Year 11 Physics: Electricity
Series & Parallel: **Practical** Assessment

Mark: (10)		1/5

Power supply number	

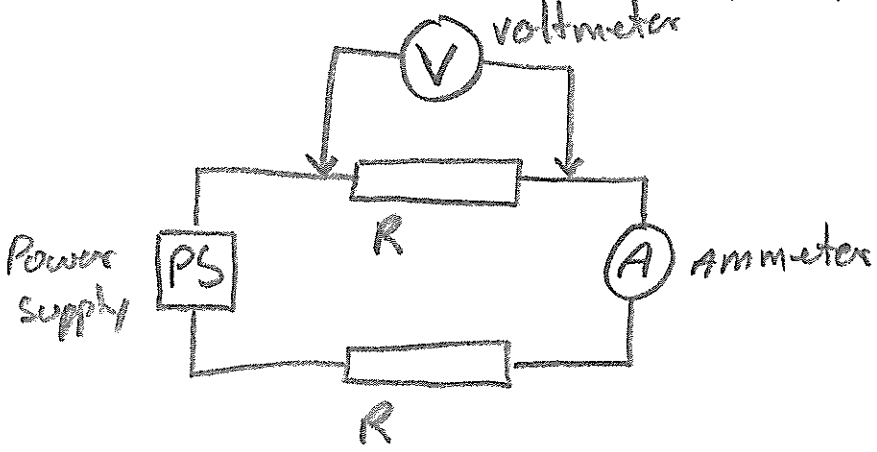
Name: Solutions
Teacher: _____

You have been given 2 **unknown** resistors (coloured blue and red). Your task is to determine the resistance value of both resistors. You must use a series circuit with both the 2 unknown resistors within the circuit. You must record a sufficient number of meter readings to draw a VI graph (on the graph paper provided) and then determine the values of the two unknown resistors from **your** VI graphs.

1. Draw a **SERIES** test circuit with: a power supply, both unknown resistors and with at least one voltmeter and one ammeter. Label each component used. (2 marks)

Voltmeter (0-12V)
Ammeter (0-5A)
Switch Power supply (0-12 V DC)
Electrical leads (8 of)
Red resistor (unknown value)
Blue resistor (unknown value)

½ each



✓

2. Construct a **SERIES** circuit, using both unknown resistors, to determine the actual resistor values of the RED and BLUE resistors from the VI graph. Place your readings in the table and the slope calculations in the space below. Place your slope calculated 'unknown' resistor values in the box below. (8 marks)

				R check	
PS	V_{Blue}	V_{Red}	I(mA)	R_{Blue}	R_{Red}
2	0.82	1.5	20	41	75
4	1.41	2.5	37	38	67
6	2.21	4.0	50	~~44~~ #	80
8	2.68	5.1	70	38	72
10	3.6	6.4	88	41	72
12	4.5	7.6	105	43	72
			Ave	40.2	71.6

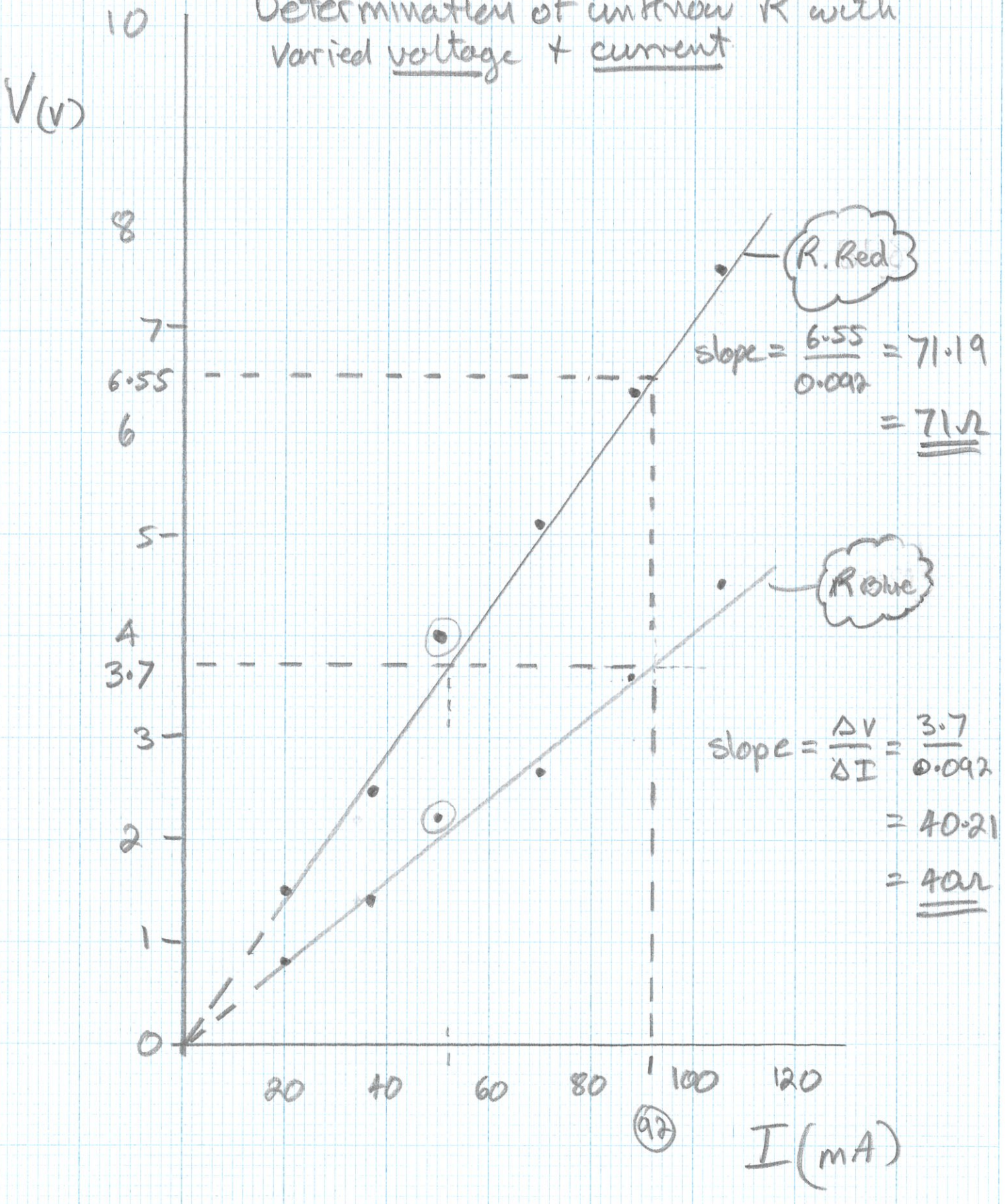
graph
R_{Blue} = 40Ω
R_{Red} = 71Ω

scale change produces large error!

Unknown resistor values
RED = 68 ± 6
BLUE = 39 ± 4

End of practical assessment.
Working space is provided on the next page if required.

Determination of unknown R with varied voltage & current



slope = $\frac{6.55}{0.092}$ = 71.19

= 71Ω

slope = $\frac{\Delta V}{\Delta I}$ = $\frac{3.7}{0.092}$

= 40.21

= 40Ω

3/5

Year 11 Physics: Electricity

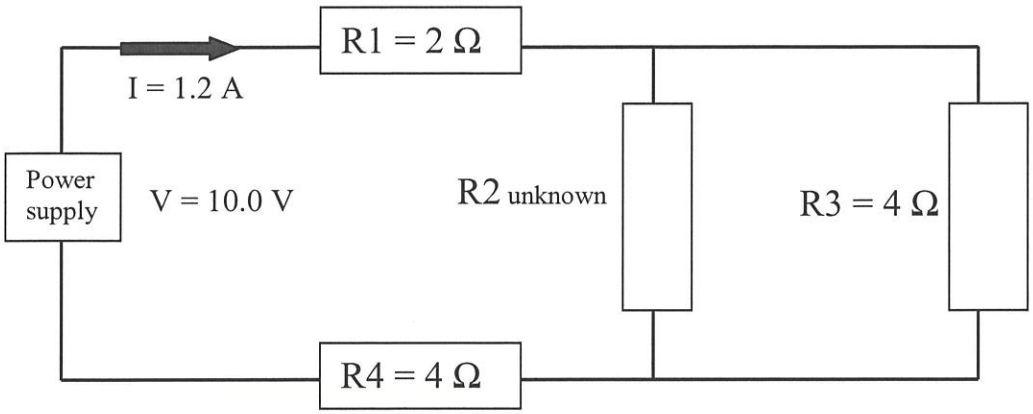
Series & Parallel: **Written** Assessment

Mark: (15)	

Name: Solutions

Teacher: _____

Q1. The following circuit is a compound resistive electrical circuit with 4 resistors. One of the resistor values is unknown. Use your knowledge of compound electrical circuits to determine the value of the unknown resistor. Provide all workings. (6)



The value of the unknown resistor is:

5.6 Ω

layout (1)

$R_T = \frac{V_{ps}}{I_T} = \frac{10\,(V)}{1.2\,(A)} = 8.3\dot{3}\ \Omega$ (1)

$R_T = R1 + R2 + R_{//23}$ (1)

$R_{//23} = R_T - (R1 + R4) = 8.3\dot{3} - 6 = 2.3\dot{3}\ \Omega$ (1)

$\frac{1}{R_{//}} = \frac{1}{R2} + \frac{1}{R3} \Rightarrow \frac{1}{R3} = \frac{1}{R_{//}} - \frac{1}{R_2}$ (1)

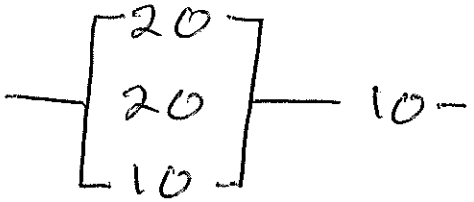
$= \frac{1}{2.33} - \frac{1}{4}$

$R_3 = 5.6\,\Omega$ (1)

2. You have been given 2 x 10 Ω resistors and 2 x 20 Ω resistors. Design a resistance network to the given value in the following 3 questions using all 4, or fewer resistors, and show your full calculations. 4/5

a) A resistor network that has a resistance of 15.0 Ω. (2 marks)

OR



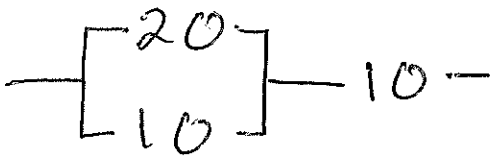
$$R_T = \frac{1}{\frac{1}{10}+\frac{1}{10}} + \frac{1}{\frac{1}{20}+\frac{1}{20}}$$

$$= 5 + 10 = \underline{15\,\Omega}$$

$$R_T = \frac{1}{\frac{1}{20}+\frac{1}{20}+\frac{1}{10}} + 10$$

$$= 5 + 10 = \underline{15\,\Omega}$$

b) A resistor network that has a resistance of 16.67 Ω. (2 marks)

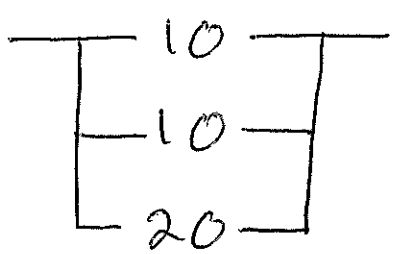


$$R_T = \frac{1}{\frac{1}{10}+\frac{1}{20}} + 10$$

$$= 6.66 + 10$$

$$= \underline{16.67\,\Omega}$$

c) A resistor network that has a resistance of 4.00 Ω. (2 marks)



$$R_T = \frac{1}{\frac{1}{10}+\frac{1}{10}+\frac{1}{20}} = \frac{1}{0.24}$$

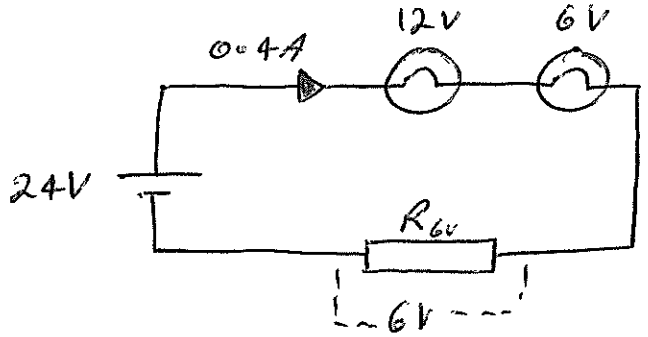
$$= \underline{4\,\Omega}$$

(1) (1)

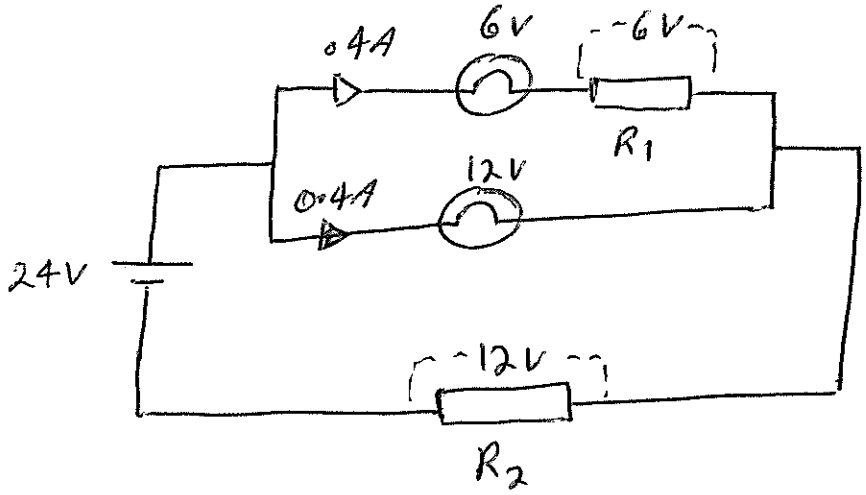
* R needs to be exact.

5/5

3. You have been given 2 lamps that you want to operate from a 24.0 V battery. The lamps have a voltage rating of 6.0 V and 12.0 V. Both lamps MUST carry a current of 0.400A and operate at rated voltage. One (1) or two (2) resistors must be placed somewhere within the circuit to enable both lamps to operate from a single switch.
Draw a circuit that satisfies the conditions of the question and provide proof of your selected resistor values. (4 marks)

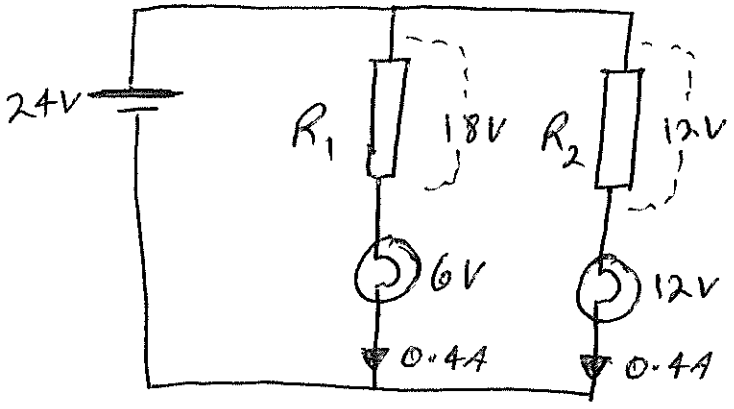


$$R_{6V} = \frac{V_B}{I} = \frac{6}{0.4} = 15\Omega$$



$$R_1 = \frac{6}{0.4} = 15\Omega$$

$$R_2 = \frac{12}{0.8} = 15\Omega$$



$$R_1 = \frac{18}{0.4} = 45\Omega$$

$$R_2 = \frac{12}{0.4} = 30\Omega$$

(2) (2)

End of written assessment.