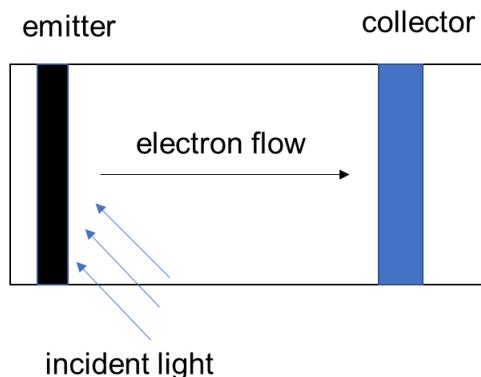


- 5 (a) Fig. 5.1 shows the schematic diagram of an experimental setup to study the photoelectric effect. Photons of wavelength 390 nm are incident on the emitter.

**Fig. 5.1**

- (i) Explain what is meant by a *photon*.

.....  
 .....  
 .....  
 ..... [2]

- (ii) Show that the energy of the photon is 3.19 eV.

[2]

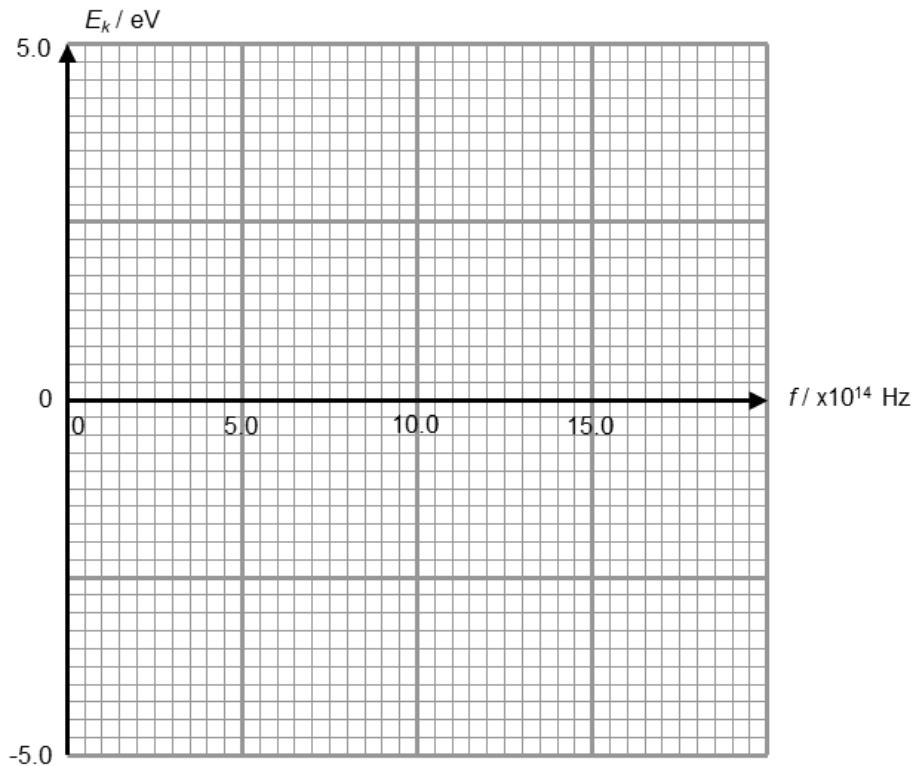
- (iii) Sodium and iron are used to investigate the photoelectric effect. The emitter and collector are made of the same metals for two set of experiments. For each metal tested, the photons incident on the emitter results in photocurrent detected. Fig. 5.2 shows the work functions of the metals.

metal	work function/ eV
sodium	2.46
iron	4.50

**Fig. 5.2****[Turn over**

1. On Fig. 5.3, sketch the variation with frequency  $f$  of the maximum kinetic energy  $E_k$  of electrons emitted from both metals.

Label **Na** for the graph of sodium and **Fe** for the graph of iron.



**Fig. 5.3**

[3]

2. The intensity of light incident on both metals is doubled while the wavelength remains constant.

State and explain the changes, if any, to the gradient and vertical intercept in Fig. 5.3.

gradient: .....

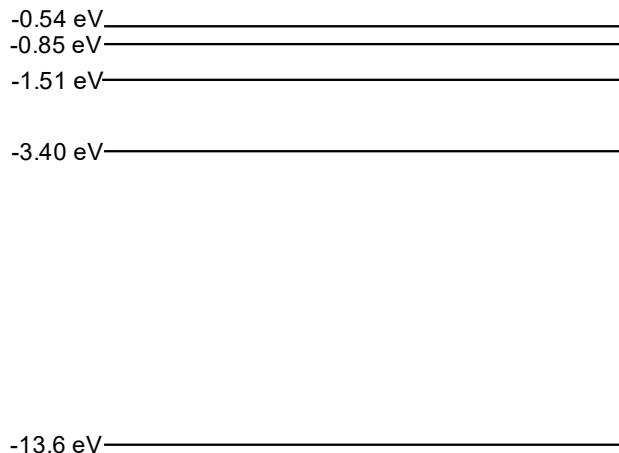
.....

vertical intercept: .....

.....

[2]

- (b) Fig. 5.4 shows some values of the energy levels of the hydrogen atom.



**Fig. 5.4**

- (i) Using Fig. 5.4, state the ionisation energy of hydrogen atom.

ionisation energy = ..... eV [1]

- (ii) Explain why the energy level values in Fig. 5.4 are negative.

.....  
..... [1]

- (iii) A beam of white light passes through a cloud of hydrogen gas and is observed on a screen. The spectrum of the transmitted light contains a few dark lines.

Explain why the dark lines occur.

.....  
.....  
.....  
.....  
.....  
.....  
..... [3]

[Total: 14]

[Turn over]