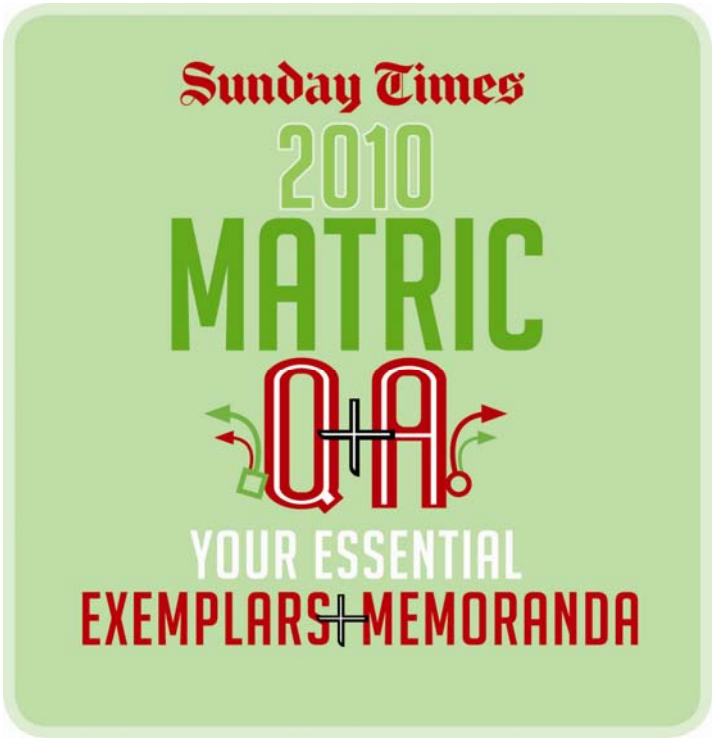


**PHYSICAL SCIENCES PAPER 1 QUESTIONS**

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**SECTION A**
**QUESTION 1: ONE-WORD ITEMS**
Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number (1.1 – 1.5).

1.1 The product of the net force and the time during which the force is applied on an object. (1)
1.2 The law that states that: The sum of the potential energy and kinetic energy before – is equal to the sum of the potential energy and kinetic energy after –. (1)
1.3 The splitting of white light into separate colours. (1)
1.4 Radiation which is commonly associated with heat or thermal radiation. (1)
1.5 The law that states that: The EMF induced in a conductor is proportional to the rate at which the conductor cuts through the magnetic field lines. (1)**[5]**

**QUESTION 2: FALSE ITEMS**
Each of the five statements below is FALSE. Correct each statement so that it is TRUE. Write only the correct statement next to the question number (2.1 – 2.5).
NOTE: Correction by using the negative of the statement, for example "… IS NOT …", will not be accepted.

2.1 When a ball is thrown vertically upwards, at its highest point it experiences no force. (2)
2.2 When the speed of an object doubles, the kinetic energy of the object also doubles. (2)
2.3 When white light passes through the cool vapour of an element and is observed through a diffraction grating, an emission spectrum is observed. (2)

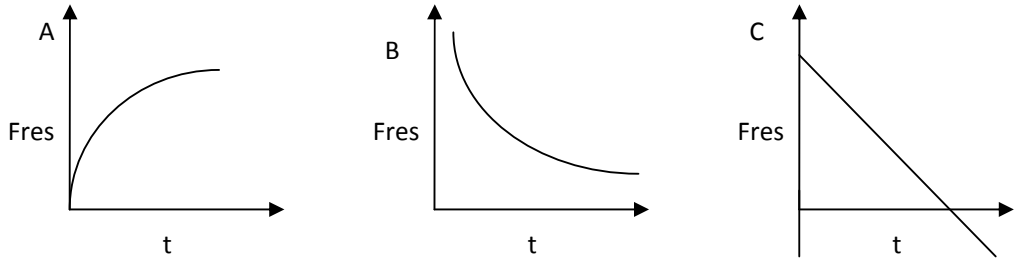
2.4 The largest potential difference would be across the resistor that has the smallest electrical resistance. (2)

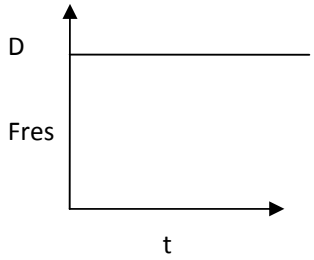
2.5 The rms current is the peak current that will flow in a coil of a generator during one cycle. (2)**[10]**

**QUESTION 3: MULTIPLE-CHOICE QUESTIONS**

Four options are given as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A to D) next to the question number (3.1 – 3.5).

3.1 Which of the following force/time graphs represent the resultant force experienced by an object that falls from a great height and reaches terminal velocity before striking the ground. **Take down as positive.**

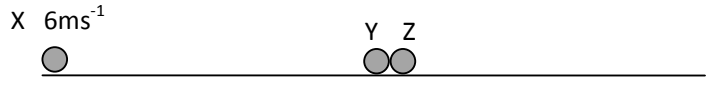



3.2 An astronaut with mass m has a weight W on earth. What will his/her mass and weight be on Jupiter if the gravitational acceleration of Jupiter is 24 times that of the earth?

| | Mass | Weight |
|---|---|---|
| A | M | 24W |
| B | 24m | $\frac{W}{24}$ |
| C | $\frac{m}{24}$ | W |
| D | M | $\frac{W}{24}$ |

3.3 Snooker ball X initially moves with a horizontal velocity of 6ms$^{-1}$ to the right and collides with two identical snooker balls Y and Z which are stationary.




If both momentum and kinetic energy are conserved in the collision, indicate which answer correctly gives the horizontal velocity in ms$^{-1}$ for the three snooker balls after the collision:

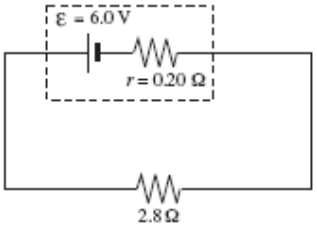
| | X | Y | Z |
|---|---|---|---|
| A | 0 | 0 | 0 |
| B | 0 | 2 | 4 |
| C | 2 | 2 | 2 |
| D | 0 | 0 | 6 |

3.4 Two metal spheres X and Y on insulated stands are placed 10 cm apart. A charge of $4\mu C$ is placed at X and a charge of $-6\mu C$ is placed at Y. Z is 5 cm away from Y. The electric field strength at point Z due to the charge on Y only is...

X O $4\mu C$ Y 10cm $-6\mu C$ O Z 5cm

A $2{,}16 \times 10^7\ NC^{-1}$ towards Y
B $2{,}16 \times 10^7\ NC^{-1}$ towards X
C $0{,}16 \times 10^7\ NC^{-1}$ towards Y
D $0{,}16 \times 10^7\ NC^{-1}$ towards X

3.5 What is the current flowing in the circuit below?

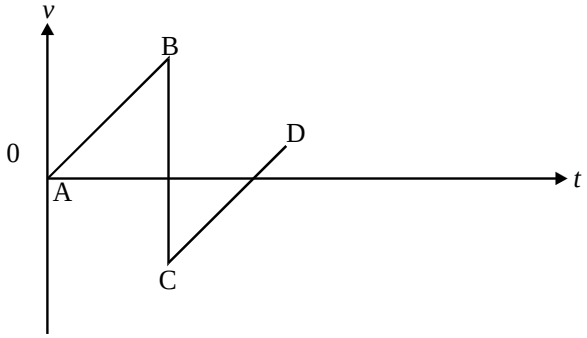



A 1,96 A
B 2,00 A
C 2,14 A
D 4,00 A

**[5 x 2 =10]**
**SECTION A TOTAL = [25]**

**SECTION B**
**QUESTION 4**

Thembi decides to investigate the motion of a ping-pong ball when it bounces on the ground. Thembi plots the graph of the ping-pong ball's motion. The graph below shows the velocity-time graph for a vertically bouncing ping-pong ball, which is released above the ground at A and strikes the floor at B. The effects of air resistance have been neglected.



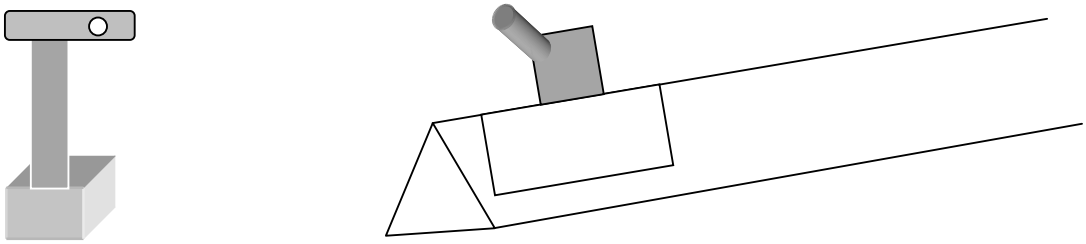

4.1.1 State what the gradient of a velocity-time graph represents. (1)
4.1.2 Explain why the gradient of the line AB is the same as line CD. (2)
4.1.3 State what the area between the line AB and the time axis represents. (2)

4.1.4 State why the velocity at C is negative. (1)
4.1.5 State why the speed at C is less than the speed at B. (2)
4.2 The ping-pong ball has a mass of 0.15 kg and is dropped from an initial height of 1.2 m. After impact the ping-pong ball rebounds to a height of 0.75 m.
Calculate:
4.2.1 the speed of the ping-pong ball immediately before impact with the ground (3)
4.2.2 the speed of the ping-pong ball immediately after impact with the ground (2)
4.2.3 the change in momentum of the ping-pong ball as a result of the impact (3)
4.2.4 the resultant average force acting on the ping-pong ball during impact if it is in contact with the floor for 0.10 s. (3)**[19]**

**QUESTION 5**

A ball with a mass of 20g is fired horizontally into a catcher mounted on top of a vehicle. The vehicle is resting on an air track.

Ball launcher Ball catcher Linear air track

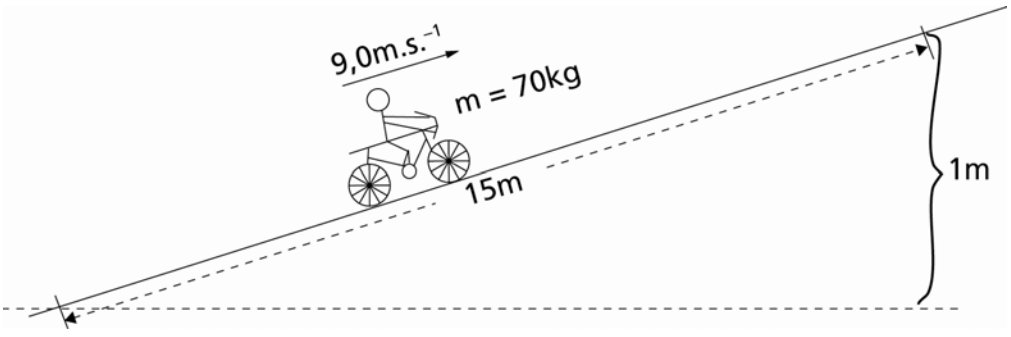


The vehicle and the catcher have a combined mass of 0.38kg and move along the air track at a steady speed of 1.2ms$^{-1}$ after the ball has entered the catcher.

5.1 State the law of conservation of momentum. (2)
5.2 The figure above shows the type of apparatus which could be used to investigate this interaction in the laboratory. Explain why the air track is used. (3)
5.3 What is the total momentum of the ball, catcher and vehicle when they are moving along the runway? (3)
5.4 Calculate the speed of the ball before it entered the catcher. (3)**[11]**

**QUESTION 6**

6.1 Nonnie, a cyclist rides along an uphill road at a constant speed of 9.0 m.s$^{-1}$ . The combined mass of Nonnie and the bicycle is 70kg. For every 15 m that she travels along the uphill road, she gains 1.0 m in height. **Neglect energy loss due to frictional forces.**



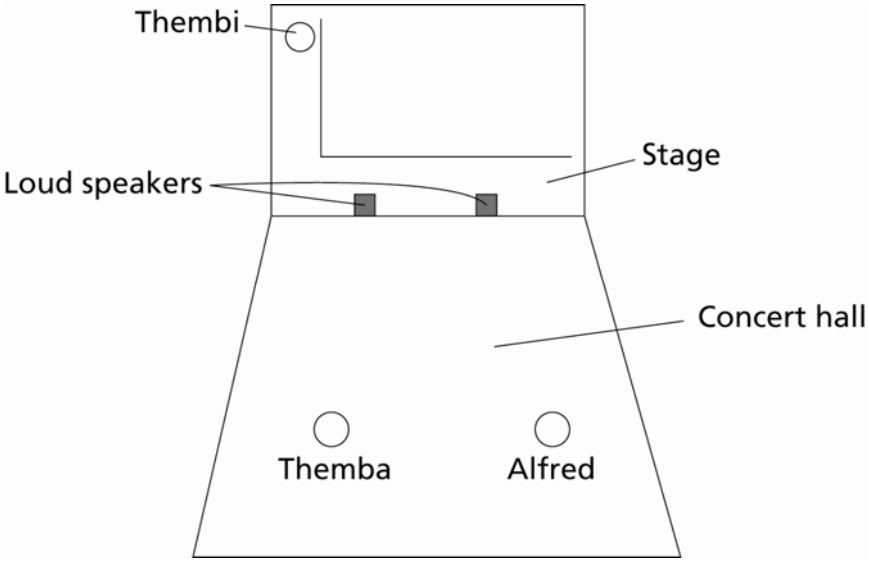
6.1.1 Calculate the component of the weight of the bicycle and Nonnie that acts along the incline. (4)
6.1.2 Calculate the power developed by Nonnie in riding up the slope. (3)
6.2 Nonnie stops pedaling and the bicycle freewheels up the incline for a short time.
6.2.1 State the energy change taking place as the bicycle freewheels up the slope. (1)
6.2.2 Calculate the distance travelled along the slope from where Nonnie stopped pedaling to where the bicycle comes to rest. (5)**[13]**

**QUESTION 7**

7.1 3-D motion pictures are made in such a way that it must be viewed through special glasses with one red and one blue lens to produce a 3-dimensional effect.

One of the systems how this is done is the following: Two images are displayed on the screen, one in red and the other in blue. The coloured filters on the lenses only allow light from the image which is the same colour as the lens to enter each eye, and your brain does the rest.

7.1.1 Which subtractive primary colours should be used to make a red lens? (2)
7.1.2 What is the complementary colour of red? (1)
7.1.3 Explain why magenta and cyan lenses cannot be used in place of red and blue lenses when the projected images are in red and blue. In answering the question, ensure that you refer to how the colour of these lenses would be made. (3)
7.2 The sound crew technicians John, Themba and Alfred are setting up the sound system for a large, outdoor concert. John positions two loudspeakers, one on each side of the stage and both facing directly out into the area where the audience will stand. In order to test loudness settings, he broadcasts a sound of a **single frequency** simultaneously from each speaker. Themba and Alfred are standing in the audience area in order to gauge if the loudness settings are suitable. Themba hears an extremely loud sound and says that the volume should be reduced. Alfred hears almost nothing at all and says that the volume should be increased.




7.2.1 Sketch a diagram to illustrate the wavefronts emanating from the two speakers.

Include a heavy dot to indicate a position where Themba might be standing. (4)

7.2.2 Name the wave phenomenon that causes Alfred's not hearing almost any sound. (2)

After discovering that Themba and Alfred are hearing two different things, the three technicians assume that their sound equipment must have been damaged during transport. They begin to pace around the audience area, trying to decide what to do next. As they walk from one side of the audience area to the other (parallel to the stage) they discover that there are alternating regions of loud and quiet. The technicians are perplexed. They obviously don't remember their Grade 12 Physics lessons!

7.2.3 List two changes which will cause the width of the alternating regions to **decrease**. (2)

7.2.4 Thembi standing in a corridor at the back of the concert hall, about 10 metres from an open doorway leading to the stage, hears the sounds coming from the hall, despite the fact `that the walls are sound-proof. Name the phenomenon that allows her to hear these sounds. (1)

7.2.5 Briefly explain why the pattern of loud and soft regions is not detected by the audience during the actual rock concert. (2)**[11]**

**QUESTION 8**

Two boats (A and B) are stationary at **different** ends of the harbour. The boatmen in each boat hear the sound of a dolphin but cannot see the dolphin. The men on boat A hears the pitch of the dolphin decreasing while the men on boat B hears the pitch of the dolphin increasing.

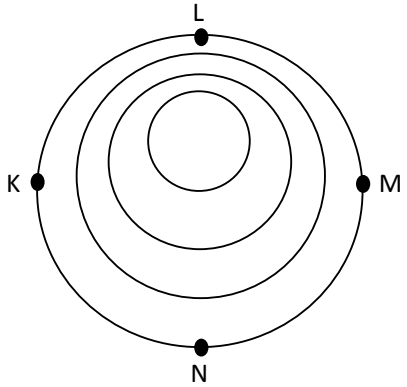
Boat A Boat B

X Y Z

8.1 What effect is responsible for the changing pitch of the dolphin for the men in each boat? (1)

8.2 What is the most likely position of the dolphin? Choose from positions X, Y or Z on the diagram above. (1)

8.3 The following diagram shows the sound wave pattern produced by the dolphin.




8.3.1 Which position is Boat A likely to be in? Select from K, L, M or N. (1)

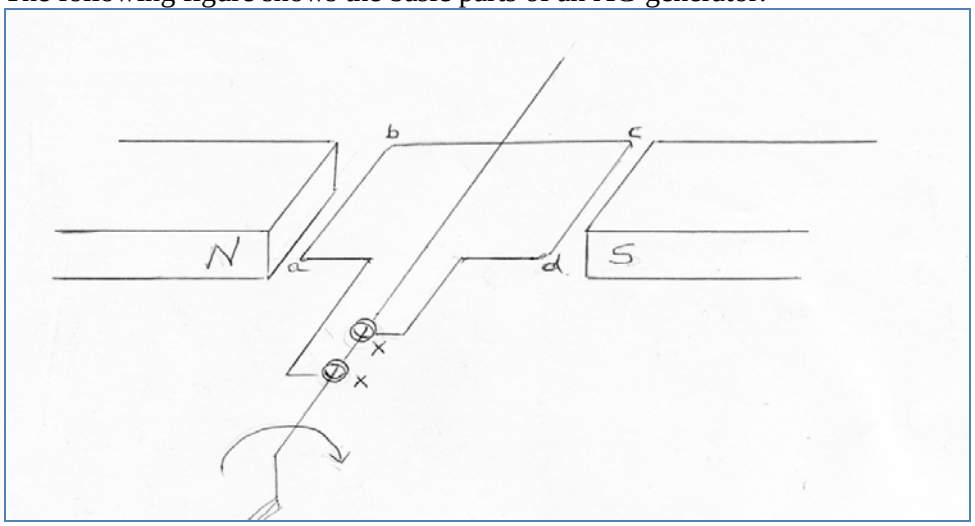
8.3.2 If the dolphin has a frequency of 520 Hz, and the dolphin is moving at 24 $m.s^{-1}$, determine the frequency of sound that a boatman in position L will hear. (3)

8.3.3 For a boat in position N, state how each of the following will change or remain the same if the dolphin speeds up:

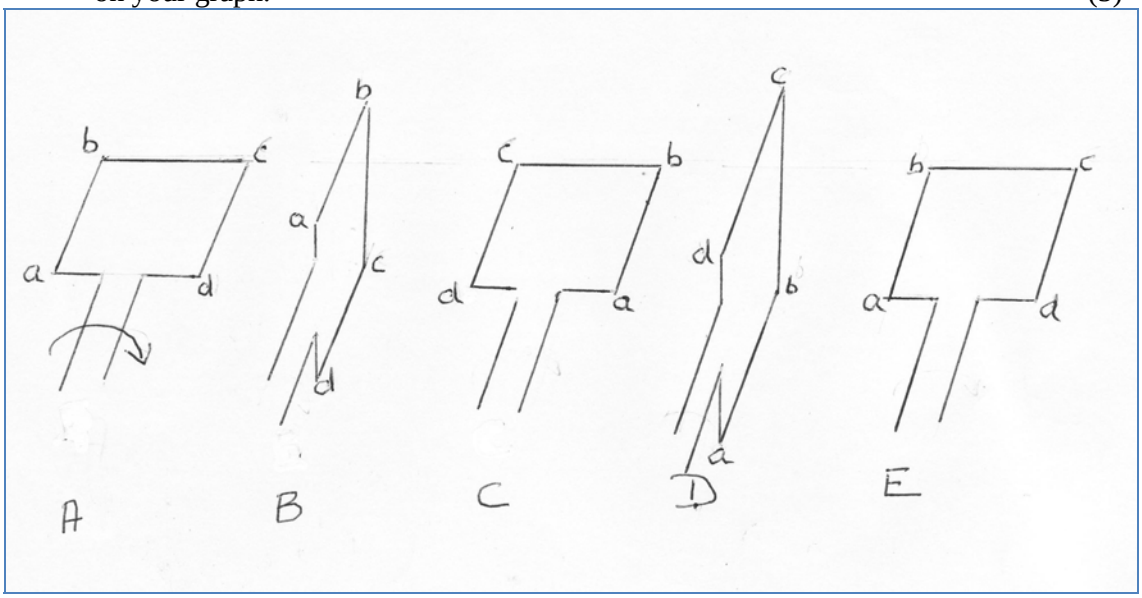
(a) Wavelength of the received sound
(b) Frequency of the dolphins call. (2)**[8]**

**QUESTION 9**

The following figure shows the basic parts of an AC-generator:




9.1 Give the name for the parts labelled X. (1)
9.2 What is the energy conversion taking place in this generator? (1)
9.3 Use Fleming's Right Hand Dynamo Rule to determine the direction of the induced current in the coil. Give your answer as either c to d or d to c. (1)
9.4 The figures below show the position of the coil during a full rotation. Draw a sketch graph of emf vs. time for one full rotation of the coil. Clearly mark positions A to E on your graph. (5)

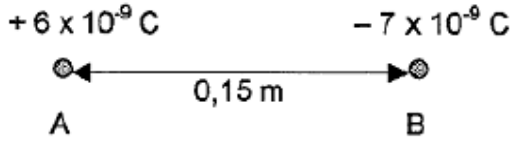



John has made a simple generator similar to that shown in the sketch and he decides to investigate the factors that influence the size of the induced emf.

9.5 Give **2** different variables that he could investigate and state how he should change each of them in order to **increase** the induced emf. (4)
9.6 What structural difference is there between a D.C. generator and an AC generator? (2)**[14]**

**QUESTION 10**

Two objects, A and B, carrying charges of + 6 × $10^{-9}$ C and - 7 × $10^{-9}$ C respectively, are placed 0,15 m apart.




10.1 State *Coulomb's la*w in words. (2)

10.2 Sketch the electric field pattern for the two objects. (3)

10.3 Calculate the magnitude of the force the two charges exert on each other. (3)

10.4 Are these forces attractive or repulsive? (1)

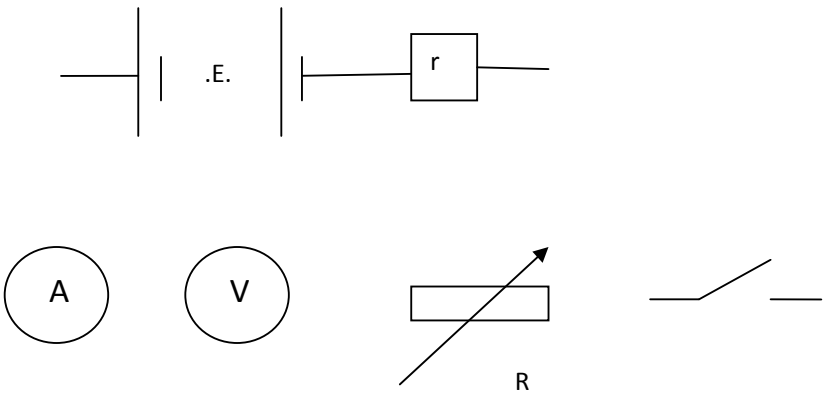
10.5 What will happen to the force if:

10.5.1 The distance is doubled?

10.5.2 Both charges are halved? (2)**[11]**

**QUESTION 11**

The apparatus below can be used in an experiment to determine the internal resistance of a battery.




11.1 Draw the circuit diagram required to allow you to take the readings necessary to determine the internal resistance of the battery. (3)

11.2 In one experiment the potential difference across the battery and the current is measured and recorded for a number of different values of resistor connected across the battery. The results are recorded in the table.

| Potential difference (v) | 0,3 | 0,5 | 0,7 | 0,9 | 1,1 | 1,3 | 1,5 |
|---|---|---|---|---|---|---|---|
| Current (A) | 0,75 | 0,68 | 0,55 | 0,45 | 0,35 | 0,25 | 0,15 |

11.2.1 Give the dependent and independent variables for the experiment. (2)

11.2.2 Which variable must be controlled during the experiment? (1)

11.2.3 Draw a graph of voltage versus current for the readings shown in the table on the graph paper. (6)

11.3 Use your graph to determine:

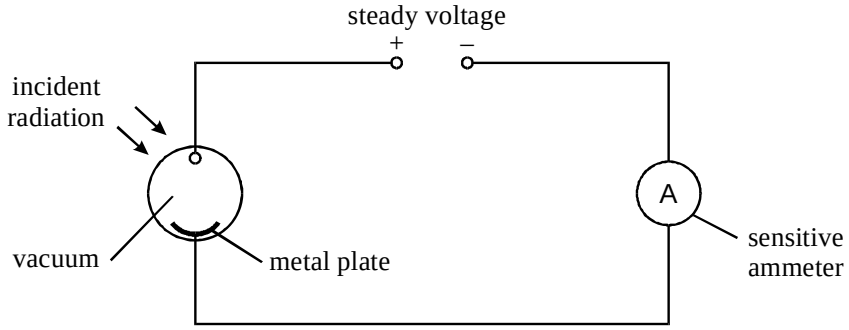
11.3.1 The emf of the battery (1)

11.3.2 The maximum current the battery can supply (1)

11.3.3 The internal resistance of the battery. (3)**[17]**

**QUESTION 12**

The diagram below shows an experimental arrangement used to demonstrate aspects of the photoelectric effect. A photo electric cell is coupled in series with a voltage source and an ammeter. When photoelectrons from the photo electric cell are emitted, the ammeter registers a current.

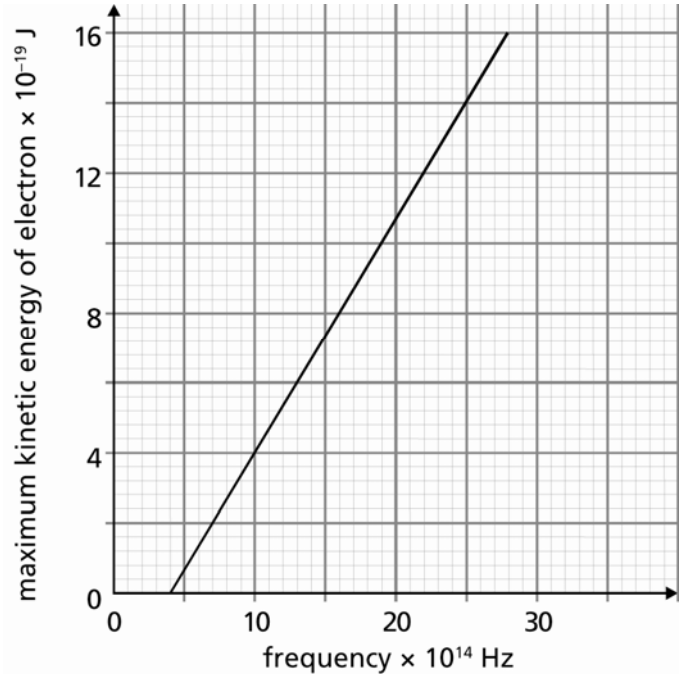



12.1 The metal plate is illuminated with radiation of a particular frequency, but **does not emit photoelectrons**. If the intensity of the radiation is increased, state and explain what effect this increase will have on the observed current. (2)

12.2 The metal plate is illuminated with radiation such that **photoelectrons are emitted.** The intensity of the radiation is increased. State and explain what effect this increase in intensity has on the observed current (3)

12. 3 The metal plate is illuminated with radiation such that photoelectrons are emitted. Air is allowed to enter the photo electric cell and the vacuum is destroyed. State and explain what effect the air will have on the observed current. (2)

The diagram below shows how the maximum kinetic energy of electrons emitted from the cathode of a photoelectric cell varies with the frequency of the incident radiation.




12.4 Write an equation that shows the relation between the energy of an incident light photon on a metal surface and the emission of photo electrons from that surface. Briefly state the meaning of each term in the equation. (4)

12.5 Use the graph to calculate the maximum wavelength of electromagnetic radiation that can release photoelectrons from the cathode surface. (4)**[15]**

**End Section B = 125 Marks**