13 The photograph shows a thin, coiled, tungsten wire used in a filament light bulb.
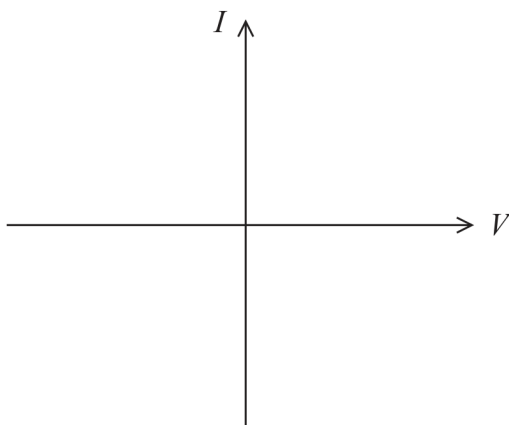

(Source: © goran cakmazovic/Shutterstock)

(a) Complete the sketch graph to show how current varies with potential difference for a filament bulb.

(2)

(b) The tungsten wire has a diameter of 0.046 mm and a length of 580 mm. When emitting light, there is a current of 0.44 A in the filament and a potential difference of 140 V across the filament.

(i) Calculate the drift velocity v of the electrons in the tungsten wire.

number of charge carriers per m^3 in tungsten $= 1.26 \times 10^{29}$

(3)

....

....

....

....

....

$v =$ ....

(ii) When the potential difference across the tungsten filament is 140 V the current in the filament is 0.44 A.

The table shows typical resistivity values for tungsten at different temperatures.

Temperature / °C	20	700	1700	2700	3200
Resistivity / Ωm	0.55×10^{-7}	2.43×10^{-7}	5.57×10^{-7}	9.04×10^{-7}	10.85×10^{-7}

Deduce the temperature of the filament.

(3)

....

....

....

....

....

....

(Total for Question 13 = 8 marks)