7 A student is asked to determine the emf and internal resistance of a 1.5 V cell. Write a plan for an experiment which could be used to do this using standard laboratory apparatus and a graphical method.

You should:

(a) draw a diagram of the circuit to be used, **(2)**

(b) state the quantities to be measured, **(1)**

(c) for **two** of these quantities state and explain your choice of measuring instrument, **(4)**

(d) explain how the data collected will be used to find the emf and the internal resistance, **(3)**

(e) identify the main sources of uncertainty and/or systematic error, **(2)**

(f) comment on safety. **(1)**

(Total for Question 7 = 13 marks)

This question must be marked holistically in the context of the candidate's answer, and marks awarded wherever they appear.

Question Number	Answer		Mark
7(a)	(a) Correct *circuit diagram* Cell, ammeter, voltmeter and a resistive component variable resistor in working circuit [correct circuit symbol only] (b) *State the quantities to be measured* potential difference, current (c) *for **two** of these quantities explain your choice of measuring instrument*, 1st instrument reason 2nd instrument reason <u>Examples of answer</u> P.d.: voltmeter or multimeter on voltage scale (stated or implied) 0.1 V interval or better because 1.5 V cell Or measures up to 2V because 1.5 V cell Current: ammeter or multimeter on current scale (stated or implied) 0.1 A interval or better because 1.5 V cell Or measures up to 2A because 1.5 V cell (d) *Explain how the data will be used* graph drawn of p.d. against current intercept is emf gradient is (-) *r* (e) *identify the main sources of uncertainty and/or systematic error*: **Max 2** Systematic/zero error on meter parallax errors if analogue meter accuracy of meters fluctuating reading on digital meter (f) *appropriate comment on safety* <u>Examples of answer</u> Avoid touching hot wires Low voltage so no risk of electrocution Ensure cell is not short-circuited otherwise cell will get hot	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)** **(1)**	**2** **1** **4** **3** **2** **1**
	Total for question 7		**13**