TONBRIDGE
SCHOOL

Test for Entrance into Year 12 in September 2015

PHYSICS

Time allowed: 45 minutes

Name ……

School……

Candidates should attempt **ALL** questions in Section A and **ANY TWO** questions from Section B

Please indicate below which questions you have chosen :

Question	You have selected this question	Mark
Section A		
Experimental Analysis	√	/15
Multiple Choice	√	/10
Section B		
Momentum		/10
Radioactivity		/10
Forces and Motion		/10
Electricity		/10
Total		/45

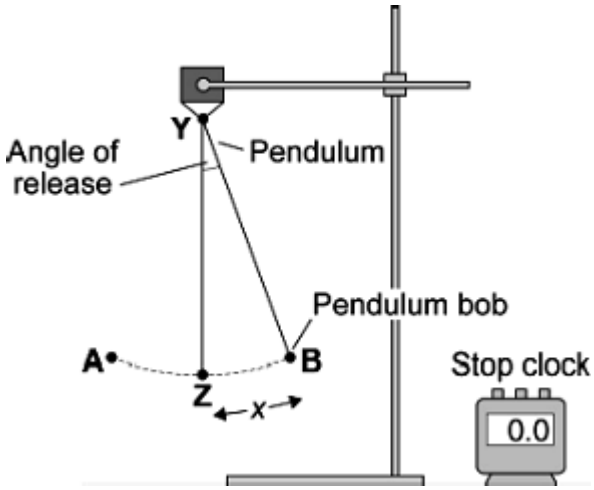
You may find some of the following formulae helpful in the examination.

Area of a circle = πr^2	$Q = I t$
Force = Pressure x area	$PE = m g h$
$F = m a$	$P = I V$
$g = 10 Nkg^{-1}$ or ms^{-2}	$v = s \div t$
$KE = \frac{1}{2} m v^2$	$V = I R$
$\triangle Q = m c \triangle T$	$W = Fd$
$P_1V_1 = P_2V_2$	$P_1/T_1 = \text{constant}$
$p = mv$	

Section A : Answer ALL questions in this section

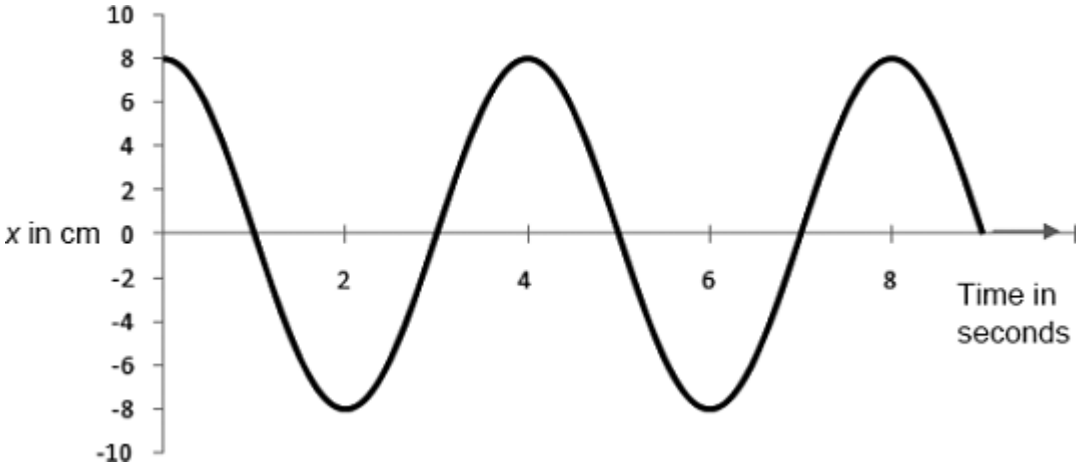
Analysis of an Experiment – no previous knowledge of this experiment is needed.

Q1.(a) A pendulum is a device that can be used for timing. Some clocks rely on the swing of a pendulum to keep time. The pendulum shown in the diagram below is suspended from point **Y** and swings from **A** to **B**, through the centre point **Z**.



Amplitude is the height of the wave from the midpoint (shown as Z above) and the amplitude can be taken to either point A or point B.

The displacement *x* of the pendulum bob was plotted against time as shown in the graph below.



By analysing the evidence in the graph, find the amplitude of the oscillation of the pendulum and the time period of the pendulum.

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.....**(3)**

(b) A student carried out an investigation to find out how the time period of the pendulum depends on the length of the pendulum.

During the investigation she kept the mass of the pendulum bob and the angle of release constant. Her data is recorded in **Table 1**.

Table 1

	Length of pendulum in metres	**Time for 10 swings in seconds**	**Time period in seconds**
1	0.20	9.2	0.92
2	0.40	12.8	1.2
3	0.60	15.0	1.50
4	0.80	18.0	1.80
5	1.00	20.0	2.00

(i) Explain why the student timed ten swings, rather than just timing one swing, for each length of pendulum.

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.....**(2)**

ii) Describe the steps that the student would take to obtain the data shown in Table 1.

In your description, comment on the number of decimal places and significant figures the student has used in each column.

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.....**(6)**

(iii) The student also carried out two more pendulum investigations. During the second investigation she kept the length of the pendulum and the angle of release constant. The data for this investigation is recorded in **Table 2**.

Table 2

	Mass of pendulum bob in grams	Time for 10 swings in seconds	Time period in seconds
1	2.5	20.0	2.00
2	5.0	20.3	2.03
3	7.5	20.1	2.01
4	10.0	20.0	2.00
5	12.5	20.2	2.02

During the third investigation she kept the length of the pendulum and the mass of the pendulum bob constant. The data for this investigation is recorded in **Table 3**.

Table 3

	Angle of release in degrees	Time for 10 swings in seconds	Time period in seconds
1	2	20.4	2.04
2	4	20.2	2.02
3	6	20.0	2.00
4	8	20.3	2.03
5	10	20.1	2.01

What conclusions can be made from the data recorded in **Table 1**, **Table 2** and **Table 3**?

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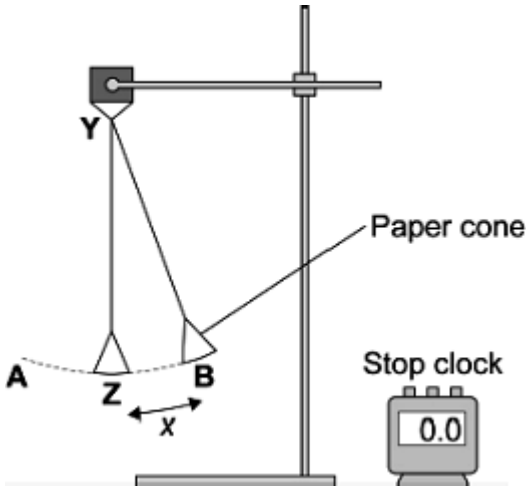
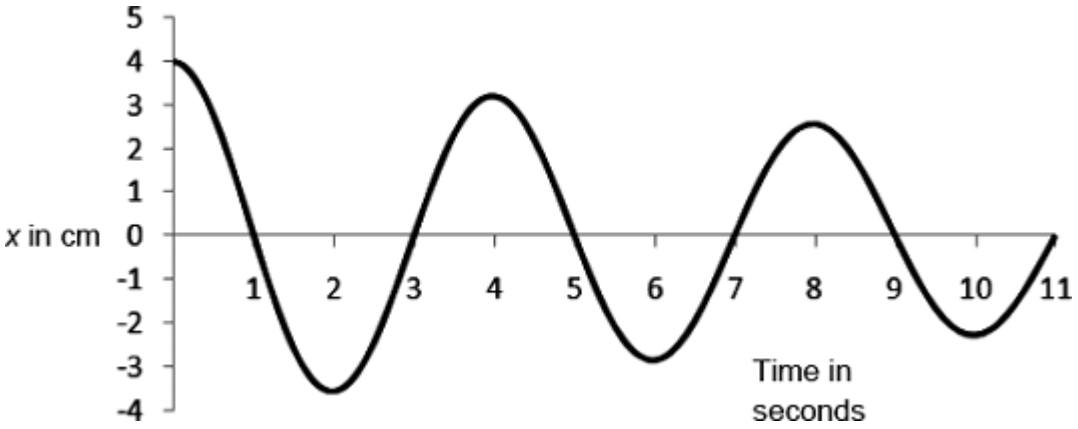
(2)

(c) The student replaced the pendulum bob with a light paper cone as shown in the diagram.



She plotted the displacement *x* of the pendulum bob against time as shown in the graph below.



The student concluded that the frequency of this pendulum decreased with time.
Does the graph support her conclusion?

Explain the reason for your answer.

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(2)

(Total 15 marks)

Multiple Choice (answer all questions)

Circle the correct Answer

1. The Earth is a distance of 1 Astronomical Unit (1 AU) from the Sun.
In these units the speed of the Earth in its orbit around the Sun is:

A. 1.00 AU / year

B. 2π AU / week

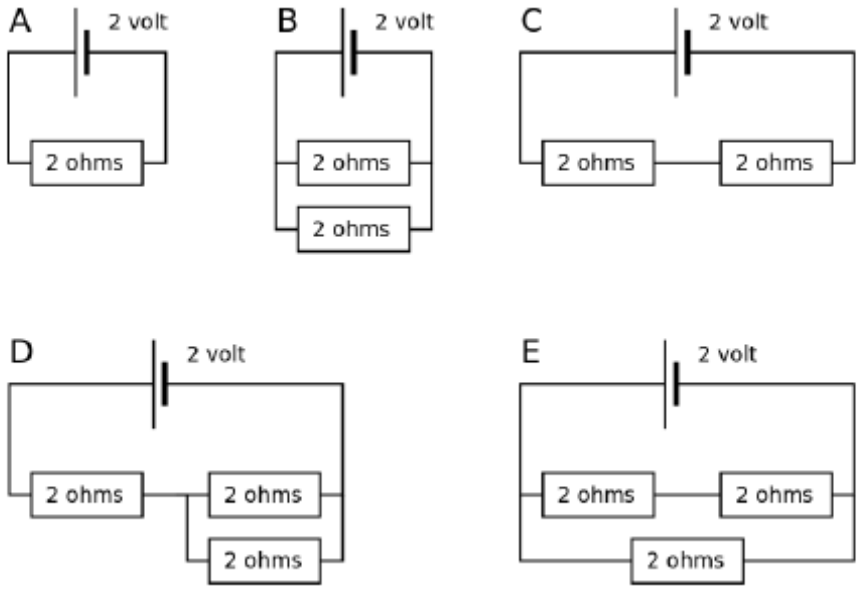
C. 0.017 AU / day

D. 0.26 AU / hour

E. 1.99×10^{-7} AU / min

(2 marks)

2. Consider the circuits shown below.
In which circuit is the current flowing through the cell the largest?



(2 marks)

3. The 3rd floor observation deck of the Eiffel tower is about 280 m above street level. Assuming that the acceleration due to gravity is 10 m/s^2 and that air resistance can be ignored, the speed of a coin dropped off the observation deck when it hits the street below is:

A. 280 m/s

B. 75 m/s

C. 28 m/s

D. 10 m/s

E. Cannot be determined without knowing the mass of the coin

(2 marks)

4. A group of explorers near the equator leave base camp and travel 7km North and then 2km East and then finally 5km South. They then realise that they are late for dinner! In what direction should they travel to return directly to base camp?

A. West
B. South West
C. South
D. South East
E. North East

(2 marks)

5. When a gas in a sealed container (which cannot expand) is heated the pressure increases.

This is because:

i. The particles of the gas hit the container walls more often
ii. The particles of the gas hit the container walls harder
iii. The particles of the gas have more potential energy

A. i) only
B. ii) only
C. iii) only
D. i) and ii) only
E. ii) and iii) only

(2 marks)

Section B: Answer ANY TWO of the following four questions

Momentum

Q1.(a) What is meant but the term "conservation of momentum"?

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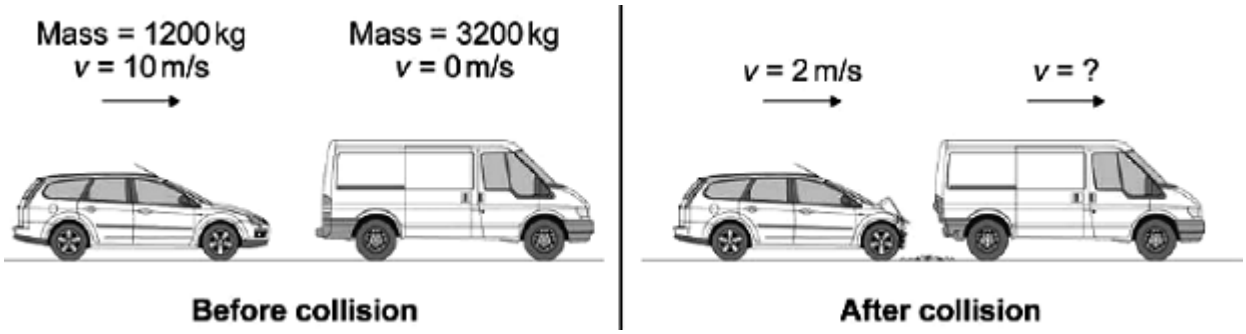
(1 mark)

(b) 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 forward after the collision.

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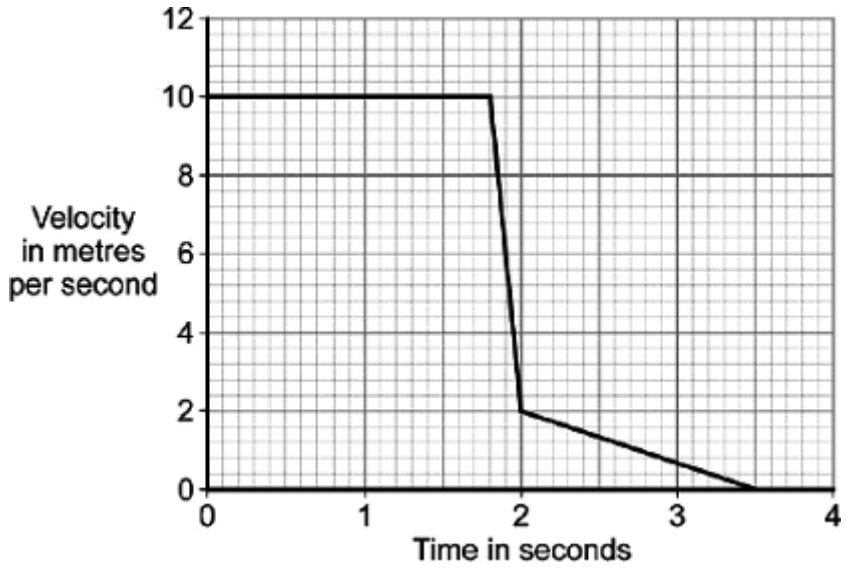
Velocity = ... m/s

(4 marks)

(c) 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.

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Distance = ... m

(2 marks)

(d) 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. Marks will be awarded for clear explanation in terms of Physics.

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(3 marks)

(Total 10 marks)

Radioactivity

Q2.(a) Describe an experiment to distinguish between the three different types of radiation. Please draw a diagram if it helps to illustrate your point.

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(4 marks)

(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, what is an isotope?

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.....**(2)**

(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.

Explain why technetium-99 is the most appropriate source to use

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.....(4)

(Total marks 10)

Forces and Motion

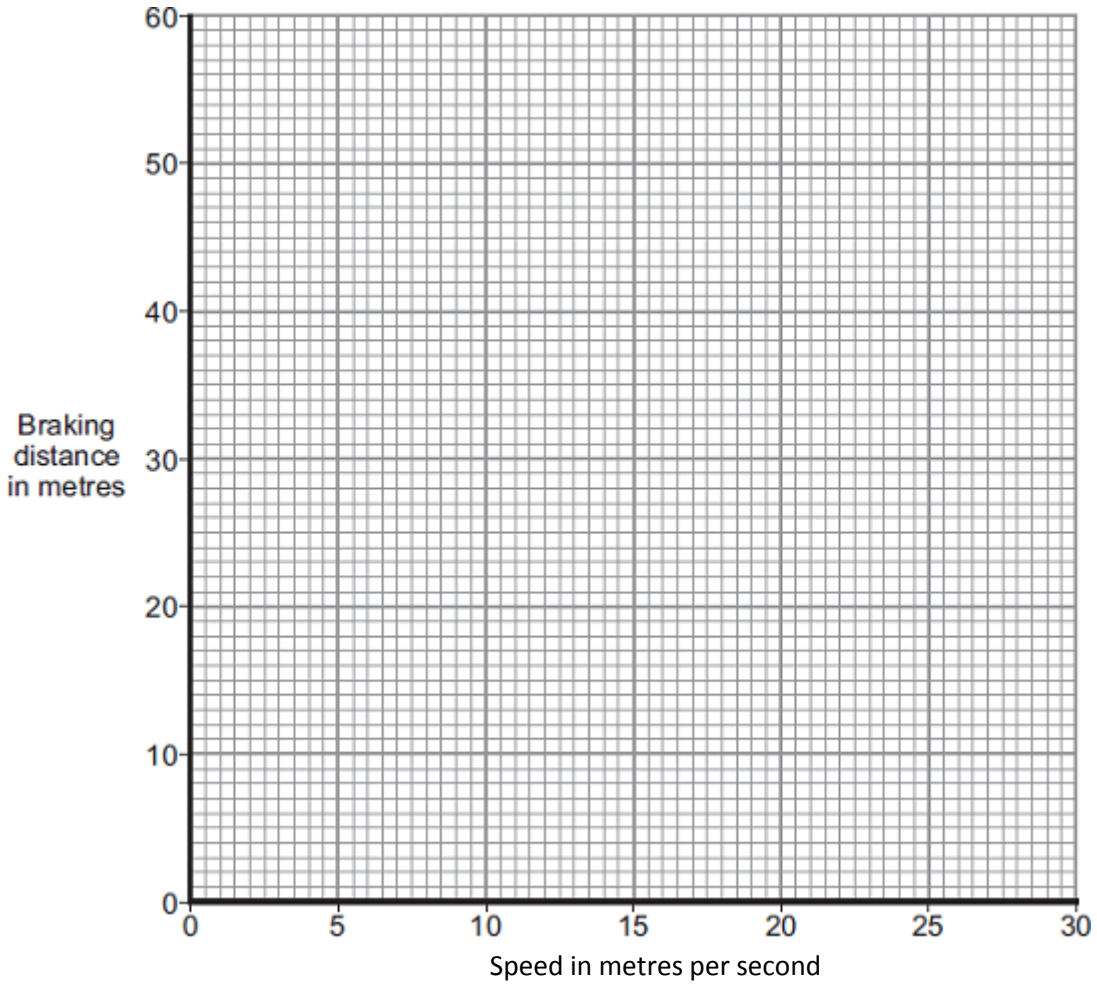
Q3. An investigation was carried out to show how thinking distance, braking distance and stopping distance are affected by the speed of a car.

The results are shown in the table.

Speed in metres per second	Thinking distance in metres	Braking distance in metres	Stopping distance in metres
10	6	6	12
15	9	14	23
20	12	24	36
25	15	38	53
30	18	55	73

(a) Using the results from the table, plot a graph of braking distance against speed.

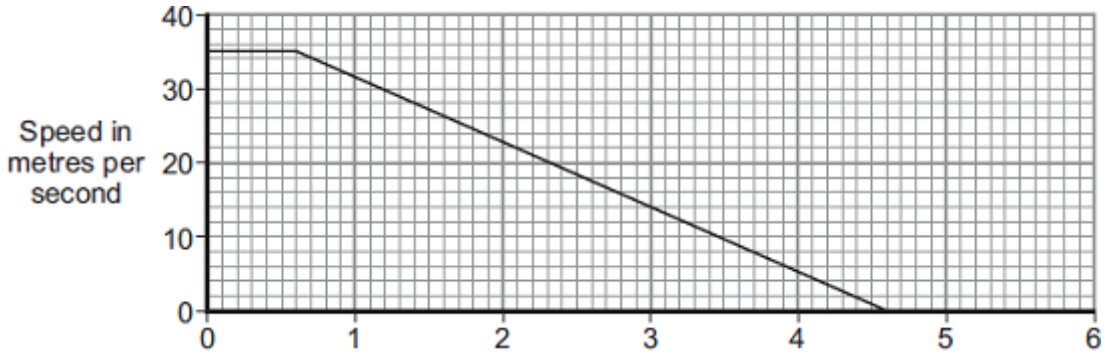
Draw a line of best fit through your points.



(2)

(b) The speed–time graph for a car is shown below.

While travelling at a speed of 35 m / s, the driver sees an obstacle in the road at time $t = 0$. The driver reacts and brakes to a stop.



Determine the braking distance.

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Braking distance = ... m

(3)

(c) A car of mass 1200 kg is travelling with a velocity of 35 m / s.

(i) Calculate the momentum of the car. Remember to include the unit.

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Momentum = ...

(3)

(ii) The car stops in 4 seconds.

Calculate the average braking force acting on the car during the 4 seconds.

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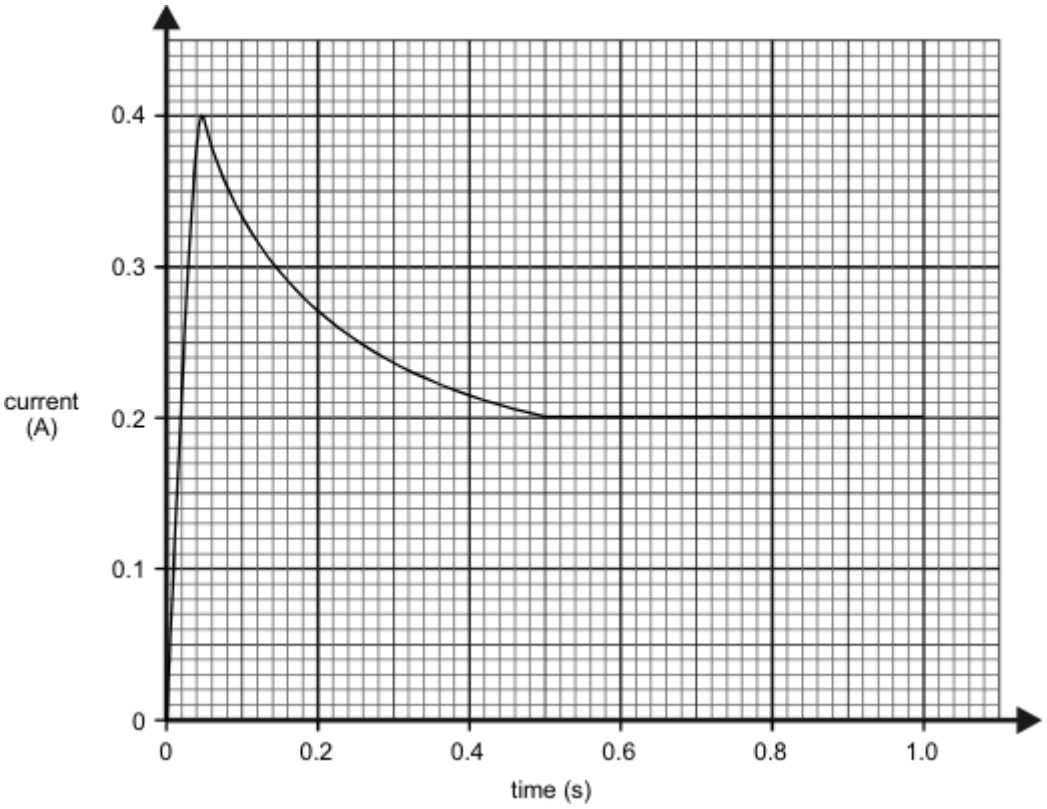
Force = ... N

(2)

(Total 10 marks)

Electricity

Q4. When a mains lamp is switched on it takes 0.5 seconds for the filament to reach its normal operating temperature. The way in which the current changes during the first second after switching on is shown in the sketch graph below. Mains voltage is 240 V.



(a) Calculate the resistance of the filament whilst the lamp is drawing the **maximum** current.

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(3)

(b) Describe how the resistance of the lamp changes after the current has reached its maximum value.

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(2)

(c) Calculate the **maximum** power taken by the lamp.

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(2)

(d) Calculate the energy used by the lamp in six hours of normal use.

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(3)

(Total 10 marks)

END OF PAPER