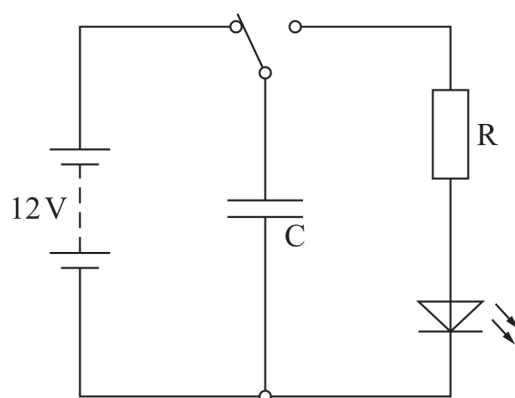**17** A student is designing a night light for a child. When switched on, the night light should come on brightly and its intensity should then gradually decrease to zero.

The time taken for the light intensity to decrease to zero should be as close to 10 minutes as possible. The time must not be less than 10 minutes.

(a) The diagram shows the student's design.

The student uses a light emitting diode (LED) and a resistor R. The LED stops emitting light when the potential difference across it falls to 1.4 V. The student assumes the LED has a constant resistance of $340\,\Omega$.

Capacitors with the following capacitances are available: $0.50\,\text{F}$, $0.51\,\text{F}$, $0.54\,\text{F}$, $0.58\,\text{F}$, $0.60\,\text{F}$.

Determine which capacitance the student should use.

resistance of $R = 860\,\Omega$

(4)

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(b) In practice, the resistance of the LED does not stay constant. The graph shows how current varies with potential difference (p.d.) for the LED.
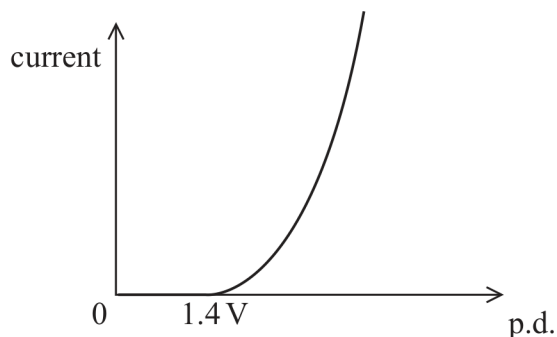
Explain how the behaviour of the LED shown in the graph will affect the time taken for the light intensity to decrease to zero.

(3)

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(c) The student states:

"A capacitor is being used in this circuit. The function of the capacitor is to store electric charge."

Explain why this is not a complete description of the function of a capacitor.

(3)

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(Total for Question 17 = 10 marks)