Candidate Name	Centre Number	Candidate Number
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WJEC CBAC

GCSE

247/01

SCIENCE PHYSICS
FOUNDATION TIER
PHYSICS 3

A.M. FRIDAY, 28 May 2010

45 minutes

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

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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

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

$$x = \frac{1}{2}(u + v)t$$

where u is the initial velocity,
v is the final velocity,
a is the acceleration,
t is the time,
x is the distance travelled,

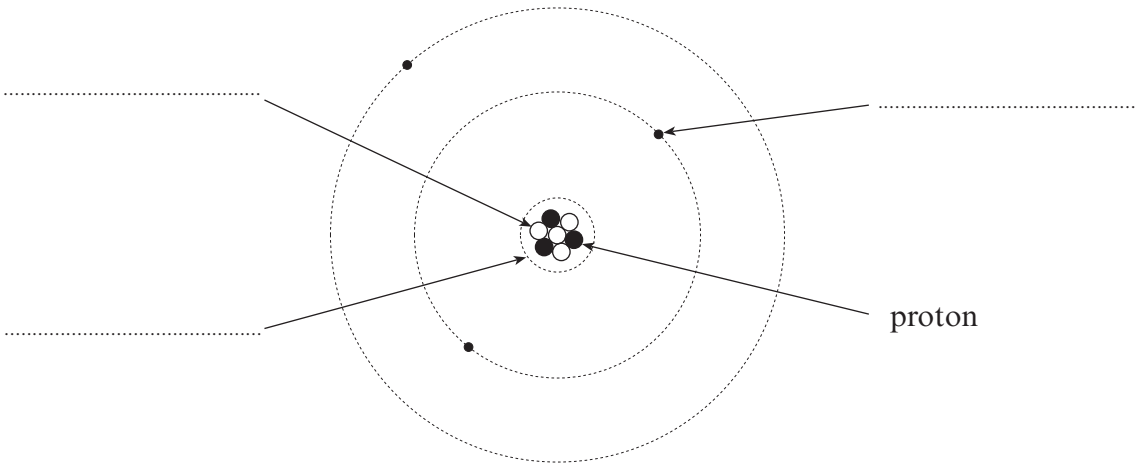
momentum = mass × velocity

Answer **all** *questions.*

1. The diagram shows the structure of a neutral atom.

(a) Label the diagram using the following words:

nucleus neutron electron [3]



(b) (i) Write down the mass number of the atom shown in *(a)*.

Mass number = ... [1]

(ii) Write down the atomic number of the atom shown in *(a)*.

Atomic number = ... [1]

5

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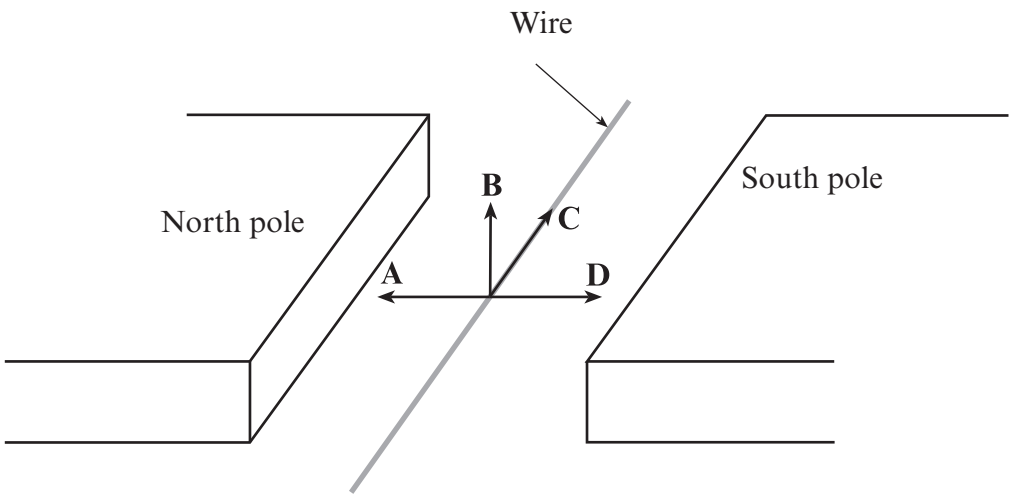
2. The diagram shows a wire being moved between the poles of a magnet.



(a) Use the letters **A**, **B**, **C** or **D** to complete the statements that follow.

(i) The direction of the magnetic field is shown by the letter .....
[1]

(ii) To produce a current, the wire needs to be moved in direction .....
[1]

(b) State two ways that the current in the wire could be made bigger. [2]

1. .....

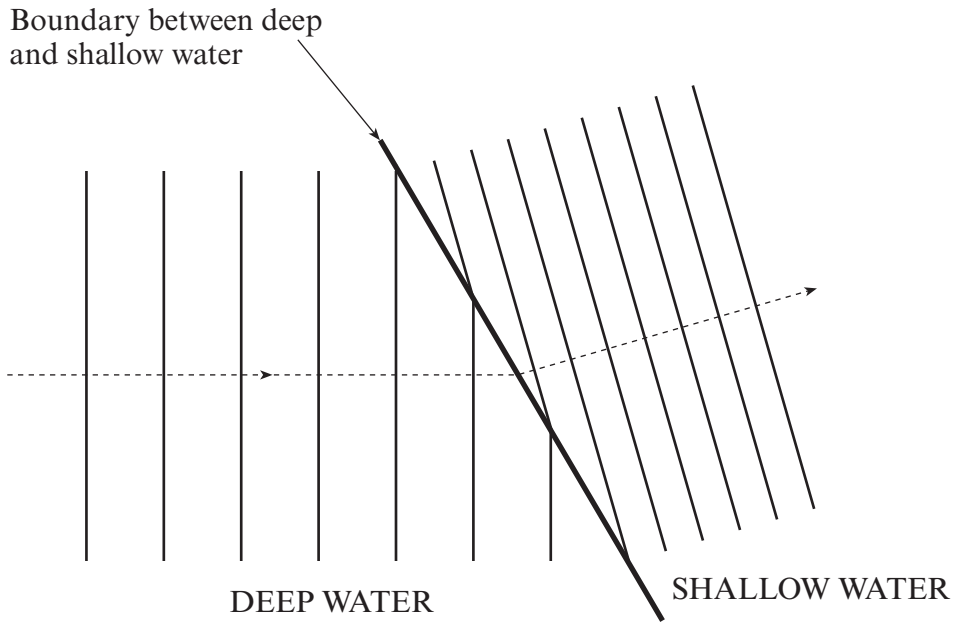
.....

2. .....

.....

4

3. The diagram shows plane waves travelling from deep to shallow water.



(a) As they move into the shallow water the waves change direction.

What name is given to this change of direction? ..... [1]

(b) Select one word or phrase from the following list to complete the sentences that follow. Each word may be used once, more than once or not at all. [2]

increases decreases stays the same

When the wave passes into the shallow water, the wavelength .....

When it passed into shallow water, the speed .....

(c) Complete the following sentences about water waves by underlining the correct word or words in each bracket: [2]

Water waves are (longitudinal / transverse). This is because the vibrations

(are along / are at 90° to / are parallel to) the direction of the wave.

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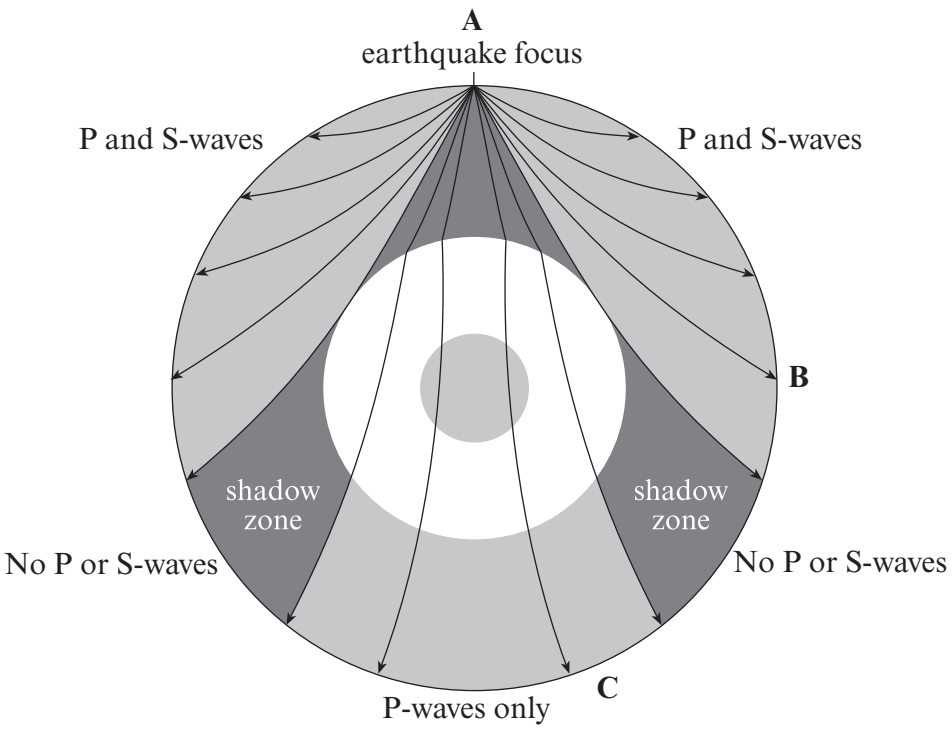
4. Earthquakes send out two types of waves, called P and S waves.
S waves cannot travel through liquid material, and they travel more slowly than P waves.
Both P and S waves travel through solids.
The diagram shows an earthquake that occurs below point **A** on the Earth.



(a) Give a reason why P waves arrive first at **B** before S waves. [1]

.....

(b) Only P waves can be detected at the monitoring station **C**. What does that tell us about the material of the Earth's core? [1]

.....

(c) Give **one** way that a P wave is different from an **S** wave that is not stated above. [1]

.....

.....

3

5. The following equation shows a nuclear reaction.

$$ {}^{2}_{1}\mathrm{H} + {}^{2}_{1}\mathrm{H} \longrightarrow {}^{3}_{2}\mathrm{He} + {}^{1}_{0}\mathrm{n} $$

This reaction only takes place if the particles on the left hand side of the equation move very quickly towards each other. This needs a very high temperature. The reaction then releases a huge amount of energy.

(a) Underline the correct word or words in the brackets of each sentence below. [3]

(i) The particles that collide together in this reaction are atoms of (hydrogen, helium, oxygen).

(ii) The particle ${}^{1}_{0}\mathrm{n}$ that is released in the reaction is a (neutron, nucleus, nitrogen)

(iii) This is an example of a (fission reaction, chain reaction, fusion reaction).

(b) Give **two** reasons why this reaction is very difficult to control. [2]

1. .....

.....

2. .....

.....

5

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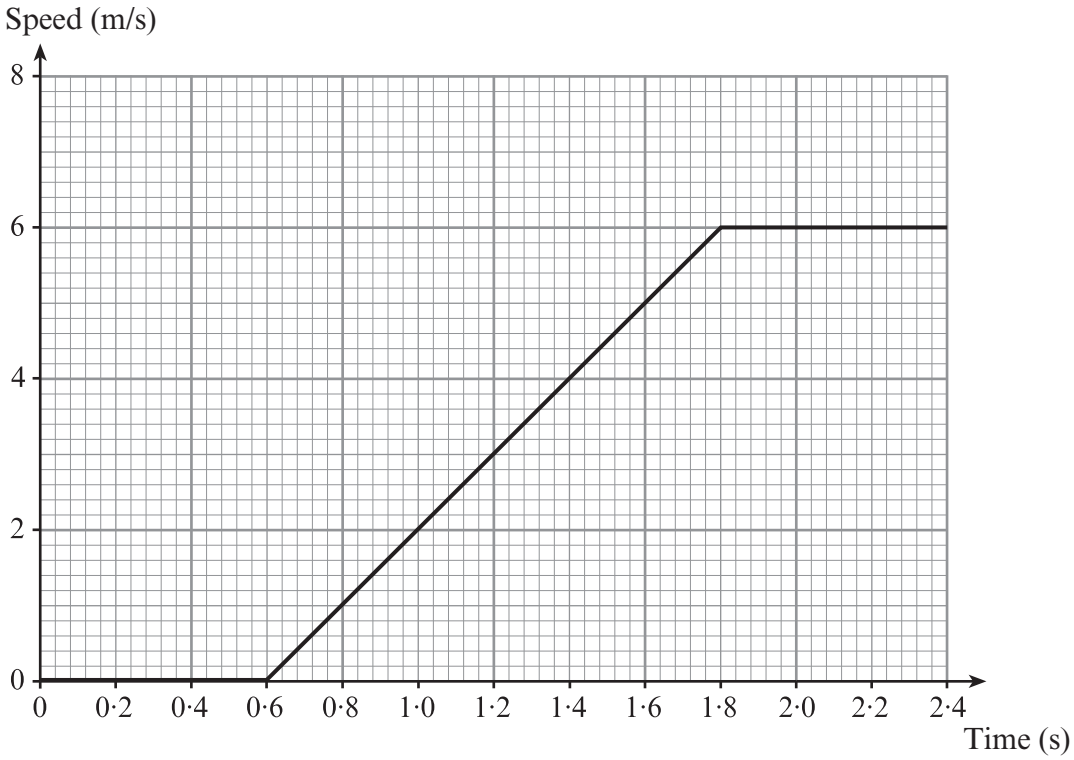
6. A car is stopped at traffic lights.
At time 0 seconds, the lights change to green. After the car speeds up it travels around a bend.



(a) How long does it take the driver to react when the lights change to green? ..... s [1]

(b) At what time did the speed reach 6.0 m/s? ..... s [1]

(c) Use the equation $a = \frac{v - u}{t}$ from page 2 to calculate the acceleration of the car. [3]

acceleration = ... m/s^2

(d) As the car goes around the bend, one of the following quantities changes.
Underline the one that changes. [1]

Speed Velocity Size of the driving force

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(e) The mass of the car is 1500 kg
Use the equation

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

to find the momentum of the car at 1.4 seconds. [2]

momentum = ... Ns

8

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7. Read the article below and then answer the questions that follow.

> The fuel used in a nuclear reactor contains a mixture of $^{235}_{92}U$ and $^{238}_{92}U$. The $^{238}_{92}U$ does not undergo fission.
>
> The $^{235}_{92}U$ atoms capture only slow moving neutrons and then split to produce two different radioactive nuclei and up to 3 fast moving neutrons.
>
> The numbers of neutrons produced in the core of the reactor have to be controlled. Boron control rods which can be raised or lowered into the core perform this task since boron readily absorbs neutrons.

(a) Describe the process of fission in the nuclear reactor. [2]

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(b) Explain why neutrons produced in the core have to be slowed down for fission of $^{235}_{92}U$ to continue. [1]

.....

.....

(c) The boron control rods are raised slightly. State **how** and explain **why** there is a change in the amount of energy produced. [2]

.....

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5

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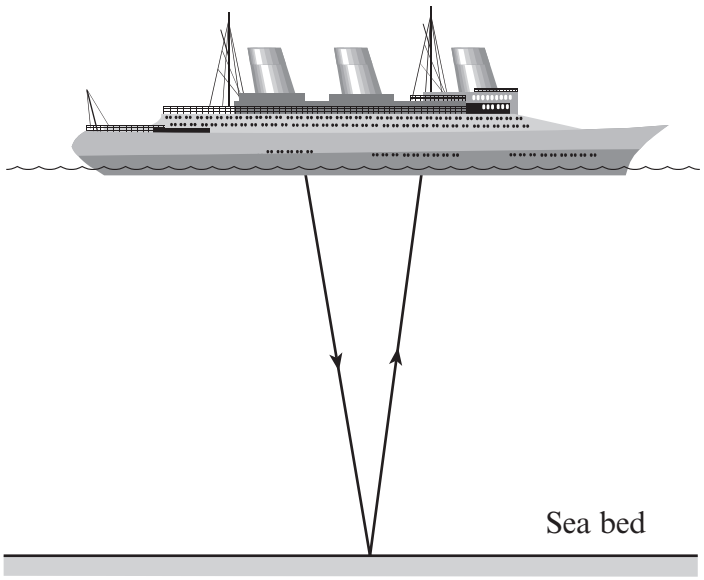
8. Ultrasound is used in sonar instruments to measure the depth of the sea.
These instruments operate at a frequency of 50 000 Hz.
The waves travel at a speed of 1500 m/s in water.



A wave is sent out from the boat to the sea bed and is received back 3 seconds later.

(a) State why ultrasound cannot be heard by humans. [1]

.....

.....

(b) Use the equation

distance = speed × time

to calculate the depth of the sea. [3]

Depth of sea = ... m

(c) State **one** other **non-medical** use of ultrasound. [1]

.....

.....

5

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9. The "two-second rule" can be used by drivers who want to keep at a safe distance behind the car in front.

The time taken to say "ONLY A FOOL BREAKS THE TWO-SECOND RULE" is about two seconds. The car in front passes a post. You are too close if you reach the post in less than two seconds.

The graph shows the official stopping distances given in the Highway Code and the stopping distances given by the 2-second rule.

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(a) What is the stopping distance given by the Highway Code for a speed of 30 m/s? [1]

Stopping distance = ... m

(b) How much further does the 2-second rule give you to stop than the Highway Code at a speed of 10 m/s? [2]

Further distance = ... m

(c) Using the information from the graph, explain why the 2-second rule should not be used at speeds above 17 m/s. [1]

.....

.....

.....

(d) Explain why the **Highway Code graph** does not support the statement: "The stopping distance is proportional to the speed of the car". [1]

.....

.....

.....

5

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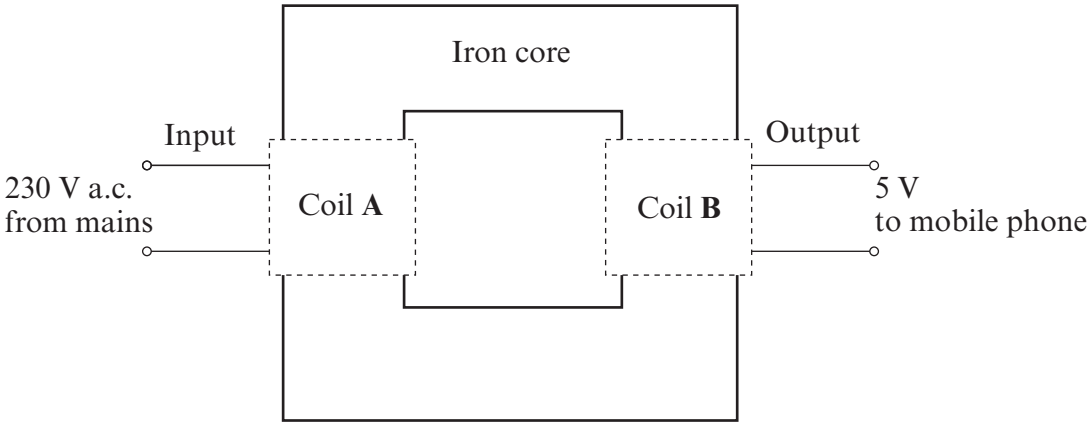
10. A mobile phone charger has a transformer in its plug. It changes a 230 V input to a 5 V output.



(a) Which coil, A or B should have the fewer number of turns?
Give a reason for your answer. [2]

.....

.....

.....

(b) Explain why the input voltage has to be alternating for the transformer to work. [1]

.....

.....

.....

(c) Explain the purpose of the iron core. [1]

.....

.....

(d) Explain why an output voltage is produced. [1]

.....

.....

5