

[1 mark]**1 2**

An electron collides with an isolated atom and raises an atomic electron to a higher energy level.

Which statement is correct?

[1 mark]

~~A~~ The colliding electron is captured by the nucleus of the atom.

~~B~~ A photon is emitted when the electron rises to the higher energy level.

~~C~~ An electron is emitted when the excited electron returns to the ground state.

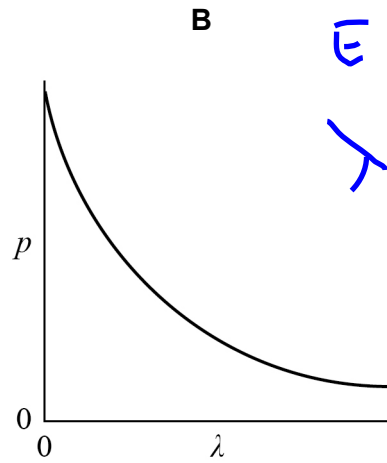
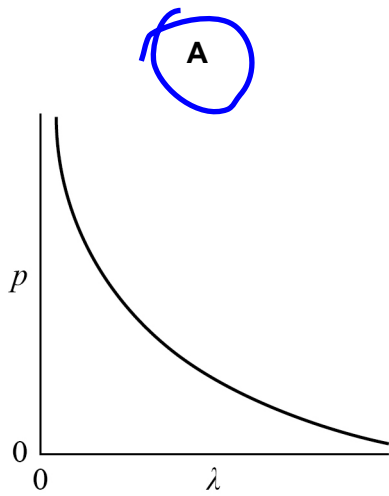
~~D~~ The colliding electron transfers energy to the atomic electron.

Turn over for the next question

Turn over ►

1 3 Which graph shows the variation of momentum p with wavelength λ of a photon? [1 mark]

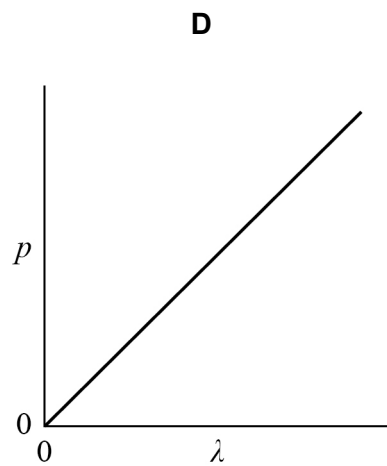
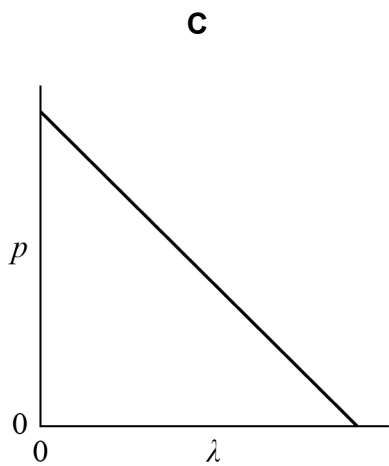
[1 mark]



Handwritten notes in blue ink:

$$E = hf$$

$$p = \frac{h}{\lambda}$$



- A
- B
- C
- D

Going to be a $1/x$ - which means its A - not B - which crosses the axis



Section A

Answer **all** questions in this section.

0 1 . 1

Two isotopes of iodine are $^{125}_{53}\text{I}$ and $^{131}_{53}\text{I}$.

Determine, for these two isotopes, the difference between the constituents of the nuclei.

[1 mark]

same p. 6 neutrons more in Iodone-131

0 1 . 2

A $^{131}_{53}\text{I}$ nuclide undergoes beta (β^-) decay to form a xenon nuclide.

State the nucleon number of the xenon nuclide.

[1 mark]

131

0 1 . 3

A $^{125}_{53}\text{I}$ nuclide decays by electron capture to form a tellurium nuclide.

State **two** differences between the constituents of the iodine nucleus and the tellurium nucleus it decays into.

[2 marks]

$p + e^- \rightarrow n$ ∴ 1 more n
1 less p



Section B

Each of Questions 8 to 32 is followed by four responses, **A, B, C** and **D**.

For each question select the best response.

Only **one** answer per question is allowed.

For each question completely fill in the circle alongside the appropriate answer.

CORRECT METHOD



WRONG METHODS

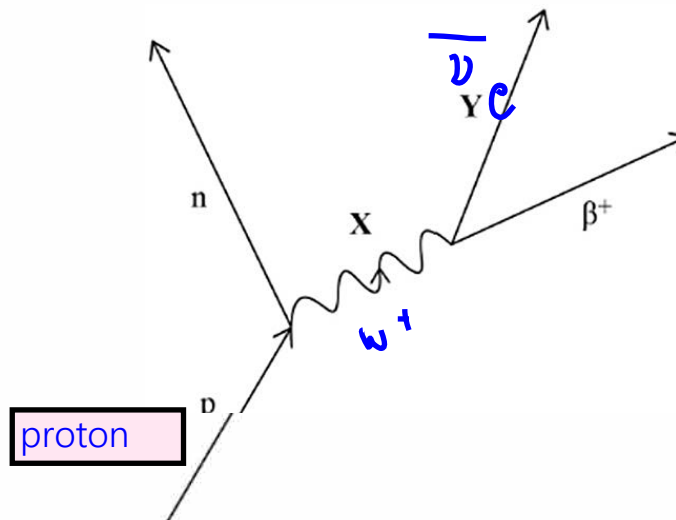


If you want to change your answer you must cross out your original answer as shown.

If you wish to return to an answer previously crossed out, ring the answer you now wish to select as shown.

You may do your working in the blank space around each question but this will not be marked. Do **not** use additional sheets for this working.

0 8 The process of beta plus (β^+) decay can be represented by



Which row identifies particles **X** and **Y**?

[1 mark]

	X	Y	
A	W^+	ν_e	<input checked="" type="radio"/>
B	W^+	$\bar{\nu}_e$	<input type="radio"/>
C	W^-	ν_e	<input type="radio"/>
D	W^-	$\bar{\nu}_e$	<input type="radio"/>



0 9

An electron collides with an isolated atom and raises an orbiting electron to a higher energy level.

Which statement is correct?

[1 mark]

- A The colliding electron is captured by the nucleus of the atom.
- B A photon is emitted when the electron rises to the higher energy level.
- C An electron is emitted when the excited electron returns to the ground state.
- D Energy is transferred from the colliding electron to the orbiting electron.

1 0

Light of frequency 2.0×10^{15} Hz is incident on a metal surface. The work function of the metal is 4.6×10^{-19} J.

$E = hf \Rightarrow E = 1.3 \times 10^{-18} \text{ J}$

Which statement is correct?

$E_{k,m} = 1.3 \times 10^{-18} - 4.6 \times 10^{-19} = 8.4 \times 10^{-19} \text{ J}$ [1 mark]

- A No photoelectrons are released.
- B Photoelectrons are released with a maximum kinetic energy of 3.1×10^{-19} J.
- C Photoelectrons are released with a maximum kinetic energy of 8.7×10^{-19} J.
- D Photoelectrons are released with a maximum kinetic energy of 18×10^{-19} J.

1 1

A photon of ultraviolet radiation has a frequency of 1.5×10^{15} Hz.

What is the momentum of the photon?

[1 mark]

- A $3.3 \times 10^{-11} \text{ kg m s}^{-1}$
- B $1.3 \times 10^{-40} \text{ kg m s}^{-1}$
- C $3.3 \times 10^{-27} \text{ kg m s}^{-1}$
- D $1.3 \times 10^{-26} \text{ kg m s}^{-1}$

$\lambda = \frac{h}{p} \Rightarrow p = \frac{h}{\lambda}$

$\frac{c}{f} = \lambda \therefore p = \frac{hf}{c}$

Turn over ►



2 2

Charged plates **X** and **Y** have a potential difference 1.5 V between them.



Which particle gains 3.0 eV of kinetic energy when moving from **Y** to **X**?

[1 mark]

- A proton
- B positron
- C electron
- D alpha particle**

1eV is energy gained by $q=1.6 \times 10^{-19} \text{C}$ being accel through 1V.
We have 3eV therefore particle must be double charged

Turn over for the next question

Turn over ►

