Specimen Paper

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

AQA Level 1/2 Certificate in Science: Double Award
Specimen Paper

Double Award

Physics Paper 1H

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

Time allowed
- 60 minutes

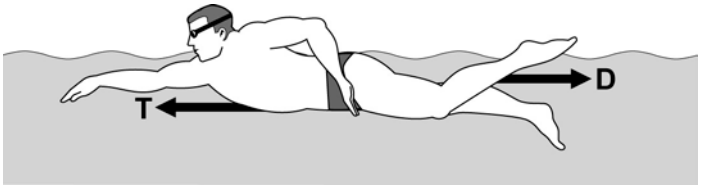
Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- 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.

Answer **all** questions in the spaces provided.

1 (a) The diagram shows the horizontal forces acting on a swimmer.



1 (a) (i) Force is an example of a vector quantity.

State what is meant by a *vector* quantity.

.....

.....

(1 mark)

1 (a) (ii) The swimmer is moving at a constant speed.
Force **T** is 120 N.

What is the size of force **D**?

..... N

(1 mark)

1 (a) (iii) By increasing force **T** to 140 N, the swimmer accelerates to a higher speed.

Calculate the size of the resultant force now acting on the swimmer.

.....

Resultant force = ... N

(1 mark)

1 (a) (iv) Even though the swimmer keeps the force **T** constant at 140 N, the resultant force on the swimmer decreases to zero.

Explain why.

.....

.....

.....

.....

.....

.....

(3 marks)

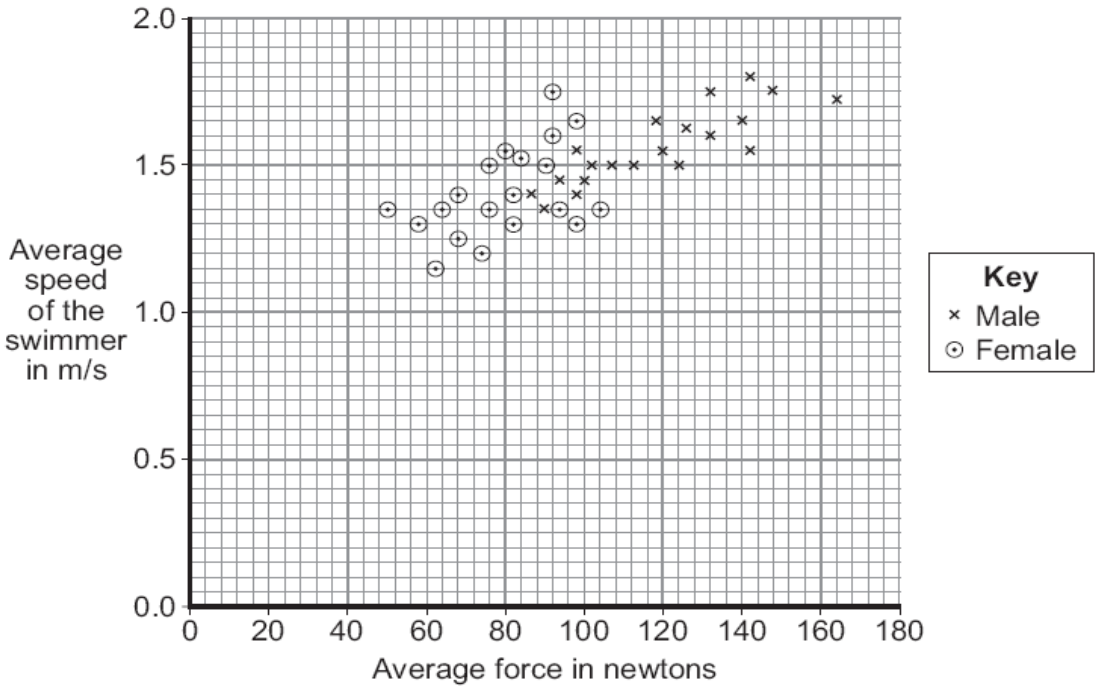
Question 1 continues on the next page

1 (b) A sports scientist investigated how the force exerted by a swimmer's hands against the water affects the swimmer's speed.

The investigation involved 20 males and 20 females swimming a fixed distance. Sensors placed on each swimmer's hands measured the force many times every second over the last 10 metres of the swim.

The measurements were used to calculate an average force.
The average speed of each swimmer over the last 10 metres of the swim was also measured.

The data from the investigation is displayed in the graph.



1 (b) (i) What was the dependent variable in this investigation?

.....

(1 mark)

1 (b) (ii) Give **one** reason for measuring the force many times every second rather than just once every second.

.....

.....

(1 mark)

1 (b) (iii) Give **two** ways in which the data for the male swimmers is different from the data for the female swimmers.

.....

.....

.....

.....

(2 marks)

1 (b) (iv) Considering **only** the data from this investigation, what advice should a swimming coach give to swimmers who want to increase their average speed?

.....

.....

(1 mark)

11

Turn over for the next question

2 Small sailing boats can be fitted with a passive radar device. The device increases the chance that the small boat will be seen on the radar screen of a large ship.

The radar transmitter on the large ship emits microwaves.

2 (a) Microwaves and radio waves are both part of the electromagnetic spectrum.

Describe **one** similarity and **one** difference between microwaves and radio waves.

.....

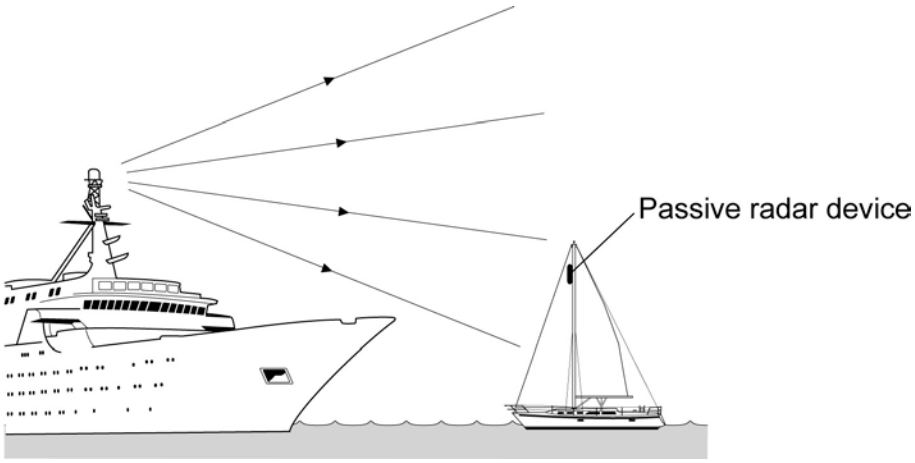
.....

.....

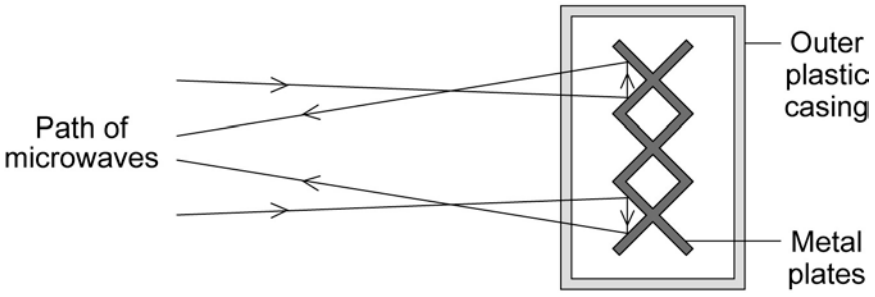
.....

(2 marks)

2 (b) The diagrams show the position of a passive radar device on a small boat and the internal construction of one type of passive radar device.



Internal construction of passive radar device



Microwaves can be absorbed, reflected or transmitted by different materials and different types of surface.

Describe what happens to the microwaves from the ship's transmitter when they reach the passive radar device.

.....

.....

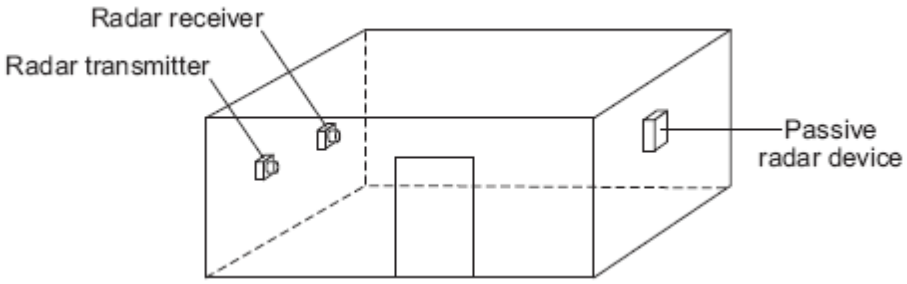
.....

.....

(2 marks)

2 (c) Each type of passive radar device has a RCS value. The larger the RCS value, the easier it is for a small boat fitted with the device to be detected.

An independent group of scientists measured the RCS values of four different types of device, **A**, **B**, **C** and **D**. The RCS value for each device was measured in the same room using the same equipment.



2 (c) (i) Why are thin metal and plastic sheets unsuitable materials for constructing the walls of the room?

.....

.....

.....

.....

(2 marks)

Question 2 continues on the next page

2 (c) (ii) Why is it important that the measurements are made by an independent group of scientists?

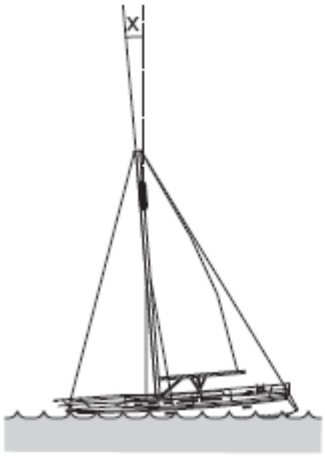
.....

.....

(1 mark)

2 (d) Because the movement of a small boat causes the mast and device to lean over, the scientists measured the RCS values at different angles.

The RCS values obtained by the scientists are shown in the table.



Device	Angle X			
	0°	5°	10°	15°
A	1.4	1.6	1.7	1.8
B	4.7	2.6	2.3	1.9
C	9.3	3.3	1.9	1.1
D	4.5	4.8	5.0	4.6

2 (d) (i) Give **two** conclusions that the scientists could make by comparing the data for device **A** and device **B**.

1 .....

.....

2 .....

.....

(2 marks)

2 (d) (ii) The scientists considered one of the values in the table to be an anomalous result. Draw a ring around the anomalous value in the table.

Explain your choice.

.....

.....

.....

.....

(2 marks)

2 (d) (iii) The scientists recommended that a passive radar device fitted to a small boat should have:

- the largest possible RCS value
- a RCS value consistently above 2.0.

Which **one** of the devices **A**, **B**, **C** or **D**, would you recommend that someone fits to their boat? ☐

Give a reason for your answer.

.....

.....

(1 mark)

12

Turn over for the next question

3 (a) **Table 1** gives some properties of alpha, beta and gamma radiation.

Table 1

Radiation	Range in air	Effect of a magnetic field
Alpha particle	…….....	deflected a small amount
Beta particle	about 1m	deflected a lot
Gamma ray	unlimited	……

Complete **Table 1** by adding the missing information.

(2 marks)

3 (b) **Table 2** gives information about four radioactive isotopes.

Table 2

Isotope	Type of radiation emitted	Half-life
iridium-192	gamma ray	74 days
polonium-210	alpha particle	138 days
polonium-213	alpha particle	less than 1 second
technetium-99	gamma ray	6 hours

Two isotopes of polonium are given in the table.

In terms of particles in the nucleus:

3 (b) (i) how are these two isotopes the same

.....

(1 mark)

3 (b) (ii) how are these two isotopes different?

.....

(1 mark)

3 (c) To monitor the blood flow through a patient's heart, a doctor injects the patient with a very small dose of technetium-99. The gamma radiation detected outside of the patient's body allows the doctor to see if the heart is working correctly.

3 (c) (i) Explain why technetium-99 is suitable for use as a medical tracer.

.....

.....

.....

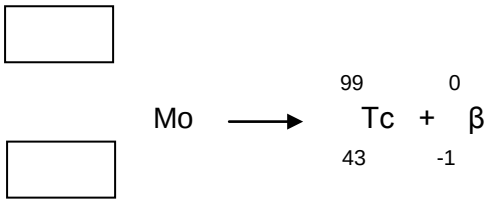
.....

(2 marks)

3 (c) (ii) Technetium-99 (Tc) is produced by the beta decay (β) of an isotope of molybdenum (Mo).

The decay can be represented by the equation below.

Complete the equation by writing the correct number in each of the **two** boxes.



(2 marks)

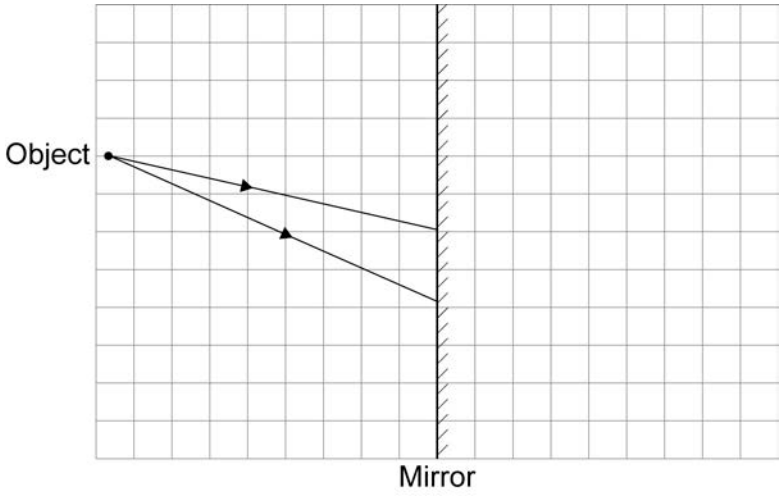
8

Turn over for the next question

4 When you look into a mirror you can see an image.

4 (a) The diagram shows a mirror and an object with two rays of light from the object that strike the mirror.

Use a ruler to complete the ray diagram to show how and where the image is formed.



(4 marks)

4 (b) A student wants to repeat the experiment in **4(a)** in a darkened room using a source of gamma rays as the object.

Give **two** reasons why this is a bad idea.

1 .....

.....

2 .....

.....

(2 marks)

6

5 (a) In 1929, the astronomer Edwin Hubble observed that the light from galaxies that are moving away from the Earth showed a *red-shift*. Red-shift provides evidence for the Big Bang theory.

5 (a) (i) Describe the Big Bang theory.

.....

.....

.....

.....

.....

(2 marks)

5 (a) (ii) State **one** further piece of evidence that supports the Big Bang theory.

.....

(1 mark)

5 (b) Although the early Universe contained mainly hydrogen, it now contains a large number of different elements.

Describe how the different elements were formed.

.....

.....

.....

.....

.....

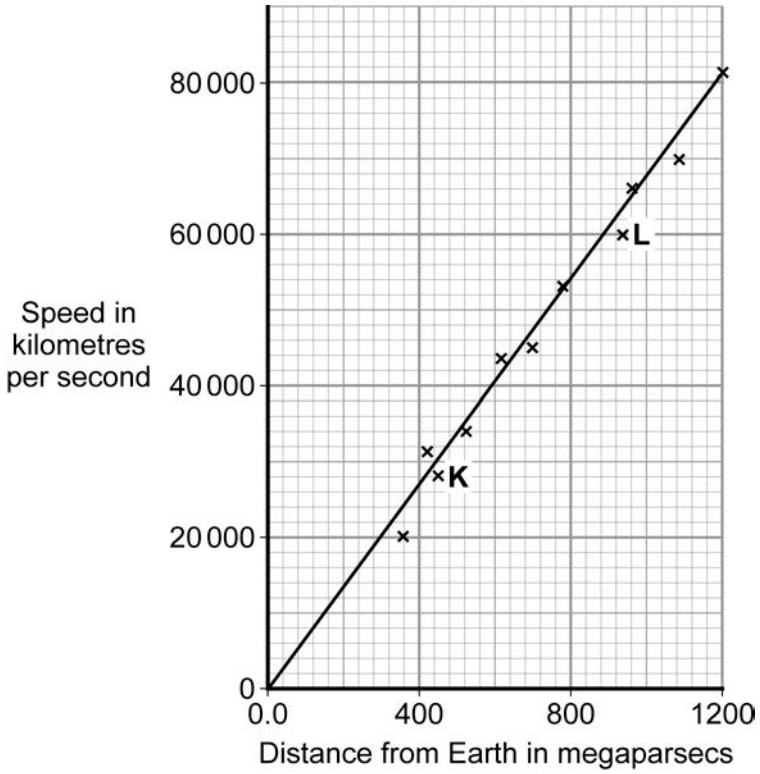
(2 marks)

Question 5 continues on the next page

5 (c) By measuring the red-shift, astronomers are able to calculate the speeds at which galaxies are moving away from the Earth and the distances of these galaxies from the Earth.

The graph shows some of the data calculated by astronomers.

1 megaparsec = 3.09×10^{19} km



5 (c) (i) The data from two galaxies, **K** and **L**, is included in the graph.

What does the graph tell us about the two galaxies, **K** and **L**?

.....

.....

.....

.....

(2 marks)

5 (c) (ii) The Andromeda galaxy is not moving away from the Earth. It is actually moving towards the Earth. This means that the light from Andromeda shows a blue-shift.

How do the wavelength and frequency of the light from Andromeda seem to have changed when viewed from the Earth?

.....

.....

.....

.....

(2 marks)

5 (d) All stars go through a life cycle.

Describe the life cycle of a star, originally much more massive than the Sun, once it has passed through the stage of being a Protostar.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

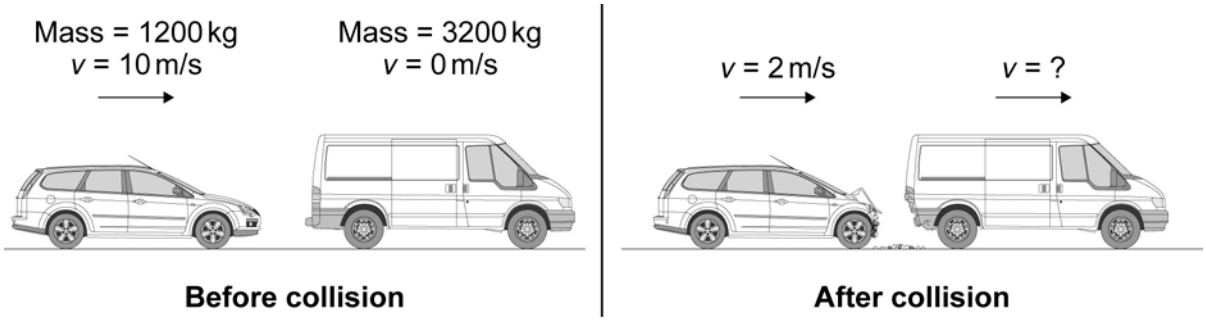
(5 marks)

14

Turn over for the next question

6 (a) The diagram shows a car before and after the car collides with a stationary van.

The handbrake of the van is not on.



Use the information in the diagram to calculate the velocity, *v*, in metres per second, with which the van moves forwards after the collision.

.....

.....

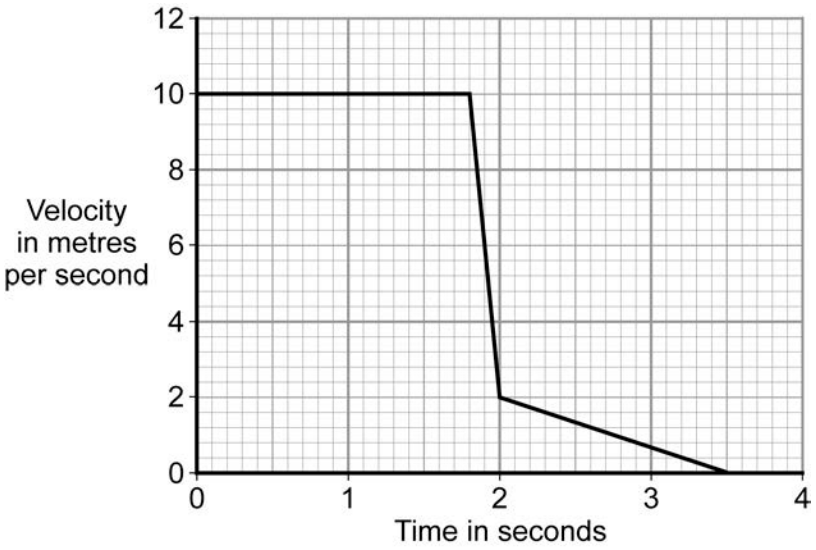
.....

.....

Velocity = ...m/s

(4 marks)

6 (b) The graph shows the velocity of the car before, during and after the collision.



Use the graph to calculate the distance travelled by the car, in metres, after the collision.

.....

.....

Distance = ... m

(2 marks)

6 (c) The collision causes the car driver to jerk forward.

Explain why wearing a seat belt reduces the risk of the driver being injured in the collision.

.....

.....

.....

.....

.....

.....

.....

(3 marks)

9

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED