PHYSICS INDUCTION ASSIGNMENT

NAME	

There is no time limit for this assignment, but it should be completed by the first day of lessons.

YOU ARE EXPECTED TO USE A BOOK OR WEBSITE TO LOOK UP RELEVANT MATERIAL

e.g. CGP Revision Guides

http://www.s-cool.co.uk/

http://www.bbc.co.uk/schools/gcsebitesize/science/

You should answer all the questions in the space provided.

The marks for questions are shown in brackets.

Set out your answers clearly, showing substitution into appropriate formulae – you will not gain full marks for a question if you only give the end answer.

Units should be given wherever appropriate.

You are expected to use a calculator where appropriate.

Select appropriate formulae from the list given.

Question	Mark	Out of
1		3
2		8
3		6
4		9
5		6
6		16
7		11
8		7
9		6
TOTAL		72
%		

The following formulae may be useful:

ELECTRICITY

current and pd $I = \frac{Q}{t}$ $V = \frac{W}{Q}$ $R = \frac{V}{I}$

power $P = VI = I^2R = \frac{V^2}{R}$

MECHANICS

velocity and acceleration $v = \frac{s}{t}$ $a = \frac{\text{change in } v}{\text{time taken}}$

equations of motion $v = u + at$ $s = \frac{(u+v)}{2}t$

work, energy and power $E_K = \frac{1}{2} m v^2$ $E_P = mgh$

$P = \frac{W}{t}$, $P = Fv$

$\text{efficiency} = \frac{\text{useful output power}}{\text{input power}}$

WAVES

wave speed $c = f\lambda$ *period* $T = \frac{1}{f}$

Where

I is current

Q is charge

t is time

P is power

V is potential difference (voltage)

R is resistance

v is velocity(final)

u is velocity(initial)

a is acceleration

W is work done/energy transferred

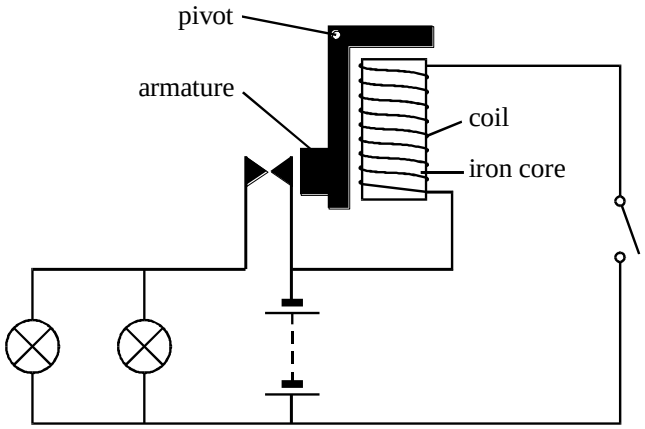
h is height

c is wave speed

f is frequency

T is period

1. In a motor vehicle, a relay is used to switch the 12 V, 60 W headlights on and off. The diagram shows the circuit.



The resistance of the relay coil is 150 Ω.
Calculate the current in the relay coil when it is connected to a 12 V supply.

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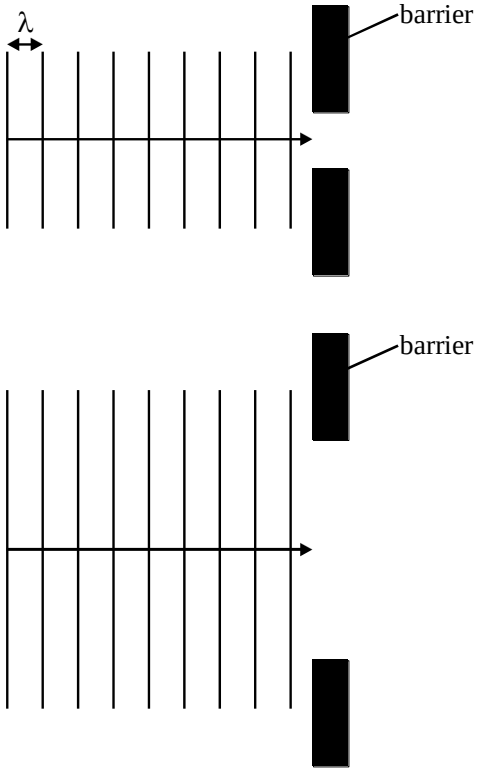
(3 marks)

2. Sound waves are diffracted when they pass through a gap in a barrier.

(a) (i) Complete the diagrams below to show how diffraction depends on the size of the gap.



(ii) What other factor affects the diffraction of a wave passing through a gap?

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(5 marks)

(b) A typical frequency of sound used for speech is 1000 Hz. The speed of sound in air is 330 m/s.

(i) Show that sound with a frequency of 1000 Hz has a wavelength of 0.33 m in air.

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(3 marks)

3. (i) A cyclist and her cycle have a total mass of 85 kg.
Calculate the combined kinetic energy of the cyclist and cycle when travelling at a speed of 12 m/s.

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(3 marks)

(ii) The kinetic energy of the cyclist and cycle increases at an average rate of 180 joules per second.
Calculate the time it takes to gain this energy.

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(3 marks)

4. (a) An electric motor is used to raise a mass of 1.5 kg through a vertical height of 1.2 m.
The load is raised at a steady speed.

(i) Calculate the increase in gravitational potential energy of the load when it is raised through 1.2 m.
The gravitational field strength is 9.8 N/kg.

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(3 marks)

(ii) The time taken to raise the load is 4.0 s.
Calculate the power output of the electric motor as it raises the load.

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(3 marks)

(iii) The input power to the motor as it raises the load is 30W.
Calculate the efficiency of the motor.

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(2 marks)

(b) Suggest a reason why the power given out by the motor is less than the power put in.

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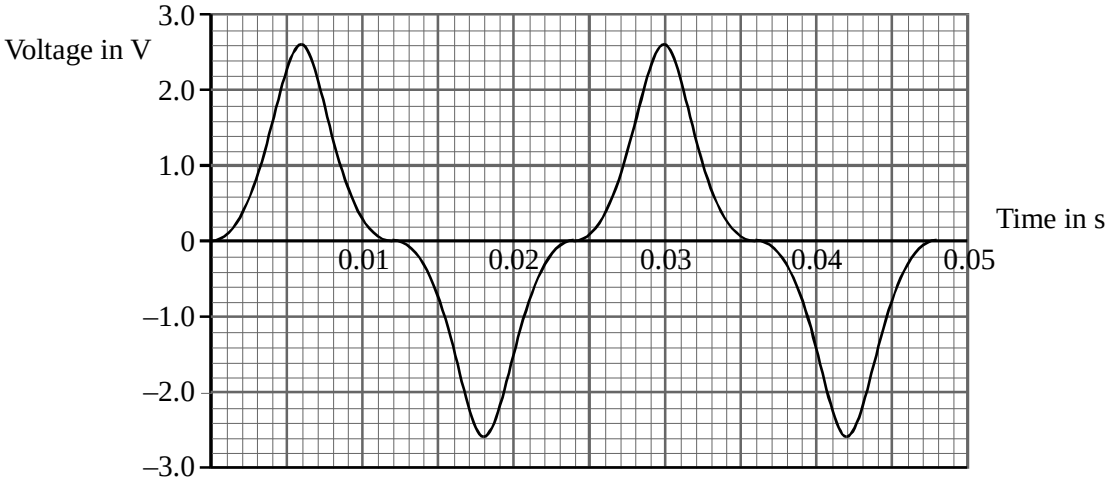
(1 mark)

5. (a) The graph shows how the output voltage of a bicycle dynamo changes with time.



(i) How can you tell that the dynamo produces an alternating voltage?

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(1 mark)

(ii) Use the graph to write down the values of

the amplitude of the voltage.....

the period of the voltage.....

(2 marks)

(iii) Calculate the frequency of the alternating voltage.

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(3 marks)

6. When an athlete attempts to jump over a horizontal hurdle he pushes down on the ground.

(a) Describe the force that causes the athlete to move upwards.

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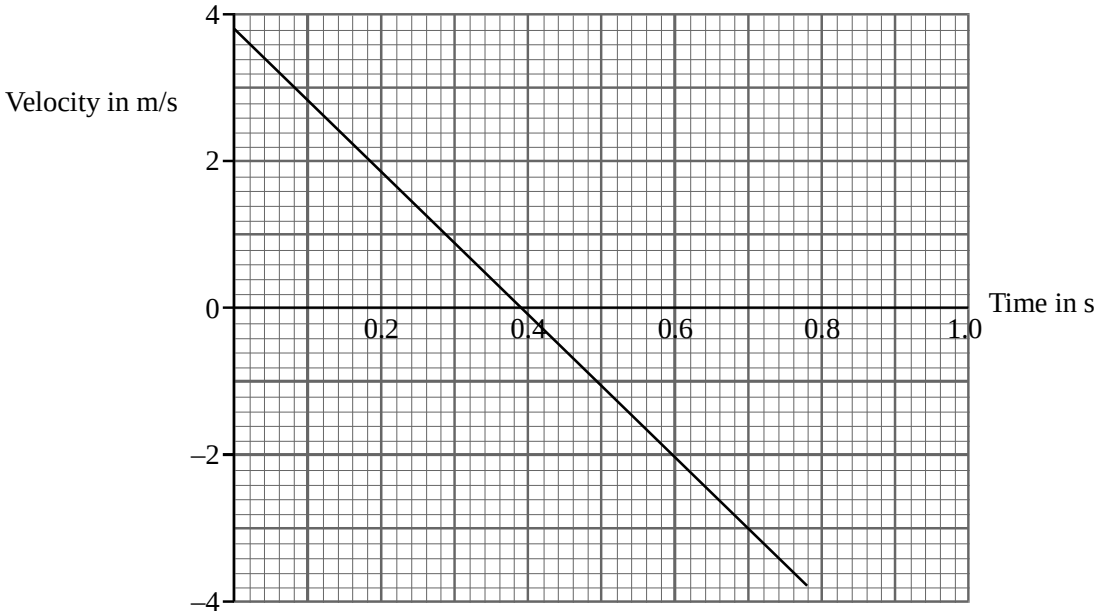
(2 marks)

(b) The graph shows how the upwards velocity of the athlete changes after leaving the ground.



(i) After what time does the athlete reach his maximum height?

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(1 mark)

(ii) What height does the athlete reach?

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(4 marks)

(iii) Calculate the acceleration of the athlete.

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(3 marks)

(iv) What is the direction of the acceleration?
Explain how you can tell from the graph.

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(2 marks)

(v) The mass of the athlete is 65 kg.
Calculate the force required to cause this acceleration.

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(3 marks)

(vi) Name the force that causes the athlete's acceleration.

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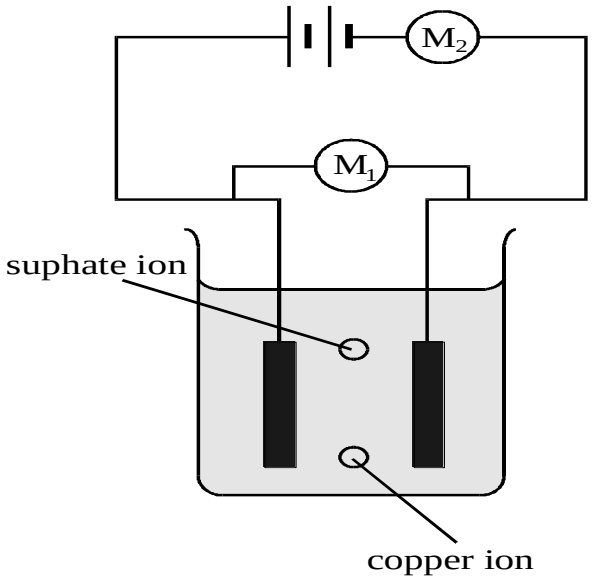
(1 mark)

7. The diagram shows the arrangement used for copper-plating an object. The electrolyte used is copper sulphate which when dissolved in water produces positive copper (Cu^{2+}) ions and negative sulphate (SO_4^{2-}) ions.



(a) (i) On the diagram, add arrows to show which way the ions move.

(1 mark)

(ii) Which meter reading shows that the ions are moving through the electrolyte? Explain your answer.

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(2 marks)

(b) In an electrolysis experiment, a voltage of 6 V produced a current of 0.5 A. The current passed for 5 minutes.

(i) Calculate the charge passing through the electrolyte during this time.

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(3 marks)

(ii) The charge on a copper ion (Cu^{2+}) is 3.2×10^{-19} coulombs. Calculate the total number of copper ions moving through the electrolyte in 5 minutes.

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(2 marks)

(iii) How much energy is used in moving each copper ion through the electrolyte?

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(**(3 marks)**

8. The table shows some information about the electromagnetic spectrum

Low frequency — High frequency

radio waves	micro-waves	infra-red	light **A** **B**	ultraviolet	X-rays	gamma rays

(a) State **two** characteristics of all electromagnetic waves.

1 .....

2 .....

(2 marks)

(b) (i) What is the colour of the light at **A**?

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(1 mark)

(ii) What is the colour of the light at **B**?

.....

(1 mark)

(c) (i) If the speed of light is 3.0×10^8 m/s, calculate the wavelength of an electromagnetic wave of frequency 4.0×10^{12} Hz

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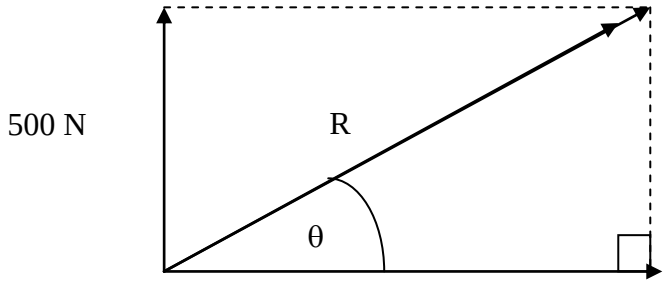
(3 marks)

9. The diagram shows two forces acting on a body. The diagonal (which is the hypotenuse of a right-angled triangle) represents the resultant (overall) force.
Calculate the resultant force, R.



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(3 marks)

Calculate the angle θ

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(3 marks)