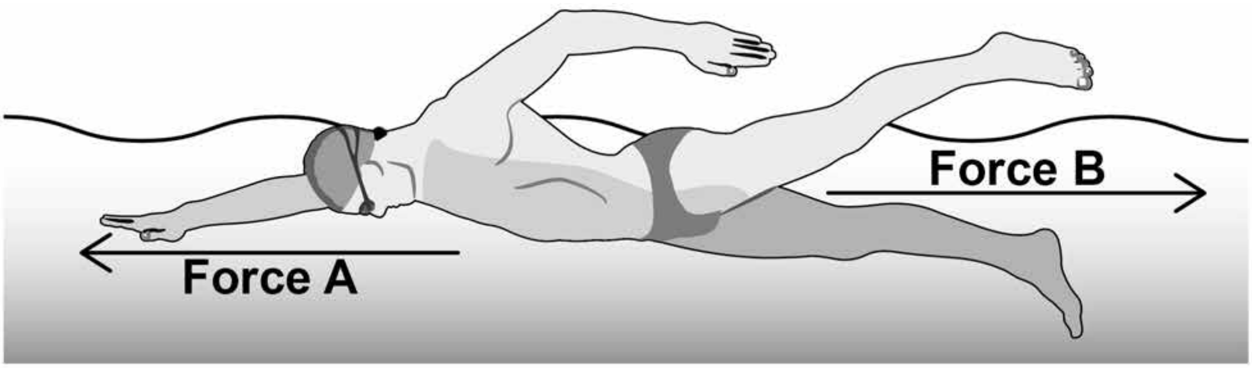
**0 7** **FIGURE 10 shows the horizontal forces acting on a man swimming in the sea.**

**FIGURE 10**




**0 7 . 1** **Describe the movement of the man when the resultant horizontal force is 0 N [1 mark]**

**0 7 . 2** **The man increases Force A.**

**Explain what happens to Force B and to the movement of the man. [4 marks]**

**[Turn over]**

**07.3** A boat moves through the sea.

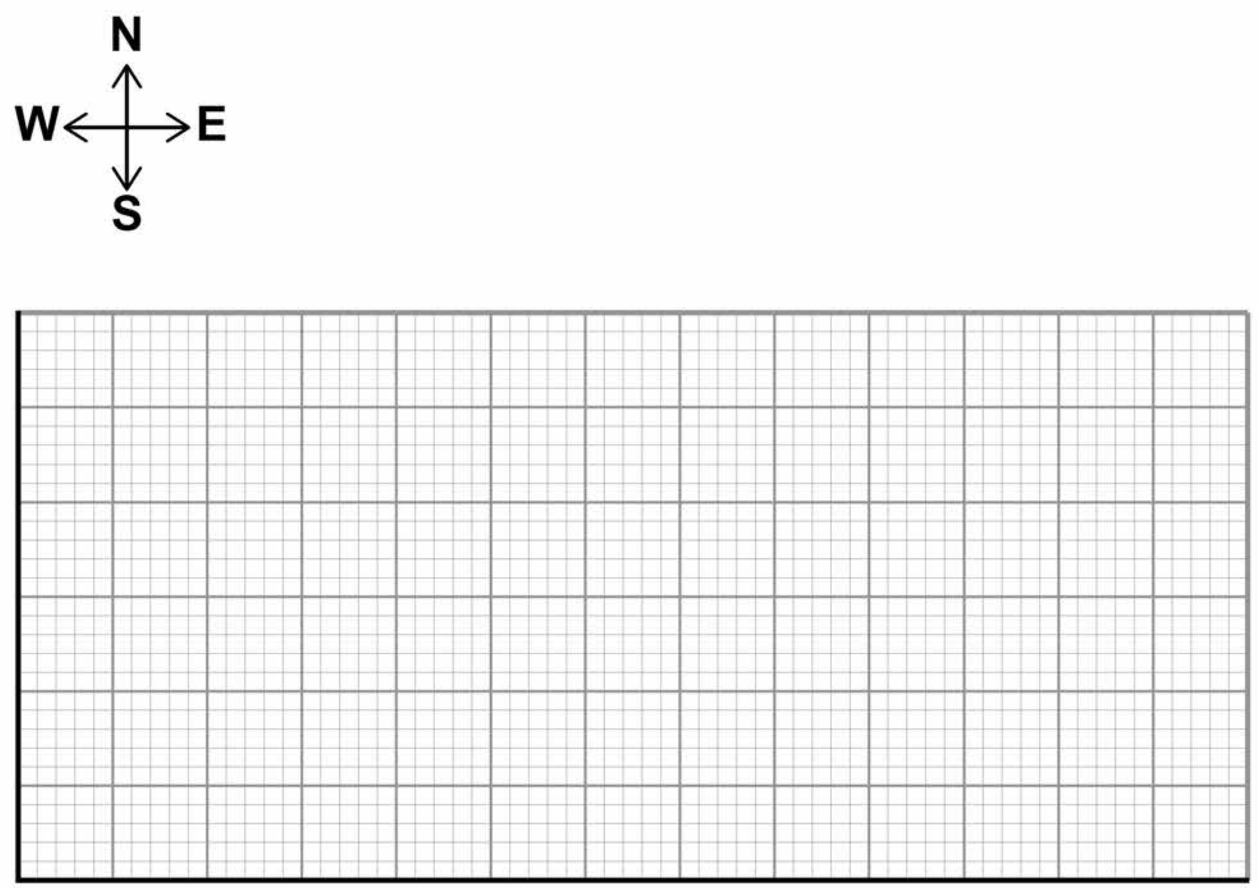
There is a 3000 N force to the west on the boat.

There is a 1000 N force to the south on the boat.

Determine the magnitude and direction of the resultant force on the boat.

Draw a vector diagram of these forces to scale on FIGURE 11 [3 marks]

FIGURE 11




Magnitude of resultant force = ____________________ N

Direction of resultant force = ____________________ degrees

**0 7 . 4** **The force to the south on the boat increases.**

**What effect does this have on the resultant force on the boat? [2 marks]**

**10**

**END OF QUESTIONS**

## There are no questions printed on this page

| For Examiner's Use | |
|---|---|
| Question | Mark |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| **TOTAL** | |