

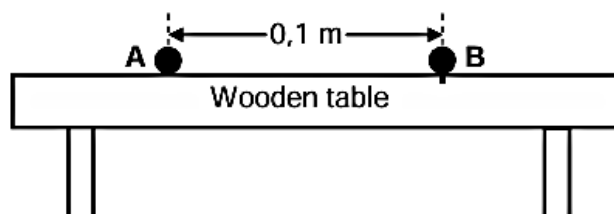
Photoelectric Effect: Exam Revision Tracker

Attempt #1		Attempt #2		Attempt #3		Attempt #4		Attempt #5	
Total	Score	Total	Score	Total	Score	Total	Score	Total	Score
12		13		12		13		11	
Percentage =		Percentage =		Percentage =		Percentage =		Percentage =	

Photoelectric Effect: Attempt #1

Total = 12 Marks

- Two small spheres, **A** and **B**, made of pure zinc are at rest 0,1 m apart on a wooden table. Sphere **A** is negatively charged and is free to move on the table, while sphere **B** is uncharged and fixed to the table, as shown in the diagram below.



High-intensity ultraviolet light of frequency $2,8 \times 10^{16}$ Hz is now shone continuously onto sphere **B**.

The work function of zinc is $6,63 \times 10^{-19}$ J.

- 1.1 Define the term *work function* of a metal. (2)
- 1.2 Explain, using a suitable calculation, why the ultraviolet light shone on sphere **B** will eject electrons from its surface. (4)
- 1.3 Sphere **A** carries a charge of $-5,4 \times 10^{-6}$ C and requires a minimum force of 0,027 N to move from rest.

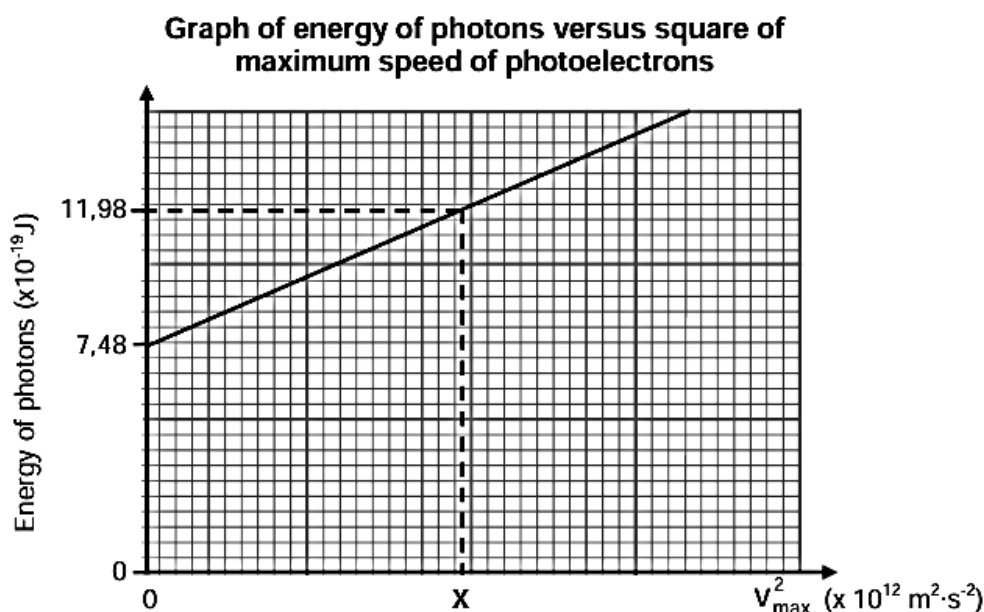
Calculate the minimum number of photons of ultraviolet light that must strike sphere **B** which will cause sphere **A** to move from its rest position. (6)

Photoelectric Effect: Attempt #2 ⚡

Total = 13 Marks

During an experiment, light of different frequencies is radiated onto a silver cathode of a photocell and the corresponding maximum speed of the ejected photoelectrons are measured.

A graph of the energy of the incident photons versus the square of the maximum speed of the ejected photoelectrons is shown below.



1. Define the term *photoelectric effect*. (2)

Use the graph to answer the following questions.

2. Write down the value of the work function of silver.
Use a relevant equation to justify the answer. (3)
3. Which physical quantity can be determined from the gradient of the graph? (1)
4. Calculate the value of X as shown on the graph. (5)

The experiment above is now repeated using light of higher intensity.

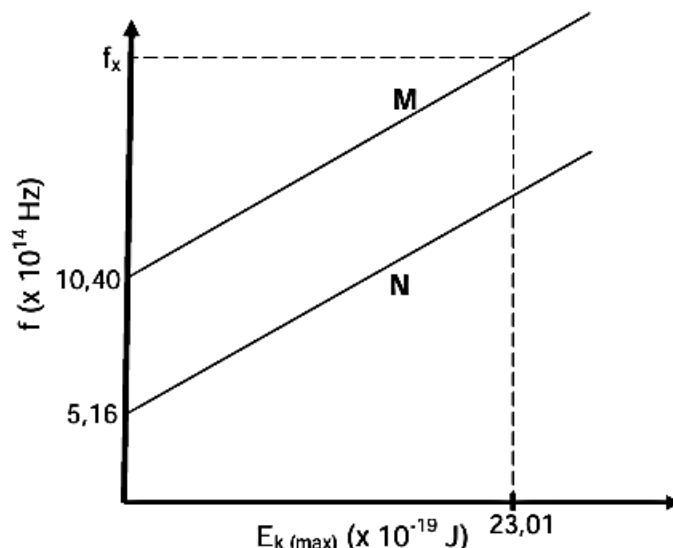
5. How will EACH of the following be affected? Choose from INCREASES, DECREASES or REMAINS THE SAME.
 - 5.1 The gradient of the graph (1)
 - 5.2 The number of photoelectrons emitted per unit time (1)

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Photoelectric Effect: Attempt #3 ⚡

Total = 12 Marks

The relationship between frequency (f) and maximum kinetic energy ($E_{k(max)}$) of photoelectrons emitted from two cathodes, **M** and **N**, of different photoelectric cells is investigated. The graphs below have been obtained from the results.



1. Define the term *threshold frequency*. (2)

2. How does the maximum kinetic energy of photoelectrons emitted from cathode **N** compare to the maximum kinetic energy of those emitted from cathode **M** when light of a frequency greater than $10,40 \times 10^{14}$ Hz is shone on each of the cathodes?

Choose from GREATER THAN, SMALLER THAN or EQUAL TO. (2)

3. Calculate the value of frequency f_x indicated on the graph. (5)

4. The experiment is now repeated for cathode **M** using light of frequency f_x , but of higher intensity. How will EACH of the following be affected?

Choose from INCREASES, DECREASES or NO EFFECT.

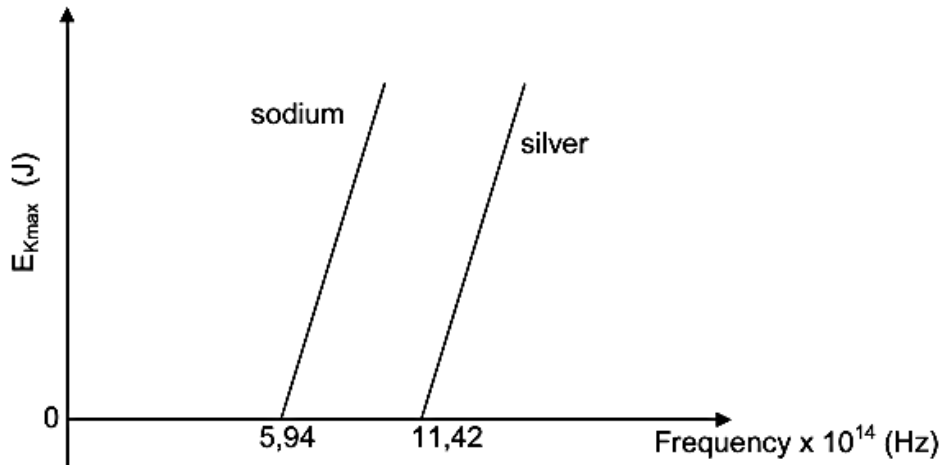
- 4.1 The y-intercept of the graph (1)
- 4.2 The number of photoelectrons emitted per unit time (1)
- 4.3 The maximum kinetic energy of the emitted photoelectrons (1)

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Photoelectric Effect: Attempt #4 ⚡

Total = 13 Marks

1. A learner is investigating the photoelectric effect for two different metals, silver and sodium, using light of different frequencies. The maximum kinetic energy of the emitted photoelectrons is plotted against the frequency of the light for each of the metals, as shown in the graphs below.



- 1.1 Define the term *threshold frequency*. (2)
 - 1.2 Which metal, sodium or silver, has the larger work function? Explain the answer. (3)
 - 1.3 Name the physical constant represented by the slopes of the graphs. (1)
 - 1.4 If light of the same frequency is shone on each of the metals, in which metal will the ejected photoelectrons have a larger maximum kinetic energy? (1)
2. In a different photoelectric experiment blue light obtained from a light bulb is shone onto a metal plate and electrons are released.
- The wavelength of the blue light is 470×10^{-9} m and the bulb is rated at 60 mW. The bulb is only 5% efficient.
- 2.1 Calculate the number of photons that will be incident on the metal plate per second, assuming all the light from the bulb is incident on the metal plate. (5)
 - 2.2 **Without any further calculation**, write down the number of electrons emitted per second from the metal. (1)

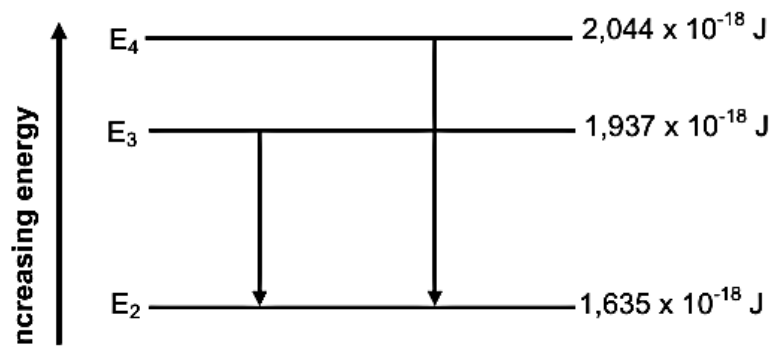
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Photoelectric Effect: Attempt #5 ⚡

Total = 11 Marks

1. In an excited atom, electrons can 'jump' from lower energy levels to higher energy levels. They can also 'drop' from higher energy levels to lower energy levels.

The diagram below (not drawn to scale) shows some of the transitions for electrons in an excited atom.



- 1.1 Do the transitions indicated in the diagram lead to ABSORPTION or EMISSION spectra? (1)
- 1.2 Calculate the frequency of the photon produced when an electron in an excited atom makes a transition from E_4 to E_2 , as shown in the diagram. (4)

The threshold frequency of a metal, Q, is $4,4 \times 10^{14}$ Hz.

- 1.3 Calculate the kinetic energy of the most energetic electron ejected when the photon produced in QUESTION 11.2.2 is incident on the surface of metal Q. (4)

Another metal, R, has a threshold frequency of $7,5 \times 10^{14}$ Hz.

- 1.4 Will the photon produced in QUESTION 11.2.2 be able to eject electrons from the surface of metal R? Write down only YES or NO.

Give a reason for the answer. (2)

