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Sample assessment 2020

Question and response book

Physics

Paper 2

Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- Write using black or blue pen.
- Respond in paragraphs consisting of full sentences.
- QCAA-approved calculator permitted.
- QCAA formula sheet provided.
- Planning paper will not be marked.

Section 1 (45 marks)

- 8 short response questions

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Section 1

Instructions

- If you need more space for a response, use the additional pages at the back of this book.
  - On the additional pages, write the question number you are responding to.
  - Cancel any incorrect response by ruling a single diagonal line through your work.
  - Write the page number of your alternative/additional response, i.e. See page …
  - If you do not do this, your original response will be marked.

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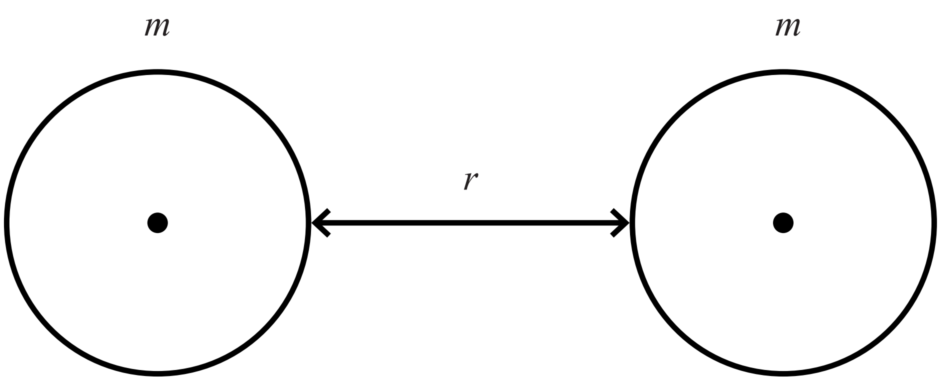
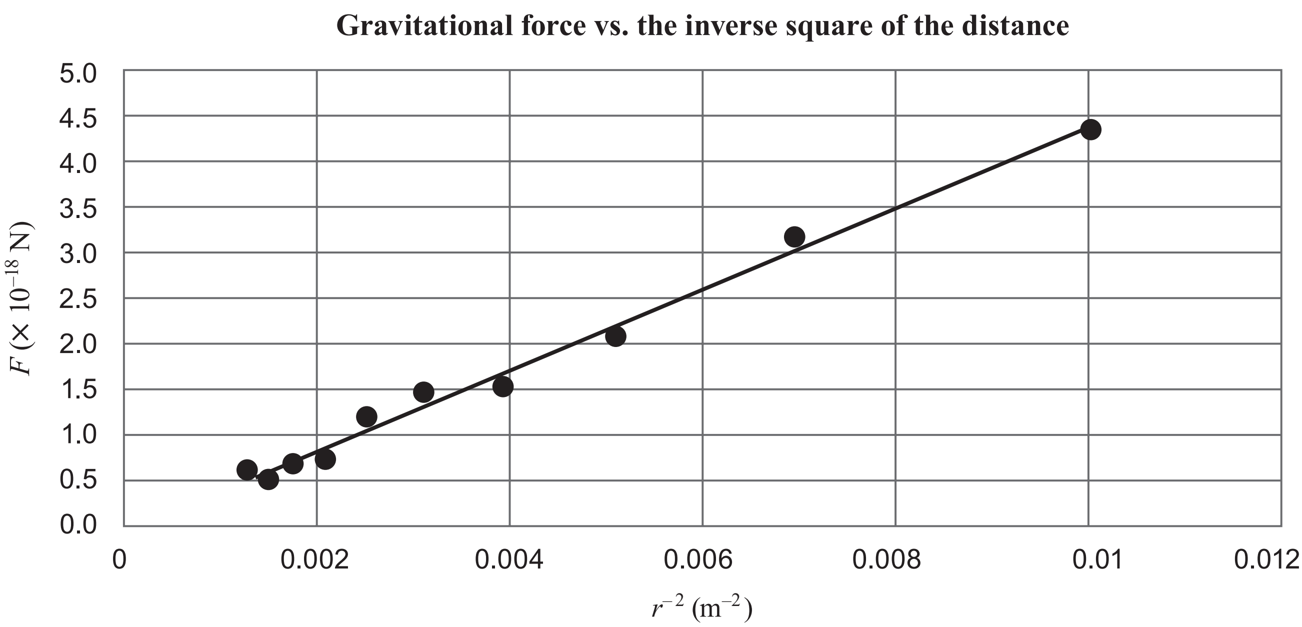
QUESTION 1 (5 marks)

Two objects, each with a mass of 2.5×10^{-3} kg, are separated by a distance *r*.



The gravitational force (F) between the two objects was measured at various distances (r). The data is plotted in the graph below.



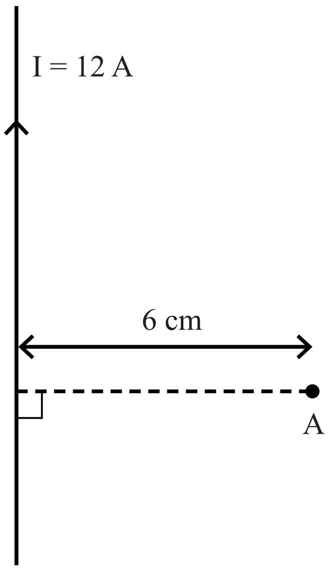
a) Identify the mathematical relationship represented by the linear trendline in the graph on page 2. Show your working. *[3 marks]*

b) Use the information provided and the mathematical relationship between F and r identified in 1a) to determine an experimental value for the gravitational constant, G. Show your working. Express the solution using scientific notation. *[2 marks]*

Experimental value for G = ____________________ N m^2 kg^{-2} (to 1 decimal place)

QUESTION 2 (2 marks)

The diagram below shows an electric current-carrying wire.



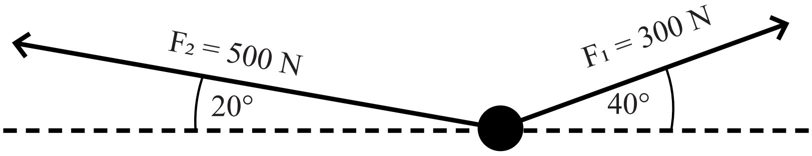
Calculate the magnitude and direction of the magnetic field around the electric current-carrying wire at point A. Show your working. Express the solution using scientific notation.

Magnitude = ______________________ T (to the nearest whole number)

Direction = ______________________

QUESTION 3 (8 marks)

The diagram below shows two forces acting upon an object.



This diagram is not to scale.

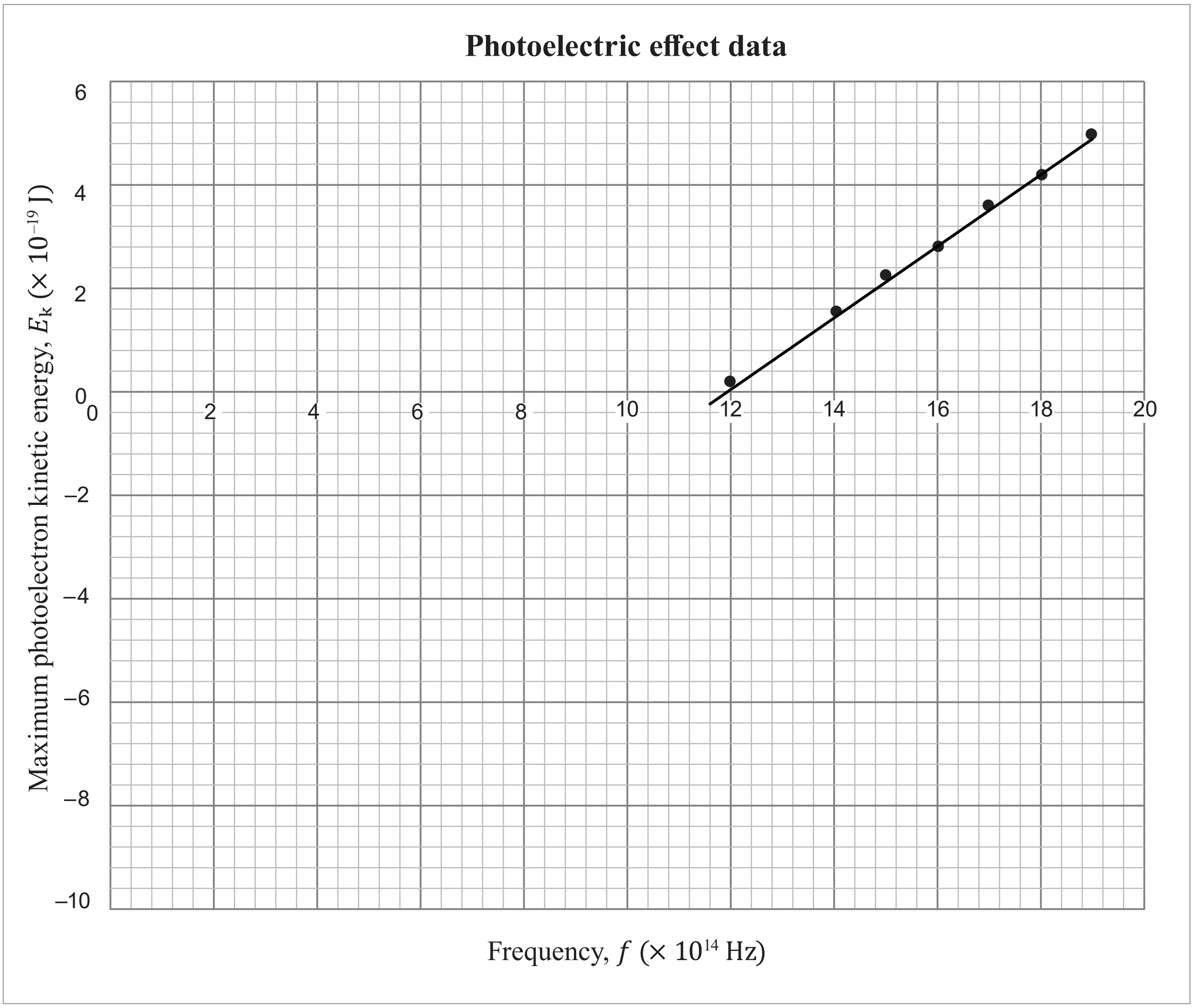
Calculate the resultant force acting upon the object, and the direction of acceleration. Show your working.

Force = ____________________ N (to the nearest whole number)

Direction = ____________________ (to 1 decimal place)

QUESTION 4 (5 marks)

The graph below shows the results of a photoelectric effect experiment where the photoelectrons were ejected from an unknown metal plate.



The table below shows the work functions of various metals.

Material	Work function, W (eV)
Lithium	2.9
Titanium	4.3
Copper	5.1

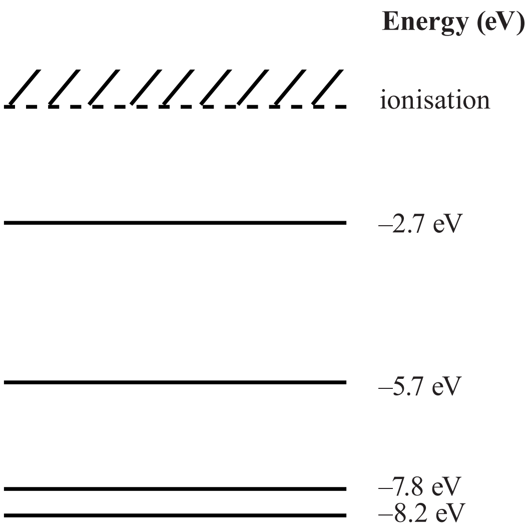
a) Identify the mathematical relationship between E_k and f, using the information from the graph on page 6. Show your working. *[3 marks]*

b) Draw a conclusion from the data about which metal is most likely to have ejected the photoelectrons in this experiment. Show your working. *[2 marks]*

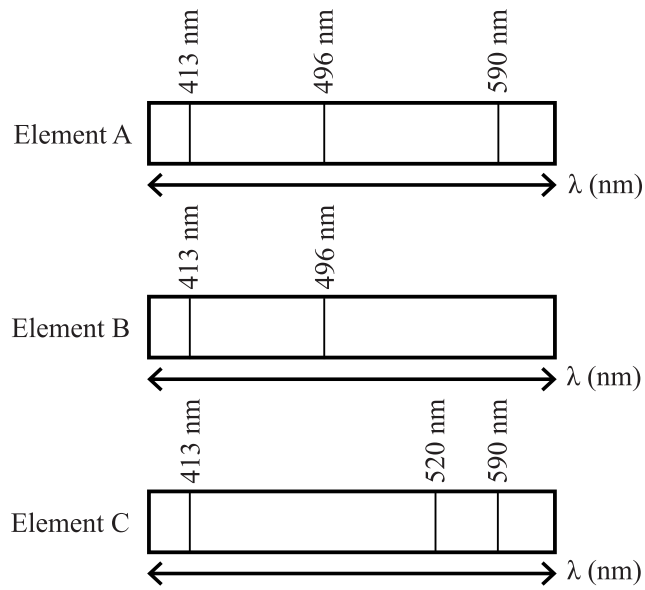
QUESTION 5 (6 marks)

Below are two diagrams. The diagram on the left shows the energy level diagram for an unknown gas, while the diagram on the right shows the emission spectra for three different elements (A, B and C).

Energy level diagram



Emission spectra

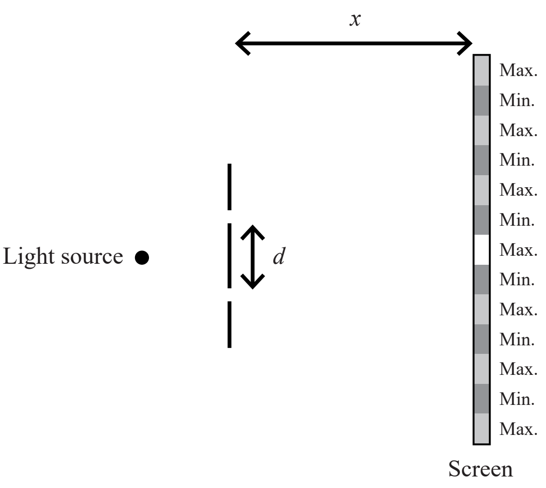


Draw a conclusion as to which emission spectra would be produced from the unknown gas. Support your answer with calculations. (Note: Do not include transitions from ionisation to any of the energy levels.)

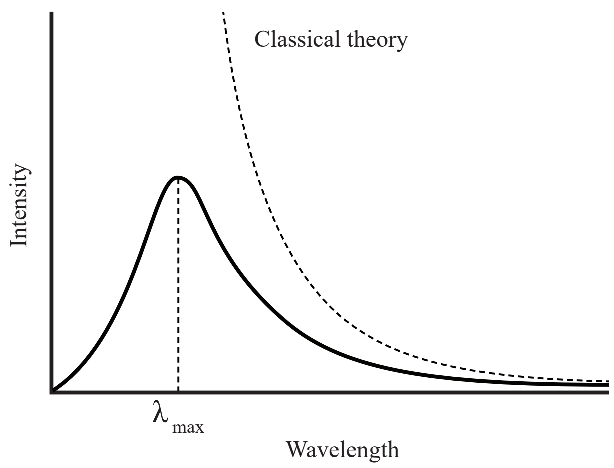
QUESTION 6 (5 marks)

Below is an image of Young's double slit experiment and a graph showing the intensity and wavelength of light emitted from a black body.

Young's double slit experiment



Black-body radiation curve

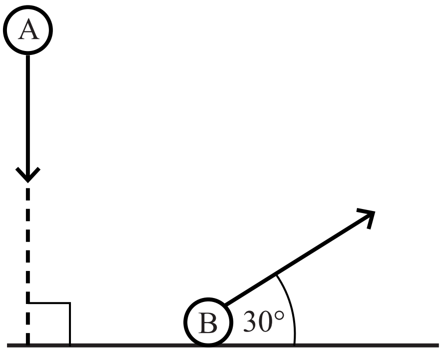


Describe wave–particle duality of light by referring to the evidence above.

QUESTION 7 (6 marks)

The diagram below shows two projectile motion scenarios — Object A and Object B.

Object A is released from an unknown height above the ground. It takes 4.20 seconds to reach the ground. At the same instance that Object A is released, Object B is projected at an angle of 30.0° from the horizontal.



Calculate the horizontal displacement of Object B, given that it lands at the same time as Object A. Show your working.

Horizontal displacement = ____________________ m (to the nearest whole number)

QUESTION 8 (8 marks)

A ladder, measured at 20 m in length when stationary, is carried horizontally by Observer A at a velocity of 0.9 c through a barn. The barn is 15 m long and has an open door at either end. Observer B, sitting in the barn, presses a button when they see that the ladder has completely entered the barn. Observer B sees both the front and rear barn doors instantaneously close and then open again at the same time the button is pressed.

Explain how this could be viewed as a paradox, and conclude whether the ladder will make contact with the barn doors. Support your explanation and conclusion with calculations.

END OF PAPER

ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

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