## AQAE

## GCSE

COMBINED SCIENCE: TRILOGY

Higher Tier<br>\section*{Paper 6: Physics 2H}

## Specimen 2018

## Time allowed: 1 hour 15 minutes

## Materials

For this paper you must have:

- a ruler
- a calculator
- the Physics Equation Sheet (enclosed).


## Instructions

- 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.


## Information

- There are 70 marks available on this paper.
- 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.


## Advice

- In all calculations, show clearly how you work out your answer.
- When answering questions 01.6 and 06.3 you need to make sure that your answer:
- is clear, logical, sensibly structured
- fully meets the requirements of the question
- shows that each separate point or step supports the overall answer.

Please write clearly, in block capitals, to allow character computer recognition.
Centre number $\square$ Candidate number $\square$
Surname


Forename(s) $\square$

Candidate signature

| $\mathbf{0}$ | $\mathbf{1} \quad$ Four students tested their reaction times using a computer program. |
| :--- | :--- |

When a green light appeared on the screen the students had to press a key.
Table 1 shows their results.

Table 1

| Student | Reaction time in s |  | Mean reaction <br> time in s |  |
| :--- | :---: | :---: | :---: | :---: |
|  | Test 1 | Test 2 |  | 0.27 |
| Boy 1 | 0.28 | 0.27 | 0.26 | 0.25 |
| Boy 2 | 0.28 | 0.47 | 0.22 | 0.29 |
| Girl 1 | 0.31 | 0.29 | 0.27 | 0.30 |
| Girl 2 | 0.32 | 0.30 | 0.29 |  |


| $\mathbf{0}$ | $\mathbf{1}$ | $\mathbf{1}$ |
| :--- | :--- | :--- |
| $\mathbf{1}$ | What is meant by 'reaction time' in this experiment? |  |


| $\mathbf{0}$ | $\mathbf{1}$. | $\mathbf{2}$ Boy 2 had an anomalous result in Test 2. |
| :--- | :--- | :--- |

Suggest a reason why.

| $\mathbf{0}$ | $\mathbf{1}$. | $\mathbf{3}$ Give one conclusion that can be made from the results in Table 1. |
| :--- | :--- | :--- |


| $\mathbf{0}$ | $\mathbf{1} .4$ | Suggest further evidence that you could collect to support your conclusion. |
| :--- | :--- | :--- |

Reaction time is important at the start of a race.
Table 2 shows the time taken by a boy to run different distances.

Table 2

| Distance in $\mathbf{m}$ | Time in s |
| :---: | :---: |
| 100 | 12.74 |
| 200 | 25.63 |
| 800 | 139.46 |


| $\mathbf{0}$ | $\mathbf{1}$ | 5 |
| :--- | :--- | :--- |
| 5 | Reaction time is more important in a 100 m race than in an 800 m race. |  | Explain why.

[2 marks]
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$\qquad$
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$\qquad$

Question 1 continues on the next page

Two girls, A and B, ran an 800 m race.
Figure 1 shows how the distance changed with time.

Figure 1

 Include data from Figure 11.
$\qquad$ (
$\qquad$ $\longrightarrow$ $\longrightarrow$ $\longrightarrow$
$\qquad$ $\longrightarrow$
$\qquad$
$\qquad$ $\longrightarrow$

| $\mathbf{0}$ | $\mathbf{1}$ | $\mathbf{7}$ Use Figure 1 to determine Girl B's speed at 60 s. |
| :--- | :--- | :--- |

Show how you use the graph to obtain your answer.

| $\mathbf{0}$ | 2 | A baby monitor has a sensor unit that transmits an image of the baby and the noises |
| :--- | :--- | :--- | the baby makes to a monitor unit. The monitor unit then displays an image of the baby and emits the noises the baby makes.


| $\mathbf{0}$ | $\mathbf{2}$ | $\mathbf{1}$ Compare the properties of the waves that transmit images and noises from the |
| :--- | :--- | :--- | :--- | monitor unit.


| $\mathbf{0}$ | $\mathbf{2}$. 2 The sensor unit can detect infrared and visible light. |
| :--- | :--- | :--- |

Suggest one advantage of being able to detect infrared.
[1 mark]
$\qquad$
$\qquad$

[1 mark]
Equation

| $\mathbf{0}$ | $\mathbf{2}$. $\mathbf{4}$ The signals for the monitor unit are transmitted as electromagnetic waves with a |
| :--- | :--- | :--- | wavelength of 0.125 m .

Wave speed of electromagnetic waves $=3 \times 10^{8} \mathrm{~m} / \mathrm{s}$
Calculate the frequency of the signal.
[3 marks]

Frequency = Hz

Turn over for the next question

| $\mathbf{0}$ | $\mathbf{3}$ A swimmer dives off a boat. |
| :--- | :--- | :--- |

Look at Figure 2.

Figure 2


| $\mathbf{0}$ | $\mathbf{3}$ | . | $\mathbf{1}$ |
| :--- | :--- | :--- | :--- |
| What two factors determine the momentum of the swimmer? |  |  |  |

1

2

| $\mathbf{0}$ | $\mathbf{3}$. | $\mathbf{2}$ What is the unit of momentum? |
| :--- | :--- | :--- | :--- |

Tick one box.

## J/s

$\square$
$\mathrm{kg} \mathrm{m} / \mathrm{s}$ $\square$
N m $\square$
$\mathrm{m} / \mathrm{s}^{2}$ $\square$

| 0 | 3 | 3 |
| :--- | :--- | :--- | :--- | The boat was stationary.

As the swimmer dives forwards, the boat moves backwards.
Use the idea of conservation of momentum to explain why the boat moves backwards.
[4 marks]
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| $\mathbf{0}$ | $\mathbf{3}$ | $\mathbf{4}$ Explain what would happen to the motion of the boat if there were more people on |
| :--- | :--- | :--- | :--- | the boat when the swimmer dived off.

[2 marks]

| 0 | 3 |
| :--- | :--- |



The swimmer's speed increases as she swims away from the boat.
The swimmer has a top speed.
Explain why.
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$\qquad$ $\longrightarrow$
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| 0 | 4 | A student changed the force applied to a spring by adding weights. |
| :--- | :--- | :--- |

Figure 3 shows a graph of her results.

Figure 3


| $\mathbf{0}$ | $\mathbf{4}$. | $\mathbf{1}$ Write down the equation that links the force applied and extension for a spring. |
| :--- | :--- | :--- | :--- |

[1 mark]

| $\mathbf{0}$ | $\mathbf{4}$ | $\mathbf{2}$ Identify the pattern shown in Figure 3. |
| :--- | :--- | :--- | :--- |

Explain your answer.
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04 . 3 Give one way the student could improve her investigation.

| 0 | $\mathbf{4}$ | $\mathbf{4}$ Describe the relationship between work done and elastic potential energy in |
| :--- | :--- | :--- | :--- | stretching a spring.


Explain the reason for the line you have drawn.

| 0 | $\mathbf{4}$ | 6 |
| :--- | :--- | :--- |

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$\qquad$

| 0 | 5 | Figure 4 shows a skydiver training in an indoor wind tunnel. |
| :--- | :--- | :--- |

Large fans below the skydiver blow air upwards.

Figure 4


| 0 | 5 | $\mathbf{1}$ The skydiver is in a stationary position. |
| :--- | :--- | :--- |

Complete the free body diagram for the skydiver.


| 0 | 5 | 2 |
| :--- | :--- | :--- | The skydiver now straightens his legs to increase his surface area.

This causes the skydiver to accelerate upwards.
Explain why straightening his legs cause the skydiver to accelerate upwards.
[2 marks]

| 0 | 5 | . | 3 |
| :--- | :--- | :--- | :--- |
| A small aeroplane used for skydiving moves along a runway. |  |  |  |

The aeroplane accelerates at $2 \mathrm{~m} / \mathrm{s}^{2}$ from a velocity of $8 \mathrm{~m} / \mathrm{s}$.
After a distance of 209 m it reaches its take-off velocity.
Calculate the take-off velocity of the aeroplane.

| 0 | 5 | . | 4 |
| :--- | :--- | :--- | :--- |
| A skydiver jumps from an aeroplane. |  |  |  |

There is a resultant vertical force of 300 N on the skydiver.
There is a horizontal force from the wind of 60 N .
Draw a vector diagram on Figure 5 to determine the magnitude and direction of the resultant force on the skydiver.

Figure 5


Magnitude of resultant force $=$

| 0 | 6 | A teacher used the equipment shown in Figure 6 to demonstrate the motor effect. |
| :--- | :--- | :--- |

Figure 6


| 0 | 6 | 1 | Describe how Fleming's left-hand rule can be used to determine the direction in |
| :--- | :--- | :--- | :--- | which the rod will move when the switch is closed, and state the direction.

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| 0 | 6 | 2 | Increasing the current can increase the force acting on the copper rod. |
| :--- | :--- | :--- | :--- |

Give one other way in which the size of the force acting on the copper rod could be increased.
[1 mark]
 When there is a current of 1.12 A the resultant force on the copper rod is 0 N . Calculate the magnetic flux density.

Gravitational field strength $=9.8 \mathrm{~N} / \mathrm{kg}$

## END OF QUESTIONS

## There are no questions printed on this page

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