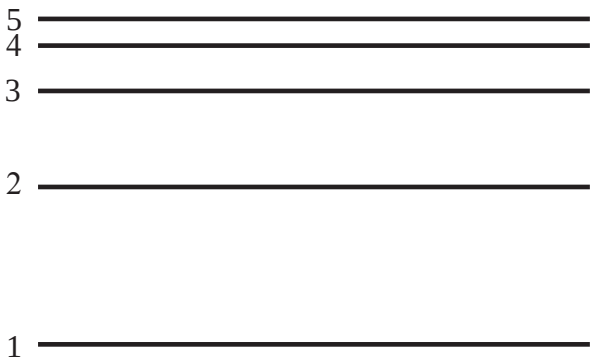
1 The diagram shows five energy levels in an atom.



Electromagnetic radiation is incident on the atom.

Which transition would be caused by the absorption of the lowest frequency of radiation?

☒ **A** 1 to 5

☒ **B** 1 to 2

☒ **C** 4 to 5

☒ **D** 5 to 4

(Total for Question = 1 mark)

2 Which of the following provides evidence that light has a wave nature?

☒ **A** The emission of light from an energy-level transition in a hydrogen atom.

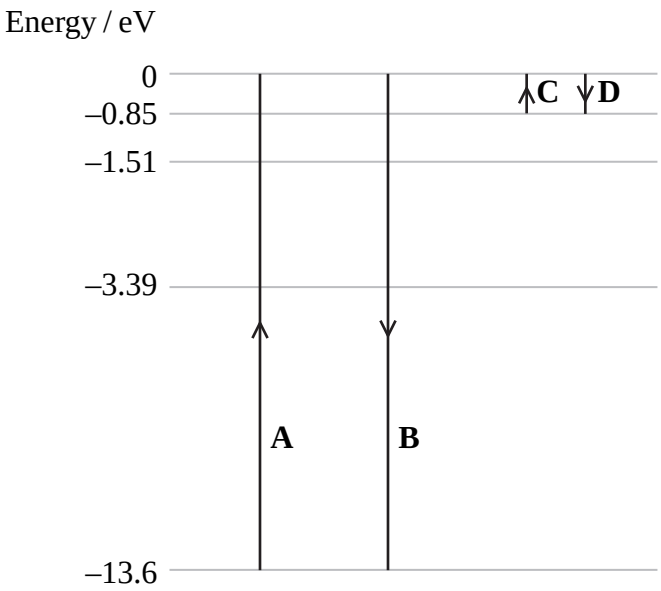
☒ **B** The diffraction of light passing through a narrow opening.

☒ **C** The absorption of ultra-violet radiation in the photoelectric effect.

☒ **D** The reflection of light from a mirror.

(Total for Question = 1 mark)

3 The diagram shows some of the electron energy levels for the hydrogen atom with four possible transitions.



The transition that would result in the emission of the longest wavelength is

☒ **A**

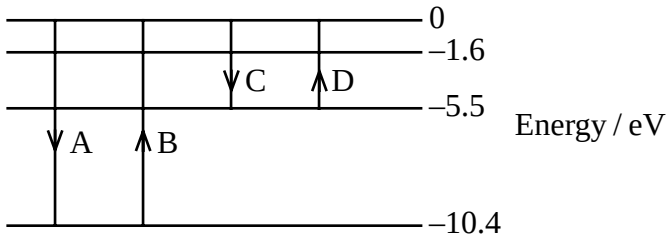
☒ **B**

☒ **C**

☒ **D**

(Total for Question = 1 mark)

4 The diagram shows some of the electron energy levels for a mercury atom.



Which of the lines A to D, drawn on the diagram, would correspond to the emission of the photon with the shortest wavelength?

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for Question = 1 mark)

5 An electron is accelerated from rest through a potential difference of 5.0 kV.

The kinetic energy gained by the electron is

☒ **A** 8.0×10^{16} J

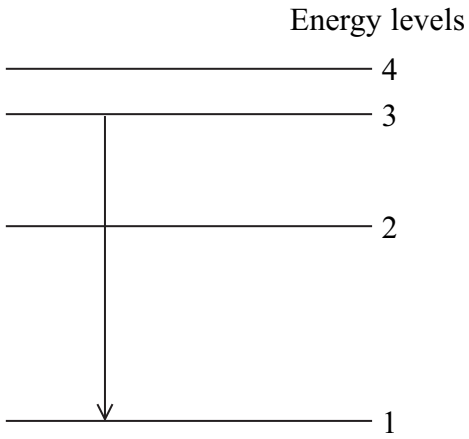
☒ **B** 8.0×10^{19} J

☒ **C** 3.2×10^{20} J

☒ **D** 3.2×10^{23} J

(Total for Question 1 mark)

6 The diagram shows four electron energy levels in an atom. The transition of an electron from level 3 to level 1 is shown. This results in the emission of a photon in the visible range.



Which transition might emit a photon in the ultraviolet range?

☒ **A** from level 2 to level 1

☒ **B** from level 4 to level 1

☒ **C** from level 3 to level 2

☒ **D** from level 4 to level 2

(Total for Question 1 mark)

7 An electron is accelerated through a large potential difference and gains a kinetic energy of 47 keV. This energy expressed as joules equals

☒ **A** 7.5×10^{-18} J

☒ **B** 7.5×10^{-15} J

☒ **C** 2.9×10^{20} J

☒ **D** 2.9×10^{23} J

(Total for Question = 1 mark)

8 The wave and particle models of light have both contributed to our understanding of light.

Which row of the table correctly matches properties of light to the model that best explains them?

	Wave model	**Particle model**
☒ **A**	photoelectric effect	refraction
☒ **B**	diffraction	atomic line spectra
☒ **C**	atomic line spectra	photoelectric effect
☒ **D**	refraction	diffraction

(Total for Question = 1 mark)

9 Which of the following can be explained only by the wave nature of electromagnetic radiation?

☒ **A** atomic line spectra

☒ **B** electron diffraction

☒ **C** photoelectric effect

☒ **D** X-ray diffraction

(Total for Question 1 mark)

10 Radiation of frequency f and wavelength λ is emitted when an electron falls from energy level E_2 to energy level E_1.

$E_2 \quad E_1$ is equal to

☒ **A** $\frac{hc}{f}$

☒ **B** $\frac{hc}{\lambda}$

☒ **C** $\frac{hf}{c}$

☒ **D** $\frac{h\lambda}{c}$

(Total for Question 1 mark)

11 The behaviour of light can be described in terms of waves or particles. The particle nature of light can be demonstrated by

☒ **A** light being diffracted as it passes through a narrow slit.

☒ **B** the speed of light reducing when it is refracted by glass.

☒ **C** light causing electrons to be emitted from a metal surface.

☒ **D** light being polarised.

(Total for Question = 1 mark)