Candidate Name	Centre Number	Candidate Number
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WJEC CBAC

GCSE

247/01

SCIENCE PHYSICS
FOUNDATION TIER
PHYSICS 3

P.M. WEDNESDAY, 10 June 2009

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark awarded**
1.	**4**	
2.	**4**	
3.	**7**	
4.	**5**	
5.	**5**	
6.	**4**	
7.	**4**	
8.	**3**	
9.	**9**	
10.	**5**	
Total	**50**	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

A list of equations is printed on page 2 of the examination paper. In calculations you should show all your working.

EQUATIONS

speed = gradient of a distance-time graph

distance travelled = area under a velocity-time graph

acceleration = gradient of a velocity-time graph

$$a = \frac{v - u}{t}$$

$$x = \frac{u + v}{2} t$$

where x = distance
u = initial velocity
v = final velocity
a = acceleration
t = time

momentum = mass × velocity

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Answer **all** *questions.*

1. The symbol for gold is $^{197}_{79}Au$.
Complete the sentences below using words from the box.

electrons	neutrons	protons	nucleus	atom

(i) An atom of gold contains 79 ..... and 79 ..... . [2]

(ii) Gold contains 197 particles in the ..... . [1]

(iii) An atom of gold contains 118 ..... . [1]

4

2. During road tests, three cars are tested to find out how long they take to accelerate from 0 to 60 mph (27 m/s).
The results are shown in the table below.

Car	Time to reach 60 mph from rest (s)
W	5
X	8
Y	9

(a) (i) State which car, **W**, **X** or **Y** has the smallest acceleration. ..... [1]

(ii) Another car, **Z**, is tested.
It is found to have twice the acceleration of car **X**.
How long did it take to accelerate from 0 to 60 mph? ..... [1]

(b) A velocity of 60 mph is the same as a velocity of 27 m/s.
Use the equation

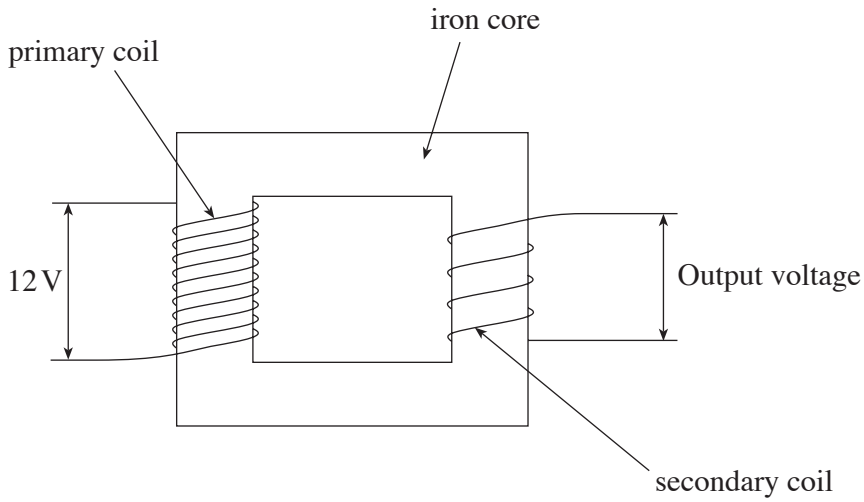
$$\text{Acceleration} = \frac{\text{final velocity} - \text{initial velocity}}{\text{time}}$$

to calculate the acceleration of car **Y** during the test in m/s^2. [2]

acceleration = ... m/s^2

4

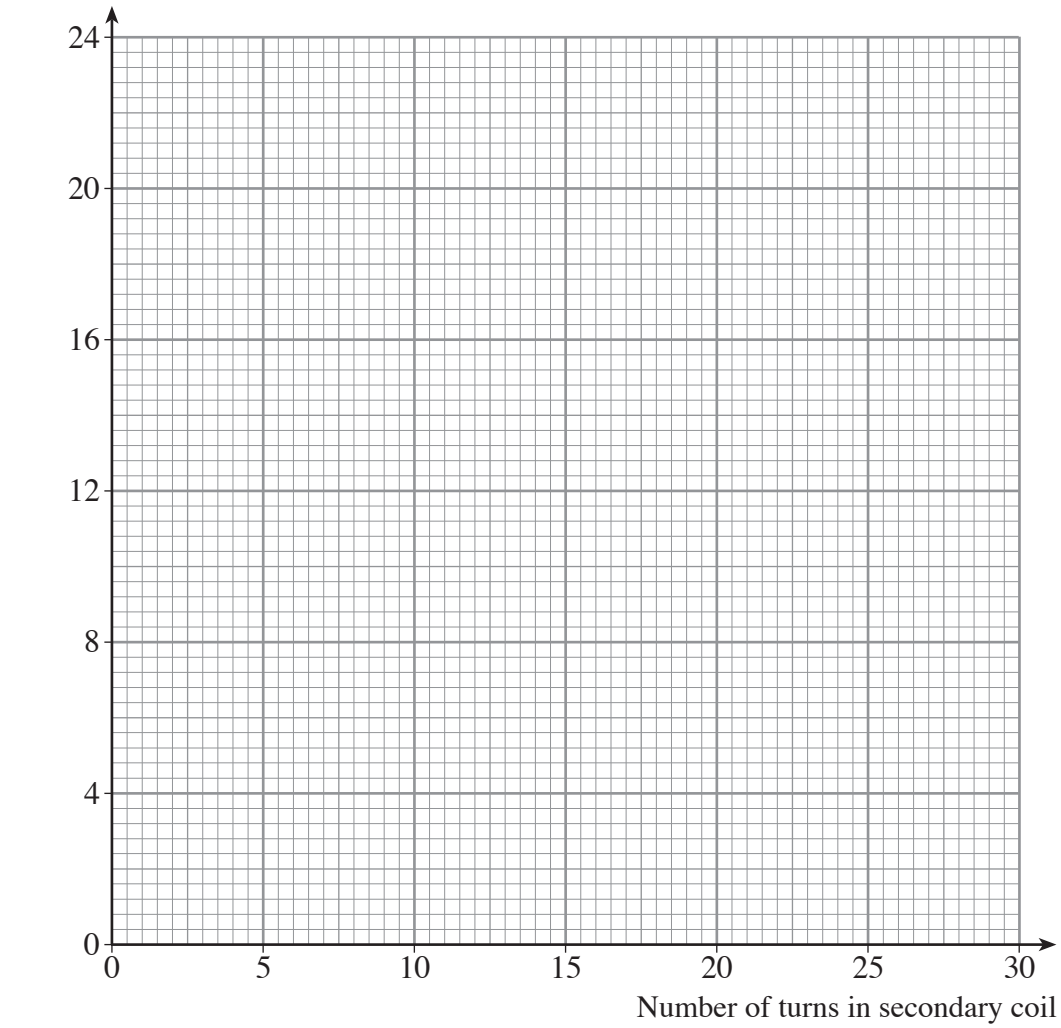
3. The diagram shows a model transformer.



In an experiment, the number of turns on the primary coil stays constant and it is connected to 12 V ac.
The number of turns on the secondary coil is changed and the output voltage is measured each time.
The results are shown in the table.

Number of turns in secondary coil	Output voltage (V)
5	4
10	8
20	16
25	20
30	24

(a) (i) Use the results to plot a graph on the grid below. [3]



(ii) Use the graph to find the number of turns on the secondary coil that are needed to produce an output voltage of 12 V. [1]

Number of turns = ...

(iii) State the number of turns on the primary coil. ..... [1]

(iv) How does the graph show that the output voltage is proportional to the number of turns in the secondary coil? [1]

.....

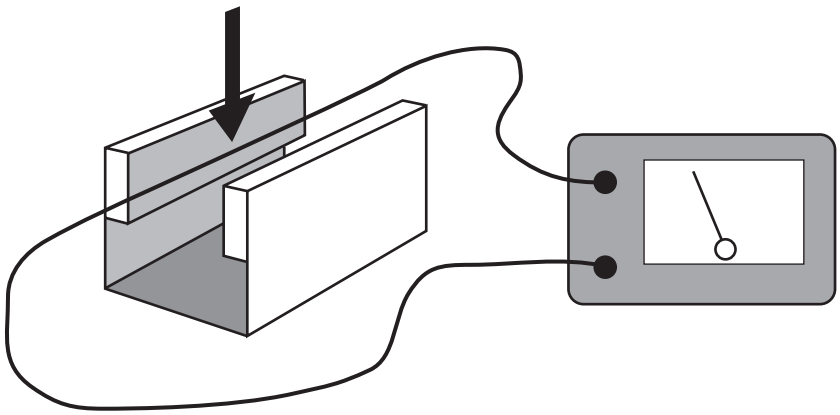
(b) Give a reason why a 12 V dc supply would not give an output voltage. [1]

.....

.....

.....

4. The diagram shows the apparatus used for investigating the current produced when a wire moves between the poles of a magnet.



When the wire moves down, the meter needle moves (deflects) to the **left**.

(a) Complete the sentences by underlining the correct choice in the brackets.

(i) The needle moves because a (voltage / current / resistance) flows through the wire. [1]

(ii) The needle moves because as the wire moves down it cuts through (the air / a magnetic field / an electric field). [1]

(b) (i) State what happens to the meter needle if the wire moves down faster. [1]

.....

(ii) State what happens to the meter needle when the wire moves up between the poles. [1]

.....

(iii) State what happens to the meter needle if the wire is not moving between the poles. [1]

.....

5

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5. During road works a speed limit is in force.
The speed limit is monitored by cameras that are 1500 m apart.
They measure the average speed of every car that passes.
If the average speed is more than 15 m/s, a speeding fine is given.

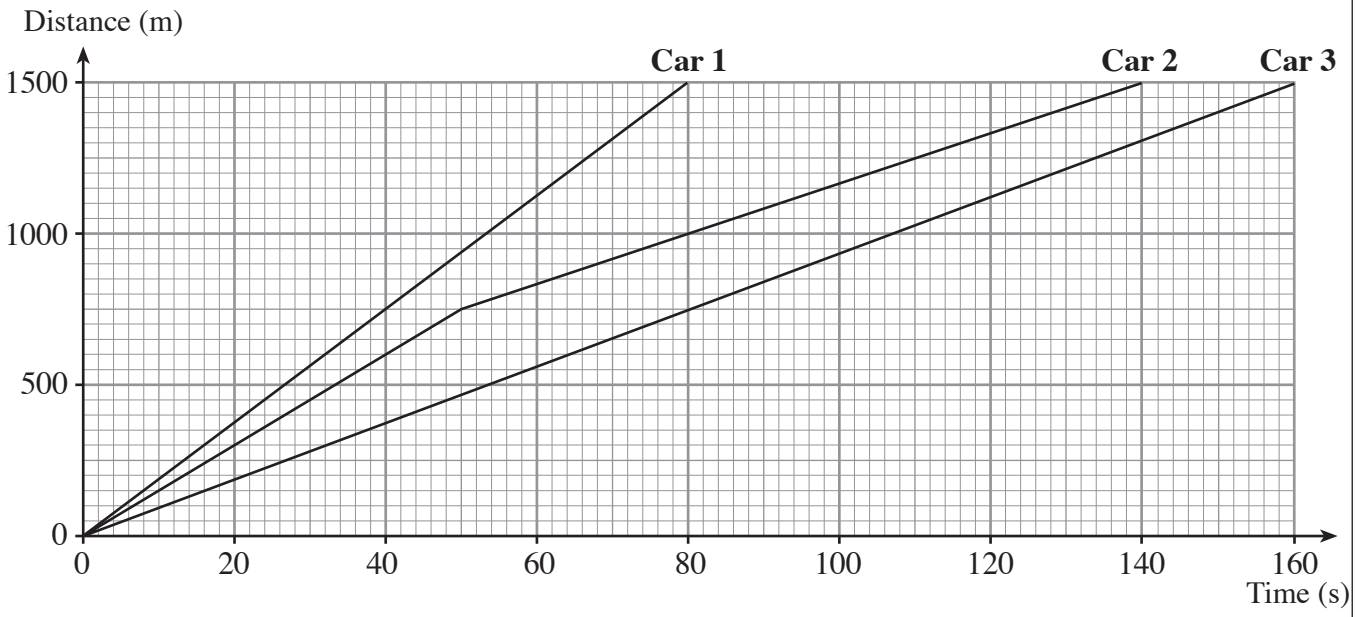
(a) Use the equation

$$\text{Time} = \frac{\text{distance}}{\text{average speed}}$$

to calculate the time taken to travel the distance between the cameras at an average speed of 15 m/s. [2]

time taken = ... s

(b) The graph shows the journey of three cars as they travelled between the cameras.

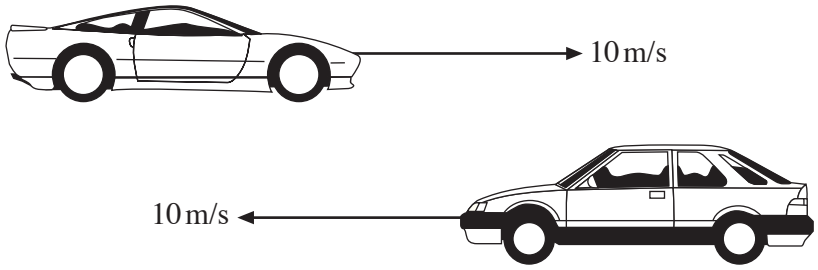


(i) Which car broke the speed limit? ..... [1]

(ii) How can you tell from the graph that it was travelling too fast? [1]

.....

(c) At one point between the cameras, a car travelling at 10 m/s passes another car also travelling at 10 m/s.
The direction of both cars is shown in the diagram.



Give a reason why the **velocities** of the cars are different even though the **speeds** are the same. [1]

.....

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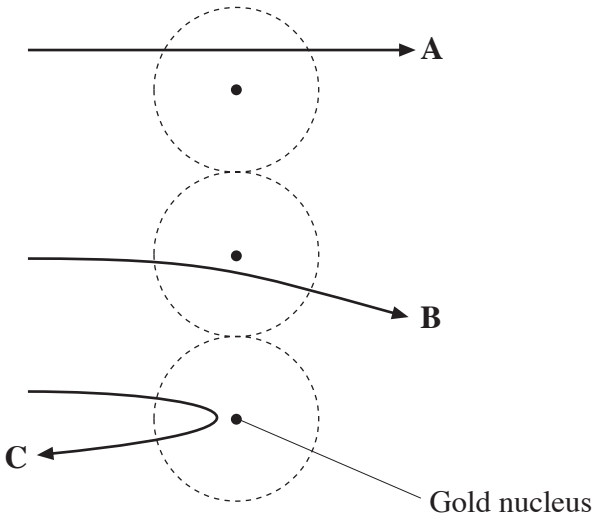
6. In the early 20th Century, scientists observed the paths of alpha particles passing through very thin gold foil.
The diagram shows the paths of three alpha particles **A**, **B** and **C**.



(i) **Circle** the correct symbol for an alpha particle in the list below. [1]

$^{4}_{2}\alpha$ $^{2}_{4}\alpha$ $^{4}_{4}\alpha$ $^{2}_{2}\alpha$

(ii) Draw **three** lines to join the path of each alpha particle with the correct reason. [3]

Path of alpha particle	**Reason**
Alpha particle **A** passed through the gold foil in a straight line because	..... it collided head on with a nucleus
Alpha particle **B** swerved slightly because	..... it passed close to a nucleus
Alpha particle **C** bounced back because	..... it was attracted to electrons
	..... most of the atom is space

Examiner only

7. At a testing station in Holland, cars are tested for safety by being driven into walls. 'Crash test dummies' are inside the cars instead of humans. In one test, a car of mass 700 kg is driven at a wall at a speed of 25 m/s.

(i) Use the equation

$$\text{momentum} = \text{mass} \times \text{velocity}$$

to calculate the change in momentum of the car as it stops as it crashes into the wall. [2]

Change in momentum = ... kg m/s

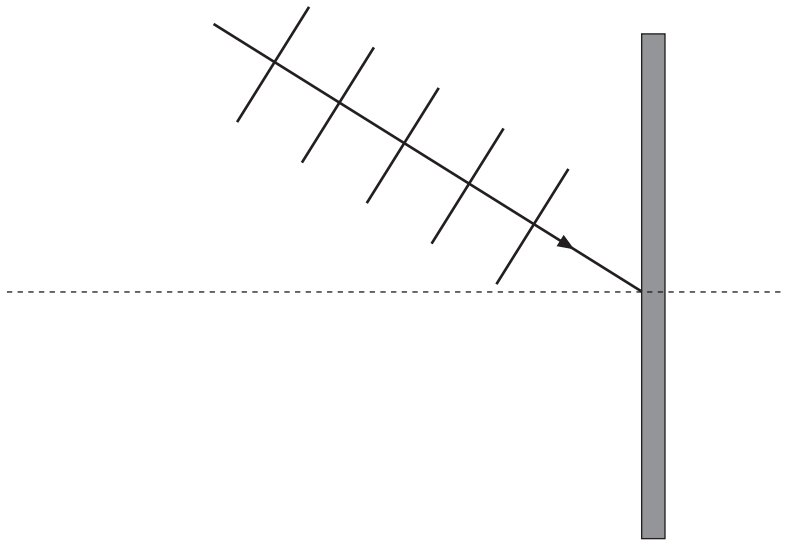
(ii) Give **two** safety features that would reduce the force on the 'crash-test dummy' by increasing the time taken to come to rest. [2]

1. .....

2. .....

4

8. The diagram shows water wave fronts hitting a barrier. The wave fronts are reflected off the barrier.



(i) **Draw** a line with an arrow (⟶) on the diagram to show the direction of the reflected waves. [1]

(ii) **Add** to the diagram to show **four** reflected wave fronts. [2]

3

Turn over.

Examiner only

9. Read the following passage and answer the questions that follow.

At the moment, nuclear reactors use nuclear fission to generate power.

In nuclear fission, you get energy from splitting one atom into two different atoms. In a nuclear reactor, high-energy neutrons split heavy atoms of uranium, producing large amounts of energy, radiation and radioactive waste.

In the future, reactors may use nuclear fusion to generate power.

In nuclear fusion, large amounts of energy are produced when two atoms join together to form one larger atom.

One type of fusion reaction involves deuterium. Deuterium is a hydrogen isotope. It is not radioactive and can be obtained from seawater. Two deuterium atoms under certain conditions combine to form an isotope of helium and a neutron and a large amount of energy. This fusion reaction does not produce high-level nuclear waste.

When atoms fuse, the nuclei must come together. A very high temperature is needed to overcome the repulsion between the positive protons. A high pressure is also needed to squeeze the atoms together so they can fuse.

(a) (i) Explain how nuclear fission is different from nuclear fusion. [2]

.....

.....

.....

(ii) Explain why in the future, nuclear fusion reactors would be more environmentally friendly than nuclear fission reactors. [2]

.....

.....

.....

(iii) Give a reason why there is an unlimited supply of fuel for a fusion reactor. [1]

.....

(iv) Name the products formed when two deuterium atoms fuse. [2]

.....

(b) Explain why it is difficult to achieve controlled nuclear fusion on Earth. [2]

.....

.....

.....

9

10. P-waves and S-waves are types of seismic waves produced by earthquakes.

(a) P-waves and S-waves travel at different speeds.

(i) Give **two other** differences between P and S-waves. [2]

1. .....

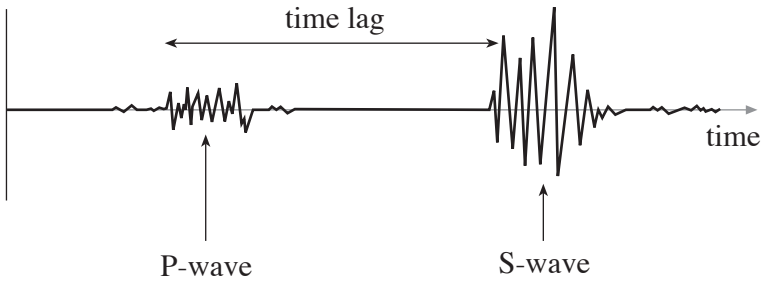
2. .....

(ii) Give **one** difference between transverse and longitudinal waves. [1]

.....

.....

(b) The diagram shows signals received from an earthquake at a monitoring station.



(i) Give a reason why the P-waves are received first. [1]

.....

(ii) State what information the time lag can tell seismologists about the earthquake. [1]

.....

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