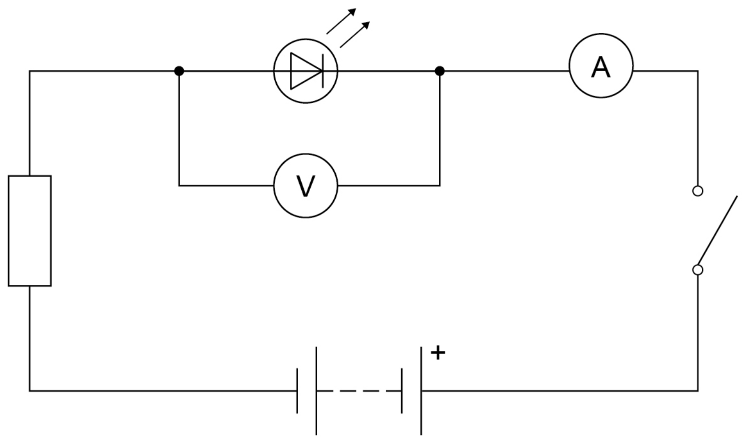
Do not write outside the box

0 5 The camera in a mobile phone uses an LED to provide light when taking a photograph.

A student investigated how the potential difference across an LED varies with the current in it.

Figure 9 shows the circuit used.

Figure 9



0 5 . 1 The student closed the switch. The voltmeter gave a reading of 5.0 V

The ammeter gave a reading of 0 mA

The LED did not emit any light.

Explain how the student should have changed the circuit to make the LED emit light.

[2 marks]

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0 5 . 2 The student changed the circuit so that the LED emitted light.

The current in the circuit was 290 mA

The power of the LED was 0.98 W

Calculate the potential difference across the LED.

Use the Physics Equations Sheet.

Give your answer to 2 significant figures.

[5 marks]

Potential difference (2 significant figures) = ____________________ V

Question 5 continues on the next page

Turn over ►

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A traditional camera uses a flash unit to provide light.

Figure 10 shows a flash unit on a traditional camera.

Figure 10

0 5 . 3 The flash unit emits light from xenon gas in a fluorescent tube.

What happens when a xenon atom emits light?

[1 mark]

Tick (✓) **one** box.

Electrons in the atom fall to a lower energy level.	☐
Electrons in the atom move to a higher energy level.	☐
Electrons leave the atom, causing ionisation.	☐
Electrons transfer to the atom from the electrical circuit.	☐

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0 5 . 4 When the flash unit is used there is a mean potential difference of 200 V across the fluorescent tube.

The flash of light lasts for 2.8×10^{-4} s

1.4 J of energy is transferred.

Calculate the mean current.

Use the Physics Equations Sheet.

[6 marks]

Mean current = ______________________ A

14

Turn over for the next question

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	reverse the connections to the LED / battery	allow reverse the potential difference across the LED / diode	1	AO3 6.2.1.4
	because an LED / diode only allows current through in one direction	allow because an LED / diode has a large resistance in the reverse direction	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	290 mA = 0.29 A		1	AO2 6.2.4.1
	$0.98 = V \times 0.29$ **or** $R = \frac{0.98}{0.29^2}$	allow a correct substitution of an incorrectly / not converted current allow R = 11.652… ignore $0.98 = (0.29)^2 \times R$ allow a correct substitution of an incorrectly / not converted current	1	
	$V = \frac{0.98}{0.29}$	allow $V = 11.65 \times 0.29$	1	
	V = 3.379…	allow a correct rearrangement using an incorrectly / not converted current	1	
	V = 3.4 (V)	allow a correct calculation using an incorrectly / not converted current allow a correctly rounded answer to 2 sig figs consistent with their calculated value of V using numbers from the question	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	electrons in the atom fall to a lower energy level		1	AO1 6.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	$1.4 = Q \times 200$		1	AO2 6.2.4.2 6.2.1.2
	$Q = \frac{1.4}{200}$		1	
	$Q = 0.0070$ (C)		1	
	$0.0070 = I \times 2.8 \times 10^{-4}$	allow a correct substitution of their calculated value of *Q*	1	
	$I = \frac{0.0070}{2.8 \times 10^{-4}}$	allow a correct re-arrangement using their value of *Q*	1	
	$I = 25$ (A)	allow an answer consistent with their value of *Q*	1	
	OR			
	$1.4 = P \times 2.8 \times 10^{-4}$ (1)			
	$P = \frac{1.4}{2.8 \times 10^{-4}}$ (1)			
	$P = 5000$ (W) (1)			
	$5000 = 200 \times I$ (1)	allow a correct substitution of their calculated value of *P*		
	$I = \frac{5000}{200}$ (1)	allow a correct re-arrangement using their value of *P*		
	$I = 25$ (A) (1)	allow an answer consistent with their value of *P*		

Total Question 5		**14**