Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4503/01

PHYSICS

PHYSICS 3
FOUNDATION TIER

A.M. THURSDAY, 23 May 2013

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**8**	
3.	**6**	
4.	**8**	
5.	**9**	
6.	**12**	
7.	**12**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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. In calculations you should show all your working.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **7***(b)*.

Equations

$\text{speed} = \dfrac{\text{distance}}{\text{time}}$	
u = initial velocity v = final velocity t = time a = acceleration x = displacement	$v = u + at$ $x = \frac{1}{2}(u + v)t$
momentum = mass × velocity	$p = mv$
$\text{pressure} = \dfrac{\text{force}}{\text{area}}$	$p = \dfrac{F}{A}$
	$T / \text{K} = \theta / ^\circ\text{C} + 273$
$\text{density} = \dfrac{\text{mass}}{\text{volume}}$	$\rho = \dfrac{m}{v}$

SI multipliers

Prefix	Multiplier	
m	10^{-3}	$\dfrac{1}{1000}$
k	10^{3}	1 000
M	10^{6}	1 000 000

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Answer **all** *questions.*

1. The diagram shows a solenoid carrying a current. The solenoid acts like a magnet. The N pole on the solenoid is labelled.

(a) **Draw** the magnetic field around the solenoid. [2]

(b) (i) State the effect on the magnetic field of increasing the current. [1]

.....

(ii) State the effect on the magnetic field of increasing the number of turns on the solenoid. [1]

.....

(iii) State the effect on the magnetic field of reversing the current through the solenoid. [1]

.....

5

Turn over.

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2. The picture shows a demountable transformer.

(a) Use the correct words from the box to complete the sentences about how a transformer works. [5]

secondary	primary	core	current	magnetic	electric	wire

A transformer works because an alternating ..... in the ..... coil produces a changing ..... field in the ..... and then in the secondary coil. This induces an alternating current in the ..... coil.

(b) The different coils available to fit the demountable transformer contain **100 turns**, **400 turns**, **800 turns** and **1000 turns**.

(i) The 400 turn coil is connected to the input voltage. State which of the above coils would be used to reduce the output voltage. [1]

..... turns

(ii) State which pair of coils would be used as input and output, to increase the input voltage by the **largest** amount. [2]

Input coil = ... turns Output coil = ... turns

8

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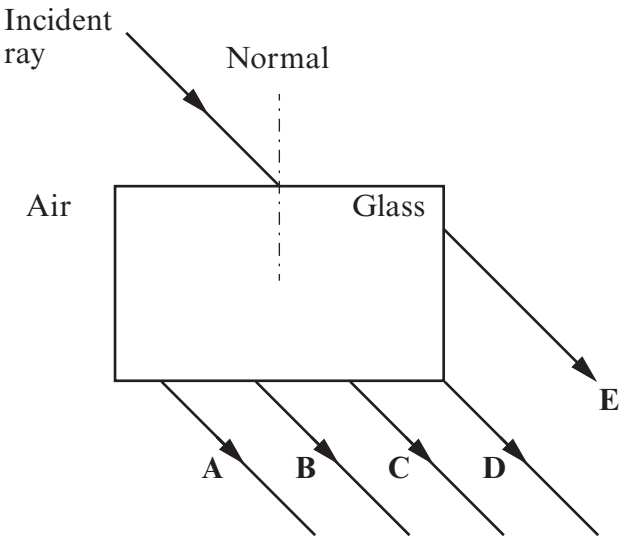
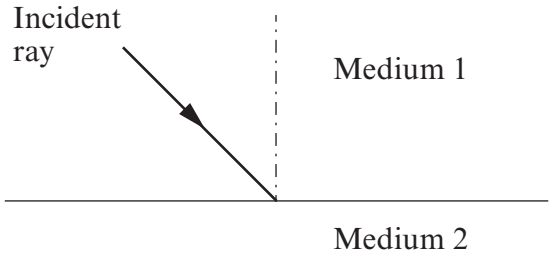
3. *(a)* The diagram shows a ray of light incident on the top surface of a glass block.



(i) This ray comes out of the block as **one** of the five rays: **A**, **B**, **C**, **D** or **E**. **Complete the diagram** to show the correct path of the ray of light **inside** the block. [1]

(ii) **Mark with a cross (x)** the angle of incidence at the top surface of the block. [1]

(b) Light is shone from medium 1 into medium 2. **Medium** 1 and **medium** 2 can be either **air** or **glass**. The critical angle for glass is 42°.



Complete the table below by using the statements in the column heading to identify what happens to the ray of light in each case. [4]

Medium 1	**Medium 2**	**Angle of incidence**	At the boundary, does the ray of light • **refract** • **totally internally reflect** • **travel along the boundary?**
Glass	Air	35°	.....
Air	Glass	42°	.....
Glass	Air	42°	.....
Glass	Air	45°	.....

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Turn over.

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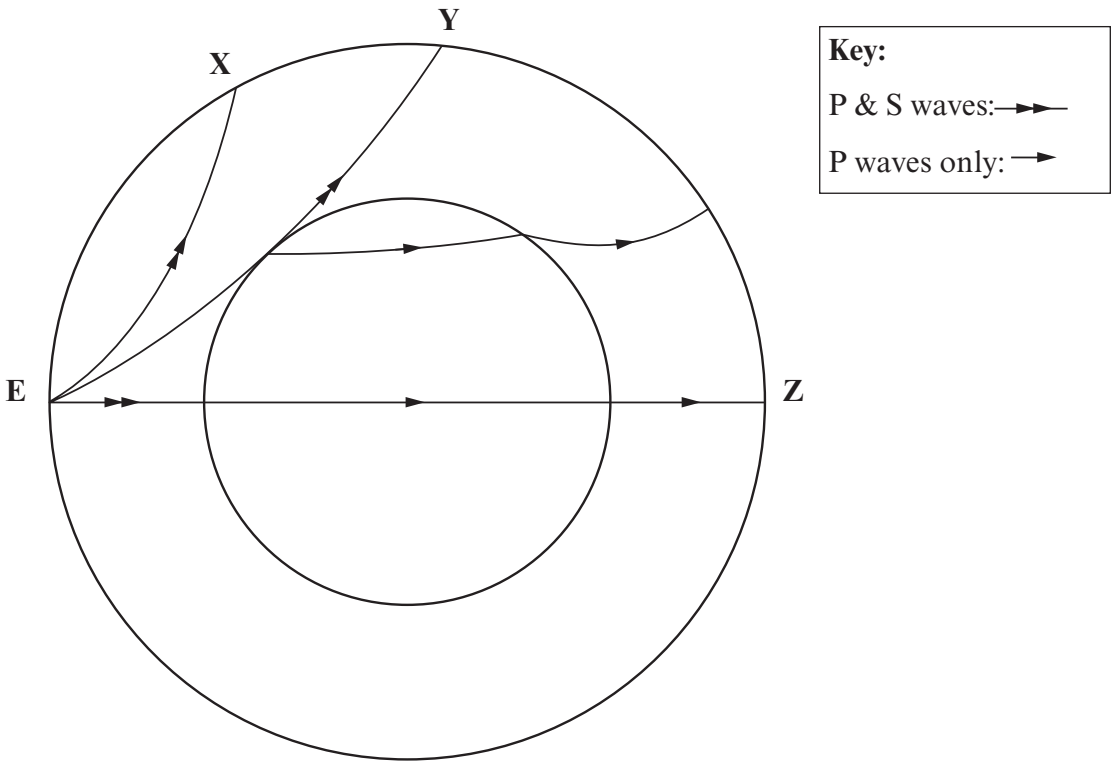
4. The diagram shows the path of P and S waves from an earthquake at **E**. Surface waves are not shown on this diagram. **X**, **Y** and **Z** are stations that detect seismic waves.

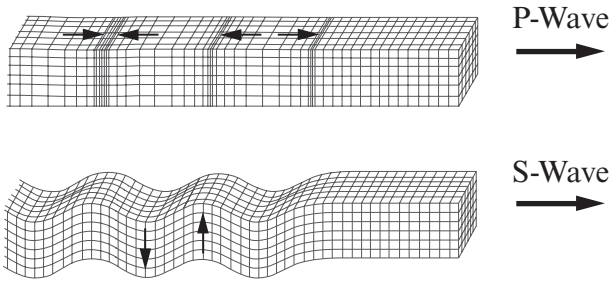


(a) (i) State the difference between surface waves and P and S waves. [1]

.....

.....

(ii) Use the diagram below to help you explain the difference between how the particles move in P and S waves. [2]



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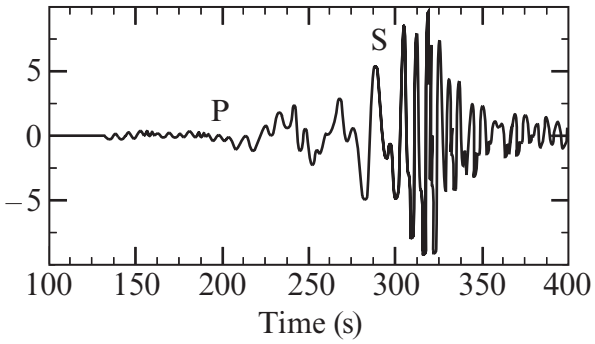
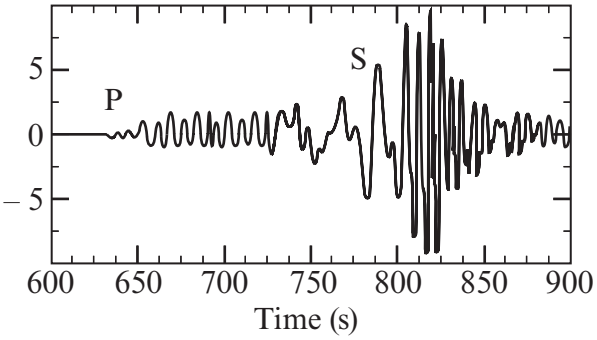
(b) The signals 1, 2 and 3 below were detected at either stations **X**, **Y** or **Z**.

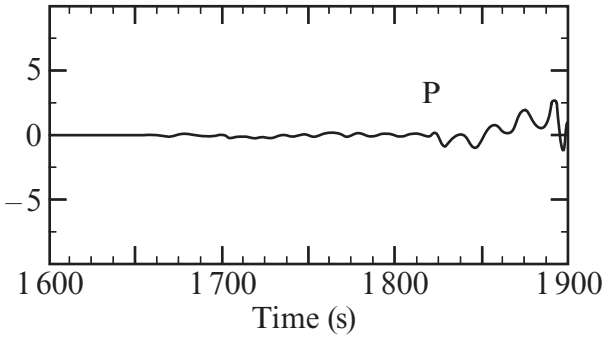
1



2



3



(i) State which signal **1**, **2** or **3** was detected at station **Z**. ..... [1]
Give a reason for your answer. [1]

.....

(ii) State which signal **1**, **2** or **3** was detected at station **Y**. ..... [1]
Explain your choice. [2]

.....

.....

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8

Turn over.

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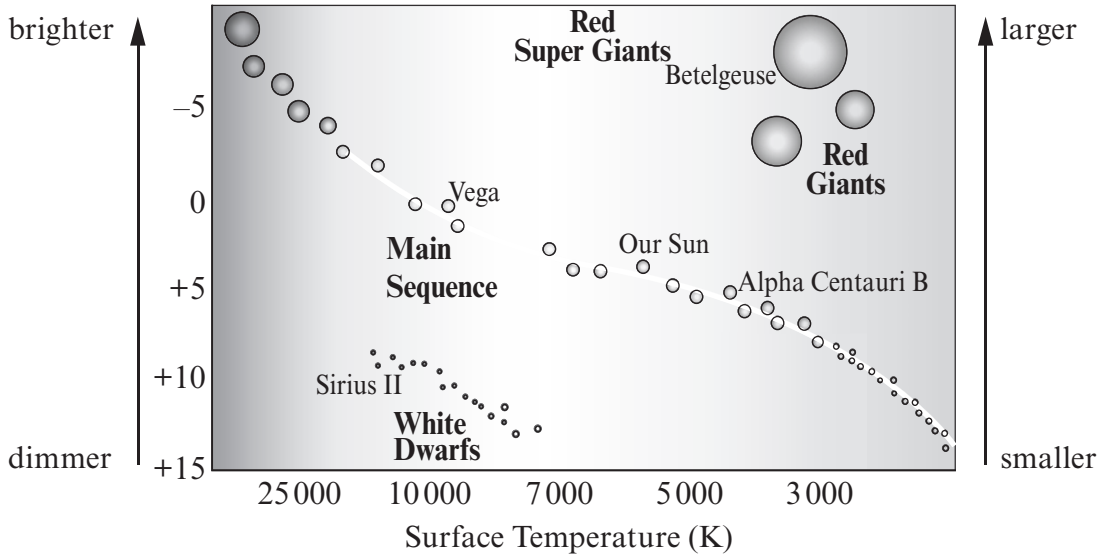
5. In the Hertzsprung-Russell (HR) diagram below, each star is represented by a dot. The position of each dot on the diagram tells us two things about each star: its brightness and its temperature. Stars on the main sequence are stable because their gravitational force and radiation pressure are balanced.



(a) Use the information in the diagram to answer the following questions.

(i) Estimate the surface temperature of our Sun. ..... K [1]

(ii) State **two** differences in the properties of Alpha Centauri B compared with our Sun. [2]

1. .....

2. .....

(iii) State **one** way our Sun and Alpha Centauri B are similar. [1]

.....

(b) (i) What changes will happen in the Sun to cause it to expand to a red giant? [1]

.....

(ii) Use information from the diagram to describe the effect these changes will have on the properties of the Sun. [3]

.....

.....

(c) **Mark** the diagram with an **X** to show where our Sun will end its life. [1]

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6. *(a)* Complete the sentence below. [2]

The law of conservation of momentum states that in a collision or explosion .....

.....

.....

(b) (i) Two cars of equal mass, 800 kg, collide. Before the collision, car **B** is at rest while car **A** has a constant velocity of 15 m/s. In the questions that follow, ignore the effects of friction.

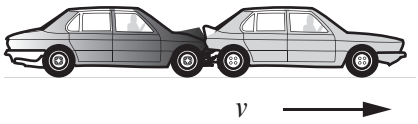
Before collision

Use an equation from page 2 to calculate the momentum of car **A** before the collision. [2]

Momentum = ... kg m/s

(ii) After the collision, the two cars are stuck together.

After collision



Use the equation:

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

to calculate the velocity v of the cars after the collision. [3]

Velocity = ... m/s

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(iii) During the collision, car **A** exerts a force of 16 000 N to the right on car **B**. What force does car **B** exert on car **A** during the collision? [2]

.....

(c) Suppose both cars had been travelling towards each other at the same speed.

(i) What would their velocity be after a head-on collision if they stuck together on impact? [1]

.....

(ii) Explain your answer. [2]

.....

.....

12

Turn over.

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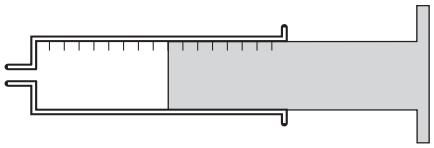
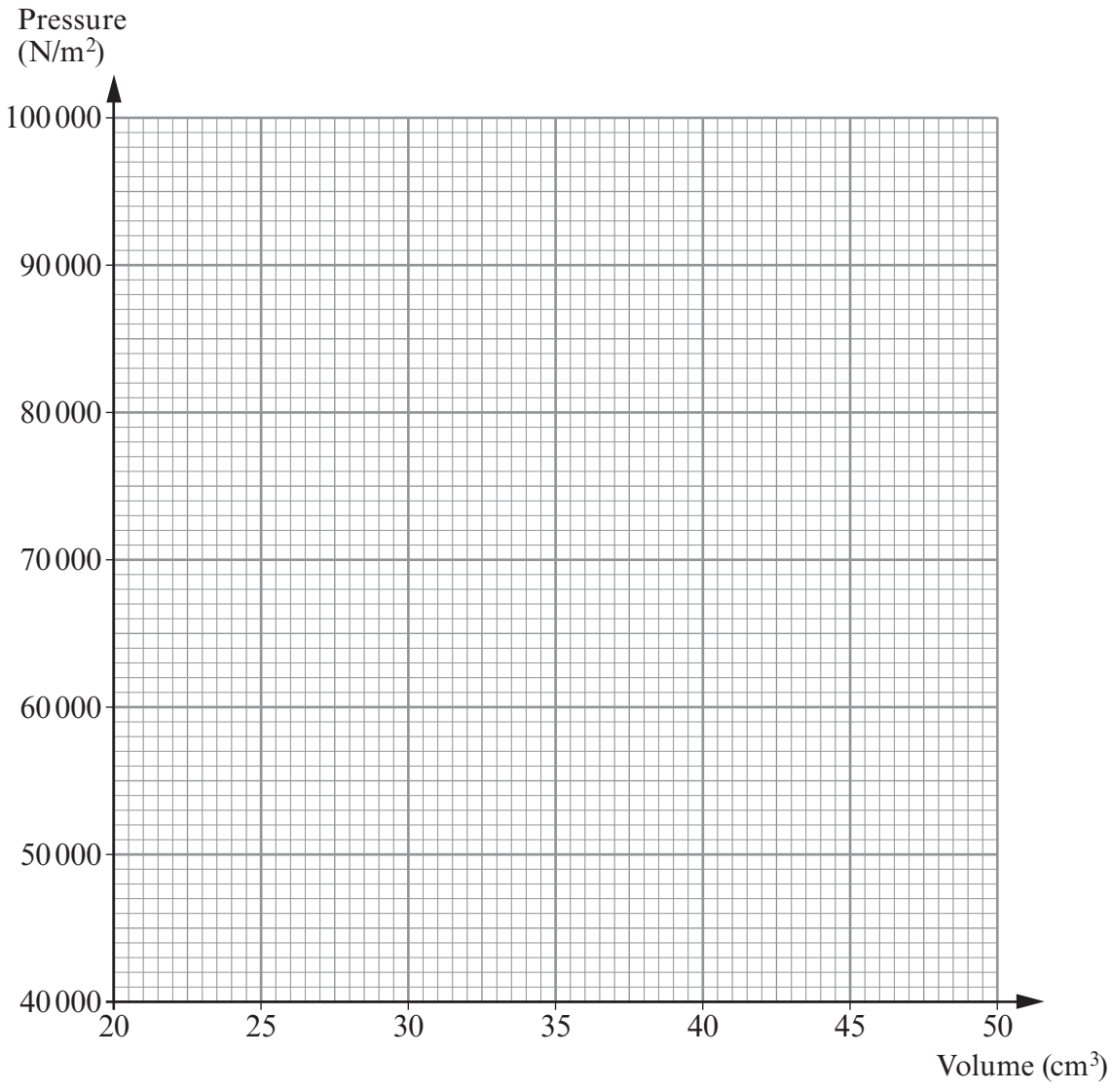
7. A fixed mass of gas is kept at constant temperature in a syringe as shown below.



The gas in the syringe is expanded (made larger) by slowly pulling the plunger out. The table shows the pressure exerted by the gas at different volumes.

Volume (cm^3)	20	25	35	40	50
Pressure (N/m^2)	100 000	80 000	57 000	50 000	40 000

(a) (i) Use the information in the table to **plot a graph** on the grid below. [3]



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(ii) Describe the relationship between the volume and pressure of the gas. [2]

.....

.....

(iii) Use your graph to write down the pressure of the gas when its volume is 30 cm^3. [1]

..... N/m^2

(b) The gas is at constant temperature. Explain in terms of molecular motion and collisions why the pressure changes in the way it does when the volume is increased. (You may want to refer to the diagram on the previous page in your answer.) [6 QWC]

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12

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