

Name _____

Class _____

Date _____

By the end of this worksheet I can...

- ☐ answer SQA analogue electronics questions from recent papers
- ☐ describe the operation of a sensing circuit step by step
- ☐ carry out voltage divider and resistor network calculations
- ☐ explain the advantages of simulation

I DO**How to describe a sensing circuit** Use this chain in every "describe" answer

- State what happens to the **sensor's resistance** (TURD: temperature up, resistance down; LURD: light up, resistance down).
- Say what happens to **V_{in}** (the voltage across the bottom of the divider).
- Compare with about **0.7 V**: the transistor switches on or off.
- Finish with the **output**: the relay, LED, buzzer or motor.

Remember

For simulation questions give a cause and its effect, e.g. "components can't be damaged, so testing costs less".

YOU DO

SQA past paper questions Answer in the spaces on each question.

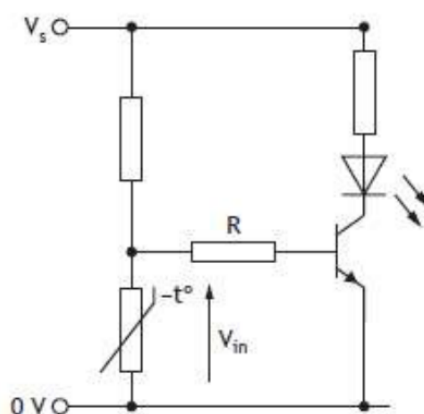
1 SQA 2025, question 14

14. A carpet cleaner is shown below.



The carpet cleaner uses a heater to maintain the temperature of the water in a clean water tank.

A simplified circuit, used to indicate when the water is too cold, is shown below.



- (a) Describe the operation of the circuit as the water temperature increases. Include reference to the resistance of the thermistor and the voltage V_{in} .

4

As the water temperature increases . . .

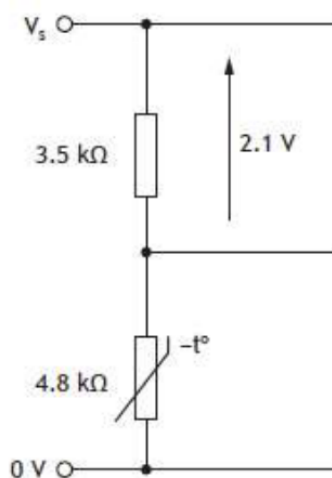
2 SQA 2025, question 14 (continued)

14. (continued)

- (b) Explain the purpose of resistor R in the circuit shown opposite.

2

The sensing part of the circuit is shown below.



- (c) Calculate the supply voltage V_s in the circuit shown above.

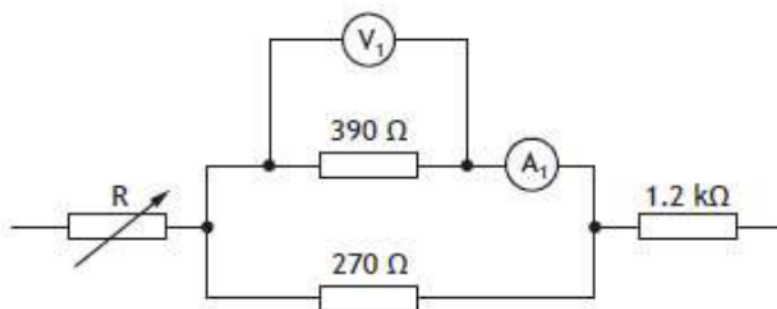
4

3 SQA 2024, question 8

8. A child's microphone with built-in speaker is shown.



Part of the circuit used to control the volume of the speaker is shown.



(a) For the circuit shown above:

(i) calculate the resistance of the parallel branch

2

4 SQA 2024, question 8 (continued)

8. (a) (continued)

- (ii) calculate the total resistance of the circuit when the variable resistor R is set to $780\ \Omega$.

2

- (b) Calculate the current reading on ammeter A_1 when the voltage V_1 is 1.2 V.

3

The resistance of the variable resistor R in the circuit is increased.

- (c) State the effect this will have on the:

(i) voltage V_1 _____ 1

(ii) current A_1 _____ 1

During the development of the child's microphone and speaker, computer simulation was used to test the complete circuit before constructing a prototype.

- (d) Explain why it is an advantage to test the circuit using computer simulation before constructing the prototype.

2

5 SQA 2024, question 10

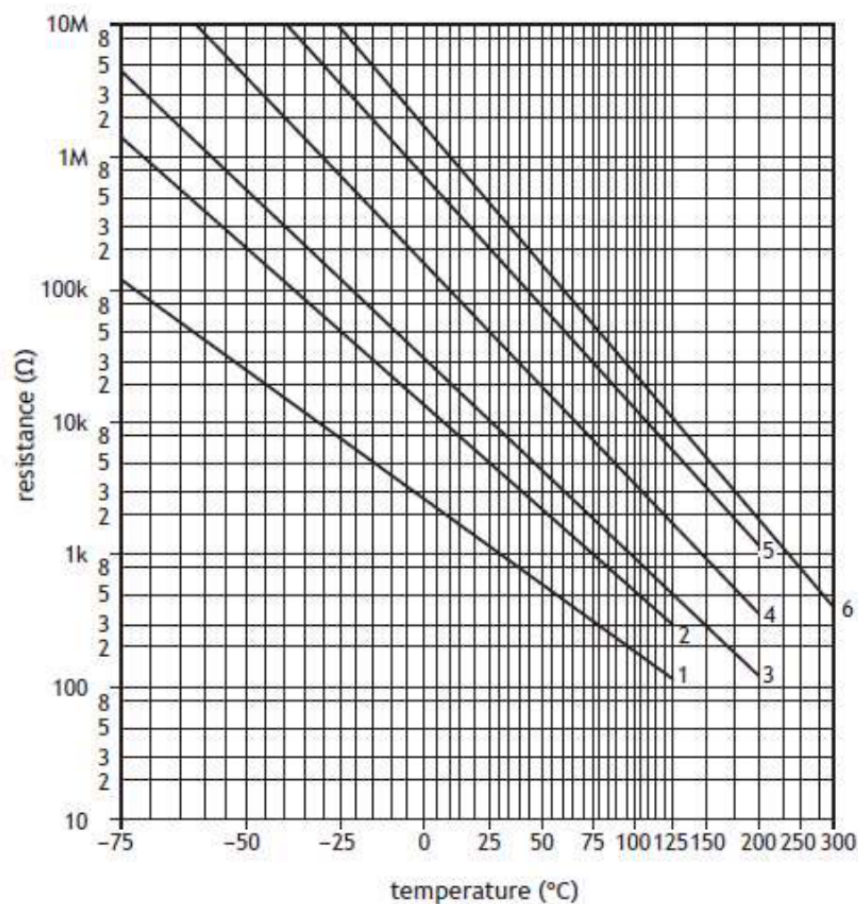
10. A kettle is shown below.

MARK



A thermistor is used as part of a sensor to measure the water temperature in the kettle.

The operating characteristics for a range of thermistors are shown on the graph below.



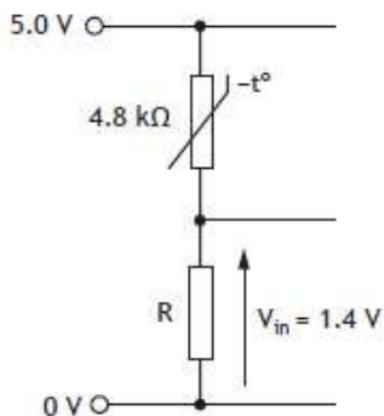
- (a) Determine the resistance of a type 2 thermistor at a temperature of 85 °C, with reference to the graph.

1

6 SQA 2024, question 10 (continued)

10. (continued)

The sensing circuit used to detect the temperature of the water is shown below.



(b) State the name of this type of series circuit.

1

(c) Calculate the resistance R in the sensing circuit shown above.

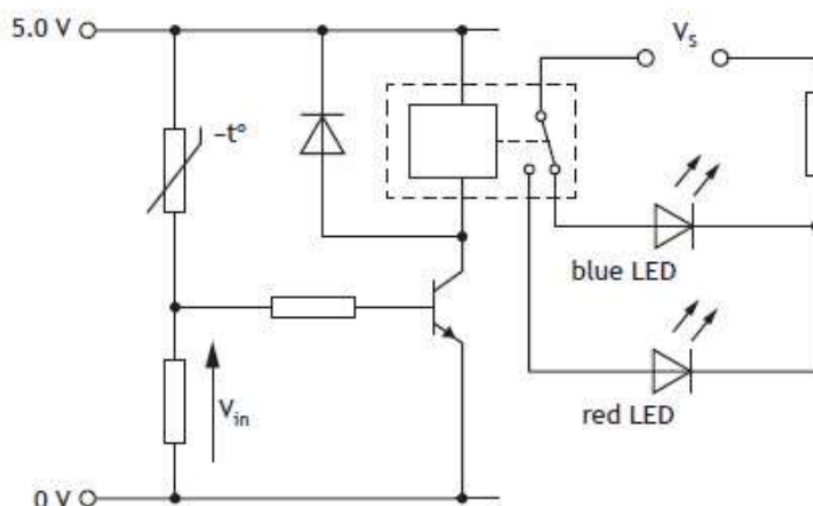
4

7 SQA 2024, question 10 (continued)

10. (continued)

The kettle has coloured LEDs to indicate the temperature of the water.

A simplified circuit used to model the operation of the LEDs is shown below.



(d) Describe the operation of this circuit as the water temperature increases.

Include reference to the resistance of the thermistor, the voltage V_{in} and both LEDs.

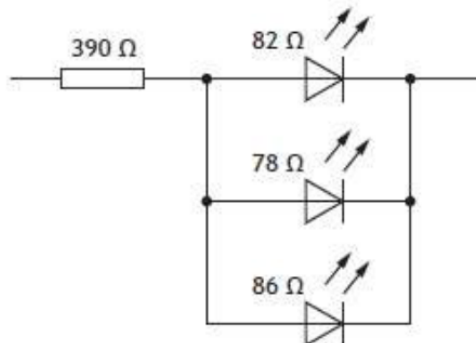
5

As the water temperature increases . . .

8 SQA 2023, question 10(d)

10. (continued)

Part of the circuit used in the warning sign is shown below.



(d) (i) Calculate the resistance of the three LEDs in parallel.

3

(ii) Calculate the total resistance of the circuit shown above.

1

9 SQA 2023, question 10(d) (continued)

10. (continued)

The warning sign is rated at 12 V, 1.8 W.

(e) Calculate the current supplied to the warning sign.

3

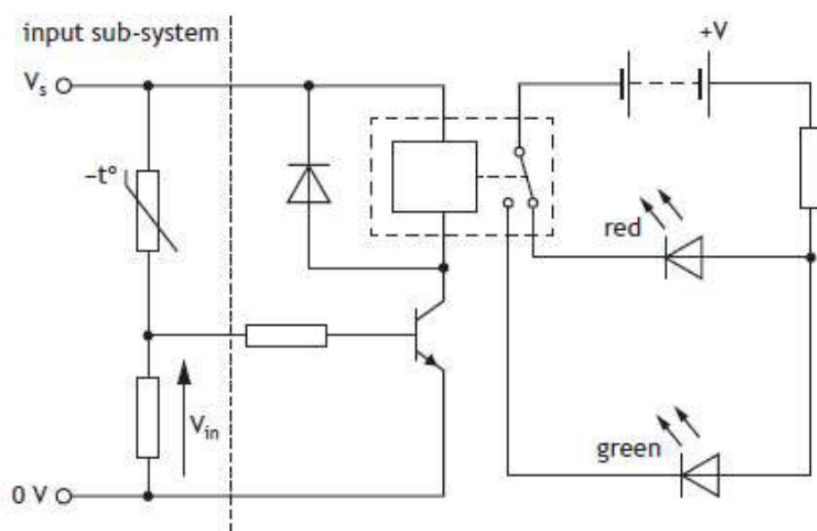
10 SQA 2023, question 14

14. A laminator is used to cover a sheet of paper in a plastic sleeve.



The plastic sleeve is heated by the laminator as it passes through.

The circuit used to indicate when the laminator is at the correct temperature is shown below.



- (a) Describe the operation of the input sub-system as the temperature increases. Make reference to the resistance of the thermistor and the voltage V_{in} .

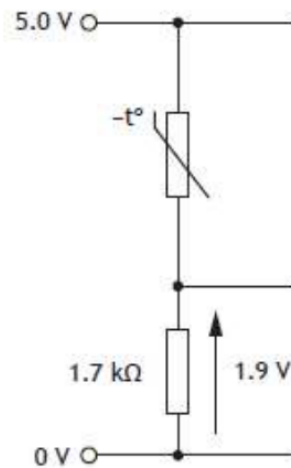
2

As the temperature increases . . .

11 SQA 2023, question 14 (continued)

14. (continued)

The input sub-system is shown below.



(b) Calculate the resistance of the thermistor for the condition shown above.

4

(c) Describe, with reference to the circuit shown opposite, the effect on the red LED and the green LED when the transistor first activates the relay.

2

When the transistor activates the relay . . .

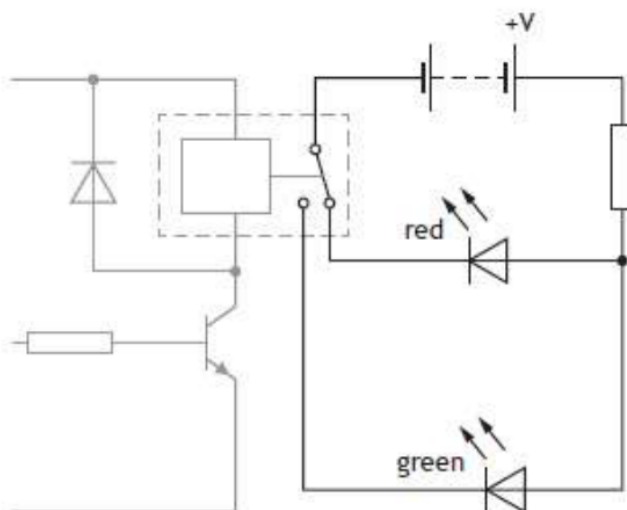
12 SQA 2023, question 14 (continued)

14. (continued)

A possible modification to the circuit is to include an audible alert when the laminator is at the correct temperature.

- (d) Draw, in the circuit below, the symbol for a buzzer connected in parallel with the green LED.

2



An electronic engineer used computer simulation to test the modified circuit.

- (e) Describe an advantage of using computer simulation compared to building a circuit for testing purposes.

1

A large reduction in speed is required for a feed roller to slowly move the plastic sleeve and paper through the laminator.

- (f) Explain why a compound gear train is more suitable than a simple gear train to create this large reduction in speed in the laminator.

2

Check and reflect

Mark your answers with the answer sheet. Which “I can” statement above still needs work? Look back at the notes for that topic on the site.
