Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0247/02

SCIENCE PHYSICS
HIGHER TIER
PHYSICS 3

A.M. THURSDAY, 24 May 2012

45 minutes

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

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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 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

speed = $\dfrac{\text{distance}}{\text{time}}$

$v = u + at$	where	x = distance
		u = initial velocity
$v^2 = u^2 + 2ax$		v = final velocity
$x = ut + \frac{1}{2}at^2$		a = acceleration
$x = \frac{1}{2}(u + v)t$		t = time

$\dfrac{V_1}{V_2} = \dfrac{N_1}{N_2}$	where	V_1 = voltage across the primary
		V_2 = voltage across the secondary
		N_1 = number of primary turns
		N_2 = number of secondary turns

momentum = mass × velocity

kinetic energy = $\dfrac{mv^2}{2}$, where m = mass, v = velocity or speed.

force = $\dfrac{\text{change in momentum}}{\text{time}}$

wave speed = wavelength × frequency

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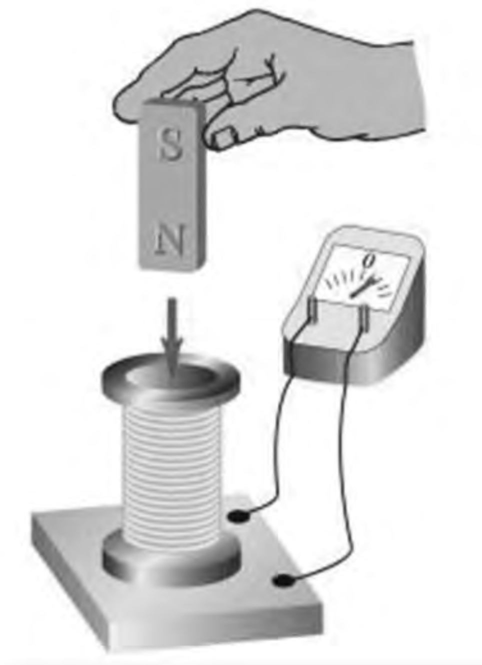
Answer **all** *questions.*

1. *(a)* Electromagnetic induction is investigated using a magnet and a coil of wire.



When the North Pole of the magnet is pushed into the coil, the meter needle flicks to the right and returns to the middle.

(i) Explain these observations. [3]

....

....

....

....

(ii) Complete the following sentences: [2]

When the North Pole is pulled back out of the coil, the meter needle ....

....

....

When the South Pole of the magnet is pushed into the same end of the coil, the meter needle ....

....

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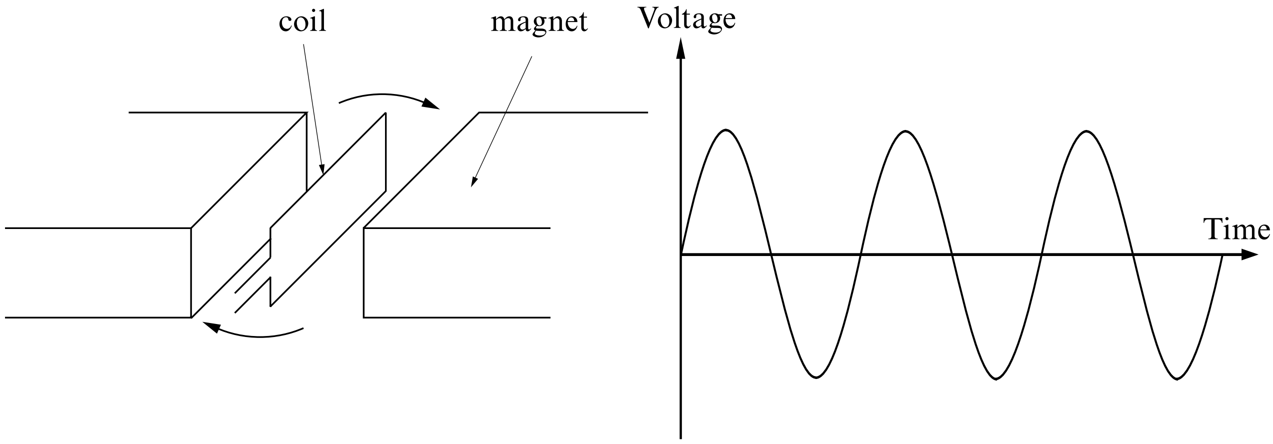
(b) The diagrams show a simple electrical generator and the alternating voltage it produces by electromagnetic induction.



The table below gives changes that could be made to the generator.
For each case, complete the table to show whether the voltage and frequency produced **decreases**, **stays the same** or **increases**. [3]

Change to generator	Effect on voltage	Effect on frequency
More turns on the coil	....	....
Spinning the coil slower	....	....
Using stronger magnets	....	....

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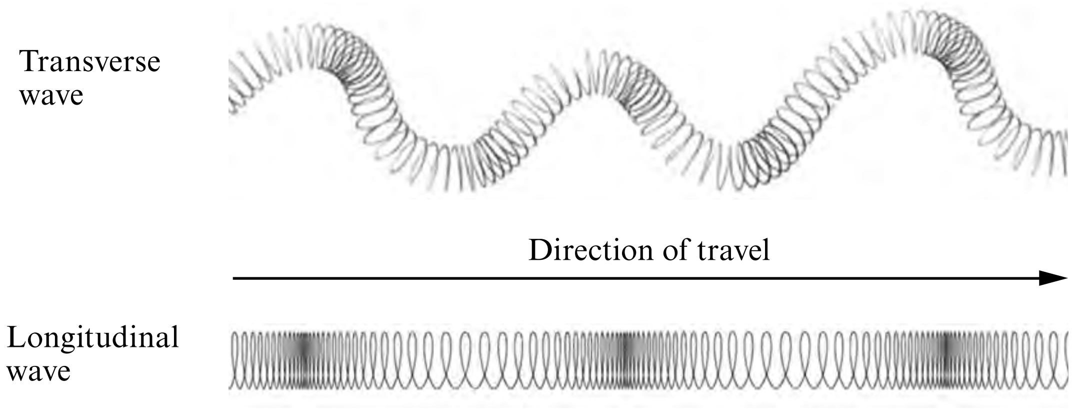
2. *(a)* A slinky spring can be used to demonstrate the difference between longitudinal and transverse waves.



Explain the difference between the two types of waves. [3]

Use the following phrases in your explanation.

at right angles *the vibrations* *are parallel to* *direction of travel*

....

....

....

....

....

....

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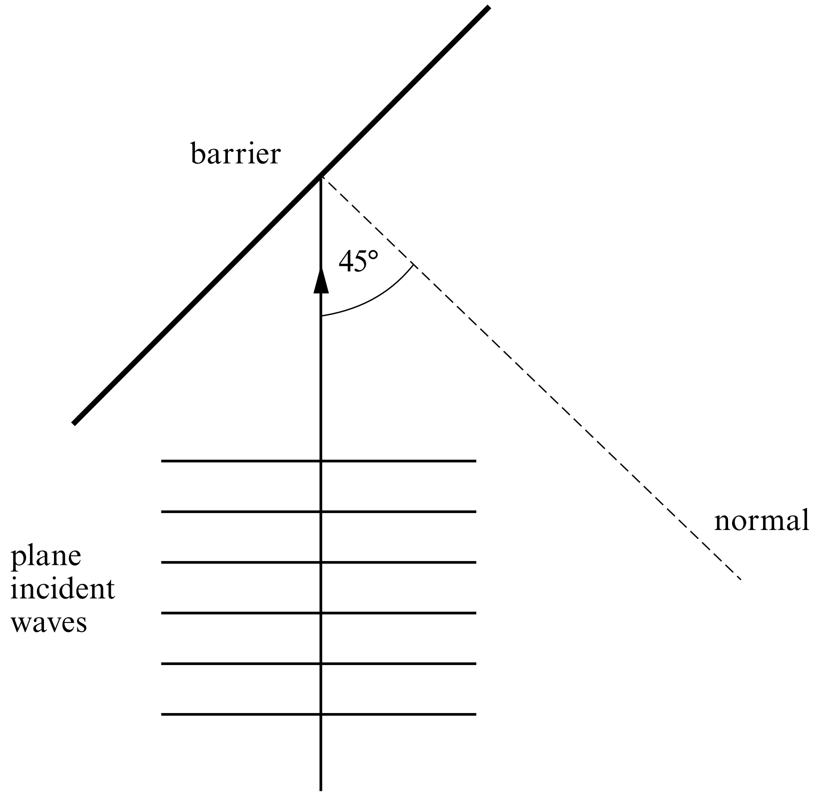
(b) The diagram shows plane waves arriving at a barrier. Complete the diagram to show the path of the reflected waves. [2]



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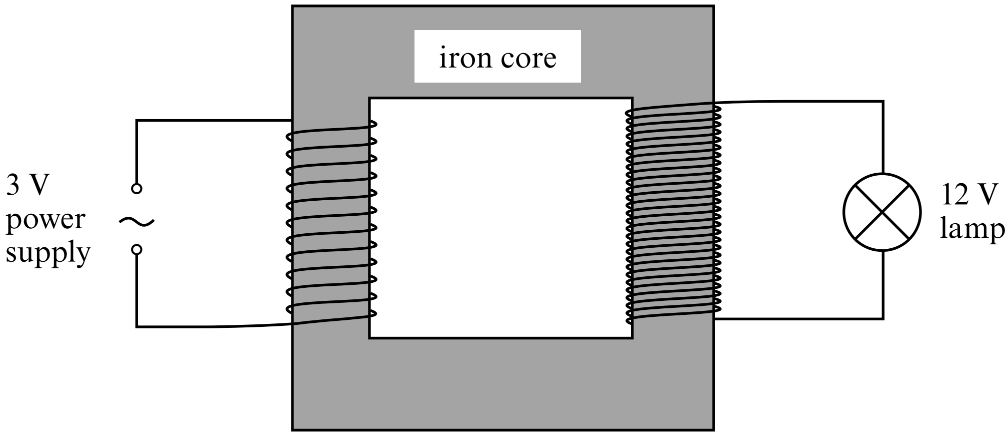
3. The diagram shows a step-up transformer designed to light a 12 V lamp from a 3 V power supply.



(a) (i) How can you tell from the diagram that this is a step-up transformer? [1]

....

....

(ii) Describe the purpose of the iron core. [1]

....

....

....

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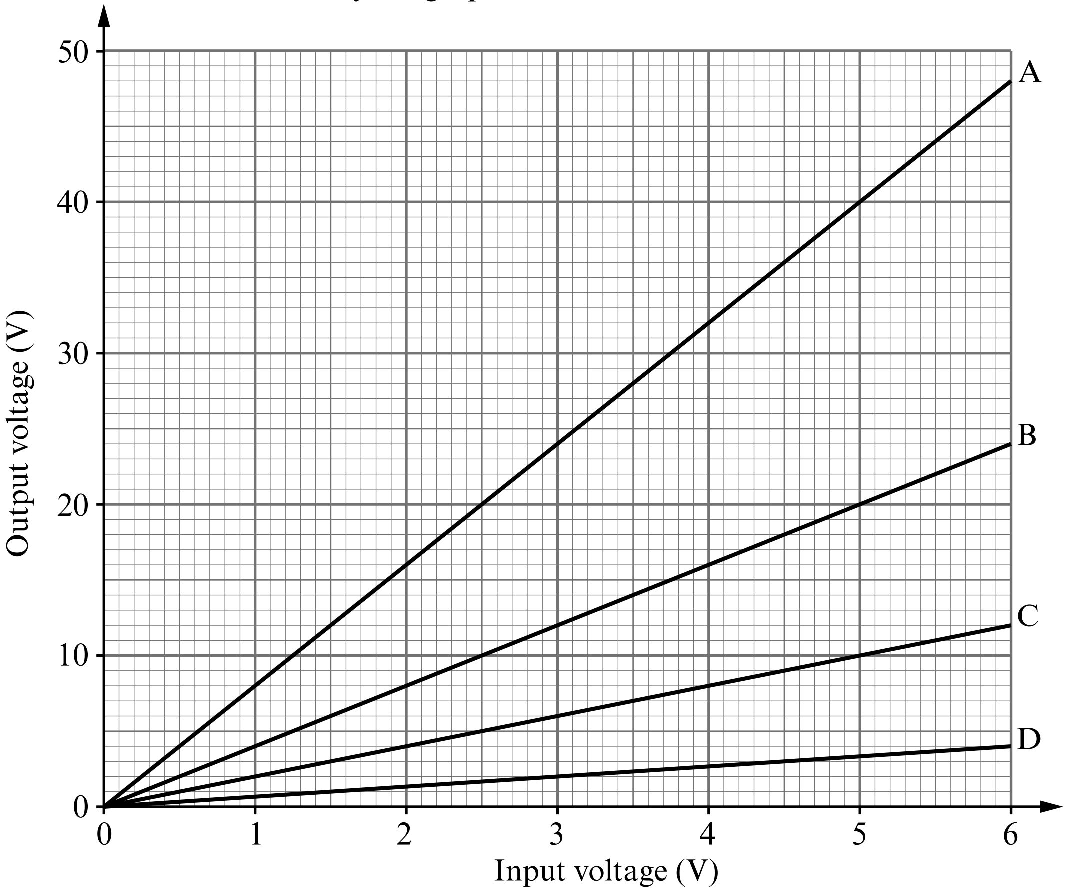
(b) Four different transformers, A, B, C and D are investigated. For each transformer, the input voltage is changed and the output voltage measured each time. The results for each transformer are shown by the graphs.



Use the graphs to answer the following questions.

(i) Which transformer, A, B, C or D, would be used to light the 12 V lamp to normal brightness, from a 3 V supply? [1]

....

(ii) Which transformer is a step-down transformer? .... [1]
Give a reason for your answer. [1]

....

....

(iii) Transformer B contains 50 turns on its primary coil.
Write down an equation from page 2 and use it to calculate the number of turns on its secondary coil.

Equation: .... [1]

Calculation: [3]

Number of turns on secondary coil = ...

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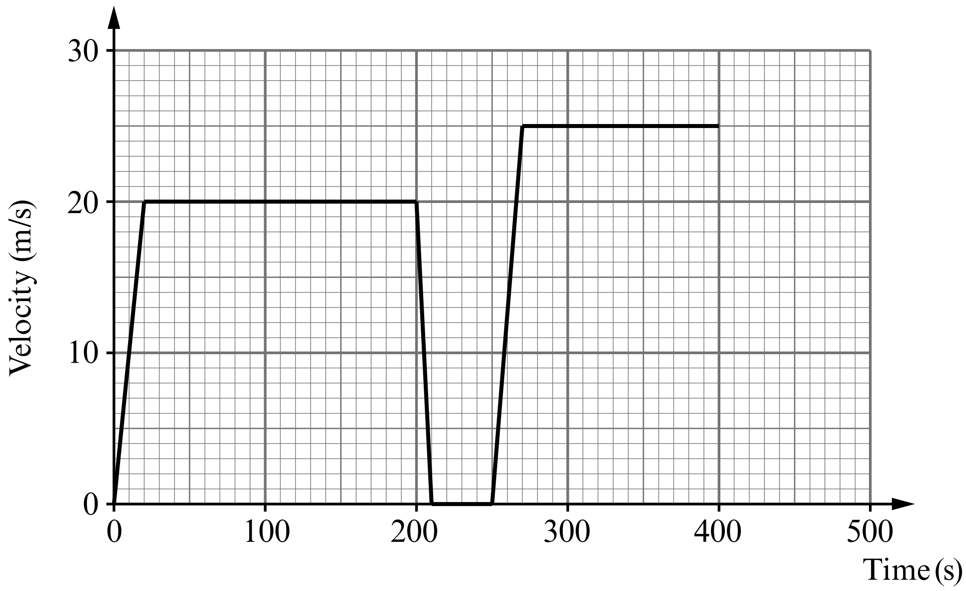
4. The velocity-time graph shows part of the journey of a train.



(a) (i) Using information from page 2, calculate the initial acceleration of the train. [2]

Acceleration = ... m/s^2

(ii) Using information from page 2, calculate the distance travelled in the first 210 s. [2]

Distance travelled = ... m

(b) Between 250 s and 400 s the train travelled a distance of 3500 m.
Using an equation from page 2, calculate the mean speed between 0 and 400 s. [3]

Mean speed = ... m/s

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5. The picture shows ultrasound being used for scanning an unborn baby.

(a) (i) What is ultrasound? [1]

....

....

....

(ii) Explain how the ultrasound produces an image of the baby. [2]

....

....

....

....

(b) Narrow beams of ultrasound can be produced because they have much shorter wavelengths than normal sound. Ultrasound of frequency 6 MHz travels at a speed of 1500 m/s through the body.
Use the equation

wave speed = frequency × wavelength

to calculate the wavelength of the ultrasound waves. [3]

Wavelength = ...m

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6. The photograph shows a collision at traffic lights.

Car **A** was stationary when car **B**, travelling at 5 m/s went into the back of **A**. The collision caused car **B** to slow down to 2 m/s and car **A** to move forward. Car **A** had a mass of 600 kg and car **B** had a mass of 1200 kg.

(a) (i) State the law of conservation of momentum. [1]

....

....

....

(ii) Use the equation

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

and the law of conservation of momentum to calculate the velocity with which car **A** moved off after the collision. [3]

Velocity = ... m/s

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(iii) If the cars were in contact for 0.2 s, use the equation

$$\text{force} = \frac{\text{change of momentum}}{\text{time}}$$

to calculate the force exerted by car **B** on car **A**. [1]

Force = ... N

(iv) Explain how this force would be affected if both cars had been fitted with crumple zones. [2]

....

....

....

....

(b) Using an equation from page 2, calculate the kinetic energy lost by car **B** during the collision. [2]

KE lost = ... J

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TURN OVER FOR QUESTION 7

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7. British scientists have drawn up plans to build the world's first nuclear fusion power station by 2030.

(a) Explain the difficulties that must be overcome in achieving nuclear fusion under controlled conditions. [2]

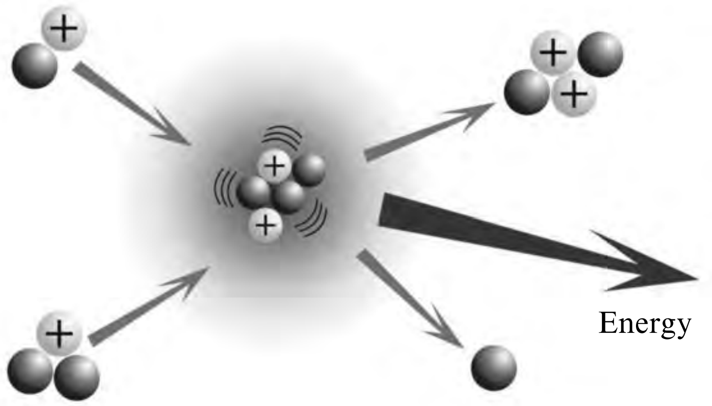
....

....

....

....

(b) The most promising fusion reaction is between two isotopes of hydrogen. These are deuterium and tritium. The reaction between the nuclei is shown in the diagram.



(i) Write down the nuclear equation for this reaction. [2]

.... + ... $\longrightarrow$ .... + ...

(ii) Tritium does not occur in nature. However tritium can be bred by bombarding ${}^{6}_{3}\mathrm{Li}$ with neutrons.

Compare the contents of a ${}^{6}_{3}\mathrm{Li}$ nucleus with those of a tritium nucleus. [2]

....

....

....

....

THERE ARE NO MORE QUESTIONS IN THE EXAMINATION.

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