

1 3

Monochromatic light with a photon energy of $4.1 \times 10^{-19} \text{ J}$ is incident on a metal surface. The maximum speed of the photoelectrons released is $4.2 \times 10^5 \text{ m s}^{-1}$.

What is the work function of the metal?

[1 mark]

A $2.5 \times 10^{-19} \text{ J}$

B $3.3 \times 10^{-19} \text{ J}$

C $4.1 \times 10^{-19} \text{ J}$

D $4.9 \times 10^{-19} \text{ J}$

1 4

What is the role of the mercury vapour in a fluorescent tube?

[1 mark]

A It absorbs photons of UV light and emits visible light.

B It absorbs photons of visible light and emits UV light.

C It emits photons of visible light following ionisation or excitation.

D It emits photons of UV light following ionisation or excitation.

Turn over for the next question

Turn over ►

1 5

The diagram shows the three lowest energy levels for an atom.
The energy levels have been drawn to scale.

level 2 _____

level 1 _____

ground state _____

Transitions of electrons between these energy levels produce photons of the following frequencies:

$$4.56 \times 10^{14} \text{ Hz}$$

$$2.46 \times 10^{15} \text{ Hz}$$

$$2.92 \times 10^{15} \text{ Hz.}$$

What is the difference in energy between the ground state and energy level 1?

[1 mark]**A** $0.3 \times 10^{-18} \text{ J}$ **B** $1.3 \times 10^{-18} \text{ J}$ **C** $1.6 \times 10^{-18} \text{ J}$ **D** $1.9 \times 10^{-18} \text{ J}$ 

1 6

A muon and an electron are travelling at the same speed.

Which row gives the particle with the greater kinetic energy and the particle with the longer de Broglie wavelength?

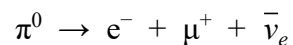
[1 mark]

	Greater kinetic energy	Longer de Broglie wavelength	
A	muon	muon	<input type="radio"/>
B	muon	electron	<input type="radio"/>
C	electron	muon	<input type="radio"/>
D	electron	electron	<input type="radio"/>

Turn over ►

Section AAnswer **all** questions in this section.

0	1	.	1
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 Determine whether the following reaction is a possible decay for the neutral pion π^0 .**[2 marks]**

0	1	.	2
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 State the **two** possible quark configurations of a π^0 .**[1 mark]**

1 _____

2 _____

0	1	.	3
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 A student suggests that the kaon K^0 and the anti-kaon \bar{K}^0 are the same particle.

Discuss whether this suggestion is correct.

[2 marks]



0	1	.	4
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The nucleus is held together by a force. It was predicted that a particle exists that is responsible for this force. The particle itself must experience this force.

The particle would have a rest energy between that of an electron and half that of a nucleon.

Discuss whether a kaon, a muon and a pion **each** have the properties of the predicted particle.

Information about these three particles is in the Data and Formulae Booklet.

[4 marks]

9

Turn over for the next question

Turn over ►

