



Gleniffer High School

National 5

“A – Team”

Past Papers

Resit Prelim

Revision Homework

DATA SHEET

Speed of light in materials

Material	Speed in m s^{-1}
Air	3.0×10^8
Carbon dioxide	3.0×10^8
Diamond	1.2×10^8
Glass	2.0×10^8
Glycerol	2.1×10^8
Water	2.3×10^8

Speed of sound in materials

Material	Speed in m s^{-1}
Aluminium	5200
Air	340
Bone	4100
Carbon dioxide	270
Glycerol	1900
Muscle	1600
Steel	5200
Tissue	1500
Water	1500

Gravitational field strengths

	Gravitational field strength on the surface in N kg^{-1}
Earth	9.8
Jupiter	23
Mars	3.7
Mercury	3.7
Moon	1.6
Neptune	11
Saturn	9.0
Sun	270
Uranus	8.7
Venus	8.9

Specific heat capacity of materials

Material	Specific heat capacity in $\text{J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$
Alcohol	2350
Aluminium	902
Copper	386
Glass	500
Ice	2100
Iron	480
Lead	128
Oil	2130
Water	4180

Specific latent heat of fusion of materials

Material	Specific latent heat of fusion in J kg^{-1}
Alcohol	0.99×10^5
Aluminium	3.95×10^5
Carbon Dioxide	1.80×10^5
Copper	2.05×10^5
Iron	2.67×10^5
Lead	0.25×10^5
Water	3.34×10^5

Melting and boiling points of materials

Material	Melting point in $^\circ\text{C}$	Boiling point in $^\circ\text{C}$
Alcohol	-98	65
Aluminium	660	2470
Copper	1077	2567
Glycerol	18	290
Lead	328	1737
Iron	1537	2737

Specific latent heat of vaporisation of materials

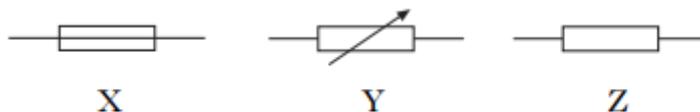
Material	Specific latent heat of vaporisation in J kg^{-1}
Alcohol	11.2×10^5
Carbon Dioxide	3.77×10^5
Glycerol	8.30×10^5
Turpentine	2.90×10^5
Water	22.6×10^5

Radiation weighting factors

Type of radiation	Radiation weighting factor
alpha	20
beta	1
fast neutrons	10
gamma	1
slow neutrons	3

Resit Prelim Revision One

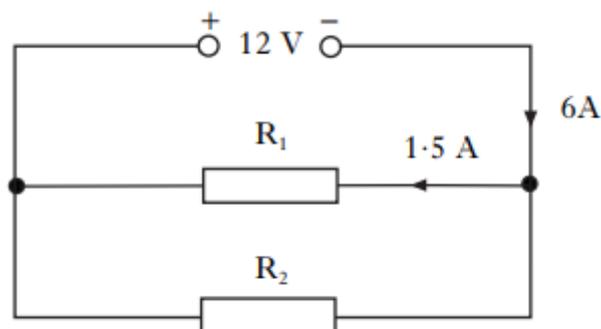
1. Three circuit symbols X, Y, and Z are shown.



Which row in the table identifies the symbols X, Y, and Z?

	X	Y	Z
A	thermistor	transistor	resistor
B	fuse	variable resistor	thermistor
C	transistor	fuse	variable resistor
D	fuse	variable resistor	resistor
E	variable resistor	resistor	fuse

2. A circuit is set up as shown.

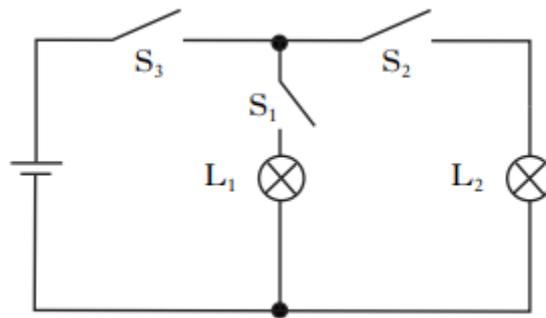


The current from the supply is 6 A. The current in resistor R_1 is 1.5 A.

Which row in the table shows the potential difference across resistor R_2 , and the current in resistor R_2 ?

	Potential difference across R_2 (V)	Current in R_2 (A)
A	12	1.5
B	6	1.5
C	12	4.5
D	6	4.5
E	12	7.5

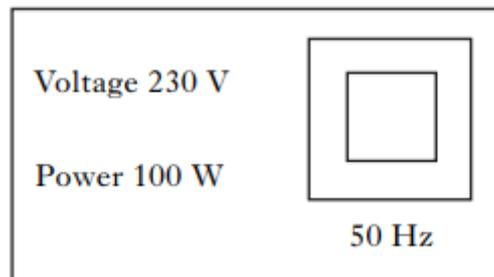
3. A circuit is set up as shown.



Which switch or switches must be closed to light lamp L_1 **only**?

- A S_1 only
- B S_2 only
- C S_1 and S_2 only
- D S_1 and S_3 only
- E S_2 and S_3 only

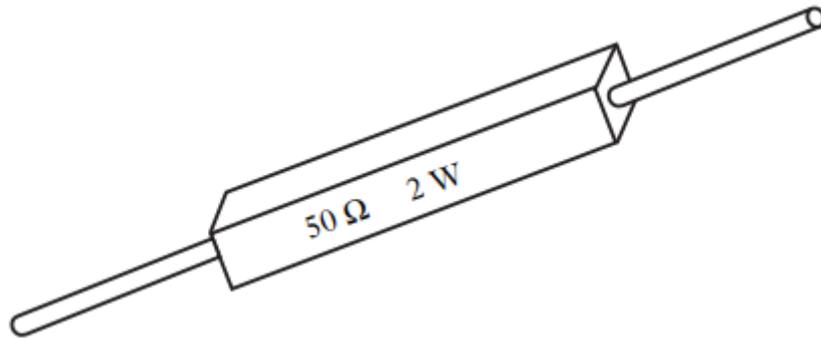
4. The information shown is for an electric food mixer.



The resistance of the mixer is

- A 0.43Ω
- B 2.3Ω
- C 4.6Ω
- D 529Ω
- E $23\,000 \Omega$

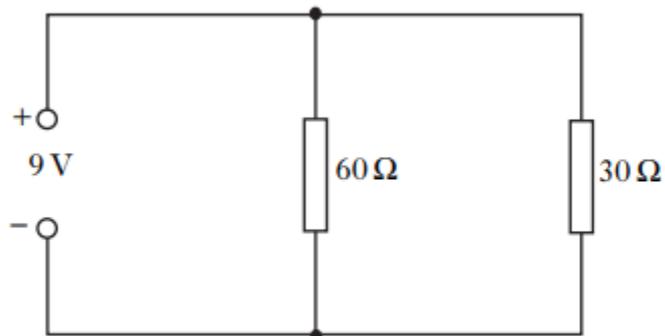
5. Some resistors are labelled with a power rating as well as their resistance value. This is the maximum power at which they can operate without overheating.



a) A resistor is labelled $50\ \Omega$, $2\ \text{W}$. Calculate the maximum operating current for this resistor.

3

b) Two resistors, each rated at $2\ \text{W}$, are connected in parallel to a $9\ \text{V}$ d.c. supply. They have resistances of $60\ \Omega$ and $30\ \Omega$.



i) Calculate the total resistance of the circuit.

3

ii) Calculate the power produced in each resistor.

4

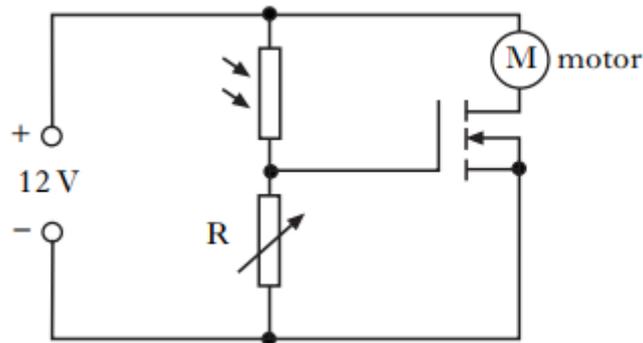
iii) State which, if any, of the resistor will overheat.

Explain your answer.

2

6. An office has an automatic window blind that closes when the light level outside gets too high.

The electronic circuit that operates the motor to close the blind is shown.



a) The MOSFET switches on when the voltage across variable resistor R reaches 2.4 V.

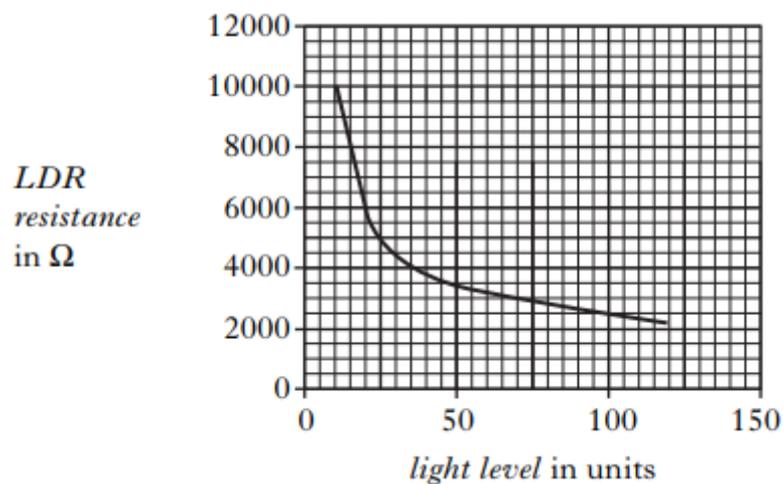
i) Explain how this circuit works to operate the motor to close the blind.

3

ii) What is the purpose of variable resistor R?

1

b) The graph shows how the resistance of the LDR varies with light level.



i) What is the resistance of the LDR when the light level is 70 units?

1

ii) R has a value of 600 Ω. Calculate the voltage across R when the light level is 70 units.

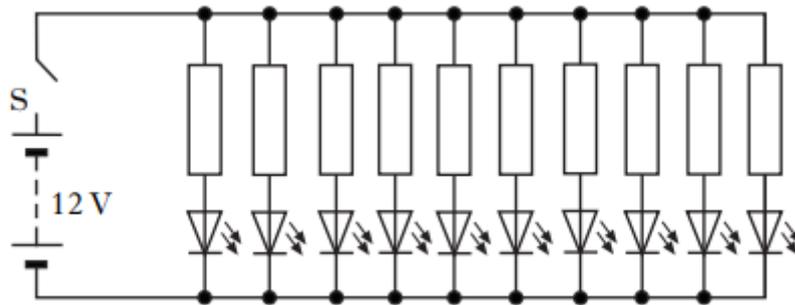
3

iii) State whether the blinds will close when the light level is 70 units. Justify your answer.

2

7. The rear light of a car is made up of a row of 10 **identical** red LEDs. Each LED requires 2 V and 20 mA to operate correctly.

The circuit for this is shown.



a) Why does each LED need a resistor in series? 1

b) The voltage of the car battery is 12 V. calculate the value of each resistor. 4

c) Calculate the total current, **in amperes**, from the battery when the rear light is operating correctly. 2

8. Gold-198 is a radioactive source that is used to trace factory waste which may cause river pollution. A small quantity of the radioactive gold is added into the waste as it enters the river. Scanning the river using radioactive detectors allows scientists to trace where the waste has travelled. Gold-198 has a half-life of 2.7 days.

a) What is meant by the term half-life? 1

b) A sample of Gold-198 has an activity of 160 kBq when first obtained by the scientists. Calculate the activity after 13.5 days. 3

c) State two safety precautions that scientists must observe when handling radioactive sources. 2

d) A scientist receives an absorbed dose of 10 mGy when handling alpha radiation. Calculate the equivalent dose received by the scientist. 3

Resit Revision Two

1. A student makes the following statements about electrical circuits.

I The sum of the potential differences across components connected in series is equal to the supply voltage.

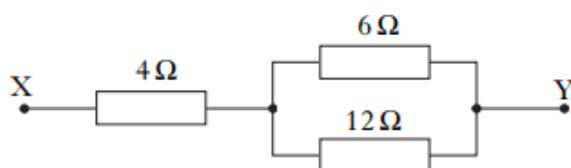
II The sum of the currents in parallel branches is equal to the current drawn from the supply.

III The potential differences across components connected in parallel is the same for each component.

Which of the statements is/are correct?

- A I only
- B III only
- C I and II only
- D II and III only
- E I, II, and III

2. Three resistors are connected as shown.



The total resistance between X and Y is

- A $2\ \Omega$
 - B $4\ \Omega$
 - C $8\ \Omega$
 - D $13\ \Omega$
 - E $22\ \Omega$
3. The resistance of a wire is $6\ \Omega$. The current in the wire is $2\ \text{A}$. The power developed in the wire is
- A $3\ \text{W}$
 - B $12\ \text{W}$
 - C $18\ \text{W}$
 - D $24\ \text{W}$
 - E $72\ \text{W}$

4. A satellite sends microwaves to a ground station on Earth.



a) The microwaves have a wavelength of 60 mm.

i) Calculate the frequency of the waves.

3

ii) Calculate the period of the waves.

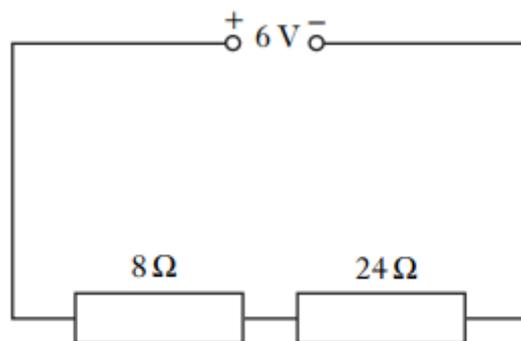
3

b) The satellite sends radio waves along with the microwaves to the ground station. Will the radio waves be received by the ground station **before, after or at the same time** as the microwaves?

Explain your answer.

2

5. A student sets up the following circuit.



a) Calculate the current in the 8 Ω.

4

b) Calculate the voltage across the 8 Ω resistor.

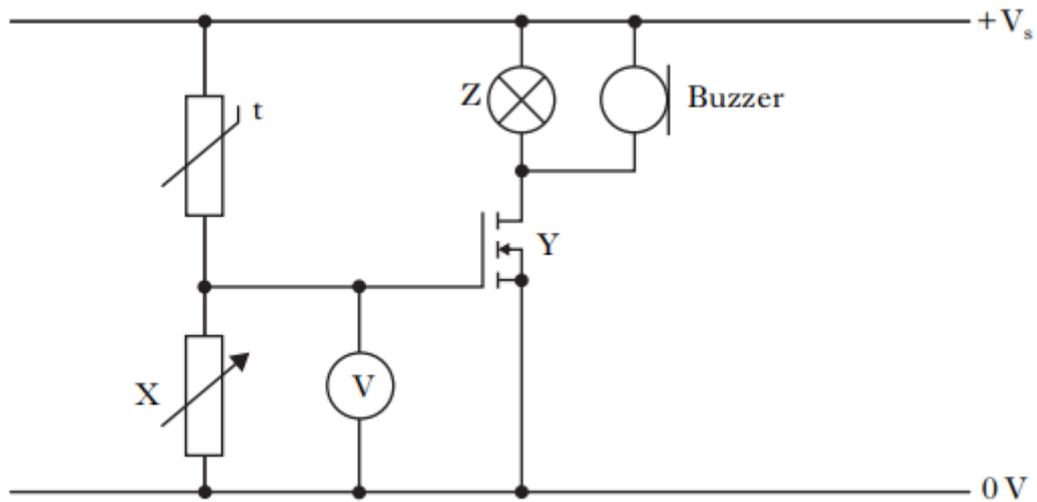
3

c) The 24 Ω resistor is replaced by one of **greater** resistance. How will this affect the voltage across the 8 Ω resistor?

Explain your answer.

2

6. Water in a fish tank must be maintained at a constant temperature. Part of the electronic circuit which controls the temperature is shown.



- a) Name components Y and Z. 2

- b) What happens to the resistance of the thermistor as the temperature increases? 1

- c) When the voltmeter reading reaches 1.8 V, component Y switches on. Explain how the circuit operates when the temperature rises. 3

- d) Why is a variable resistor chosen for component X rather than a fixed value resistor? 1

Resit Revision Three

1. A student makes the following statements.

I In an atom there are neutrons and electrons in the nucleus and protons which orbit the nucleus.

II An alpha particle consists of two neutrons and two electrons.

III A beta particle is a fast moving electron.

Which of the statements is/are correct?

A I only

B II only

C III only

D I and III only

E I, II, and III

2. A radioactive source emits alpha, beta, and gamma radiation. A detector, connected to a counter, is placed 10 mm in front of the source. The counter records 400 counts per minute. A sheet of paper is placed between the source and the detector. The counter records 300 counts per minute. The radiation now detected is

A alpha only

B beta only

C gamma only

D alpha and beta only

E beta and gamma only

3. The voltage of an electrical supply is a measure of the

A resistance of the circuit

B speed of the charges in the circuit

C power developed in the circuit

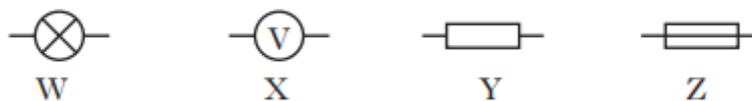
D energy given to the charges in the circuit

E current in the circuit

4. The current in an $8\ \Omega$ resistor is 2 A. the charge passing through the resistor in 10 s is

- A 4 C
- B 5 C
- C 16 C
- D 20 C
- E 80 C

5. Four circuit symbols, W, X, Y, and Z, are shown.



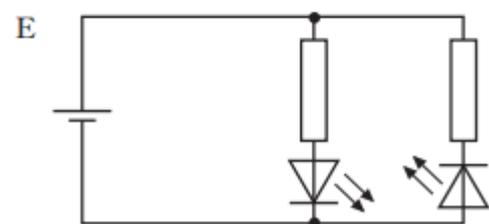
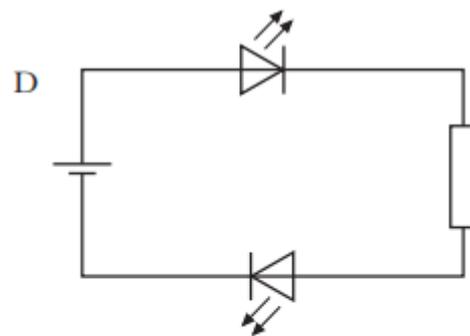
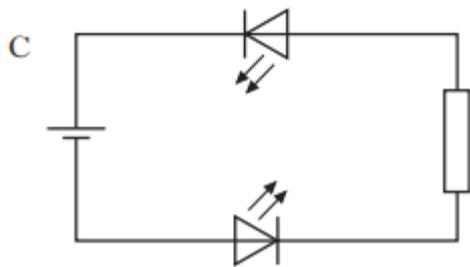
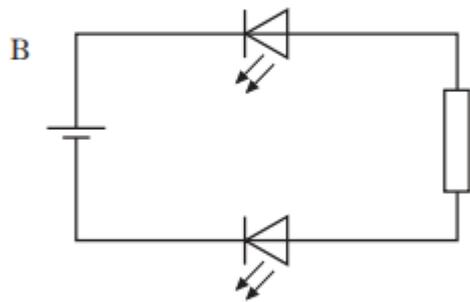
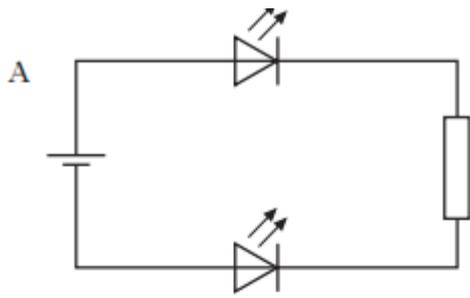
Which row in the table identifies the components represented by these symbols?

	W	X	Y	Z
A	battery	ammeter	resistor	variable resistor
B	battery	ammeter	fuse	resistor
C	lamp	ammeter	variable resistor	resistor
D	lamp	voltmeter	resistor	fuse
E	lamp	voltmeter	variable resistor	fuse

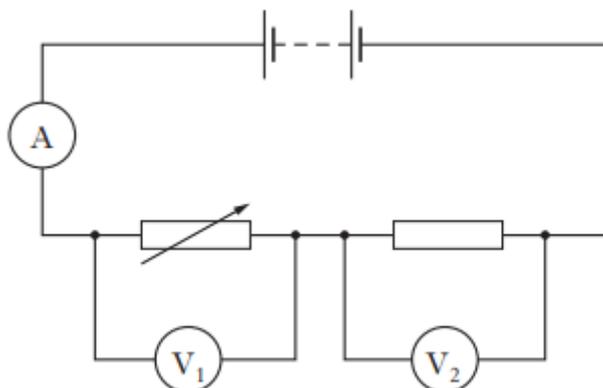
6. Which row in the table correctly identifies input and output devices?

	Input device	Output devices
A	microphone	Loudspeaker, LED
B	solar cell	thermocouple, LED
C	loudspeaker	microphone, relay
D	LED	loudspeaker, relay
E	thermocouple	microphone, LED

7. A student sets up the circuits shown. In which circuit will both LEDs be lit?



8. A circuit is set up as shown.



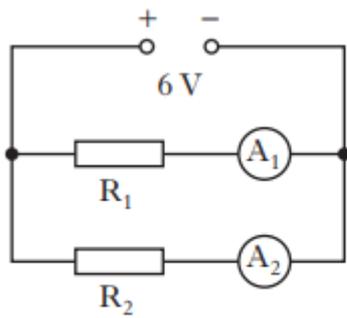
The resistance of the variable resistor is increased.

Which row in the table shows the change in the readings on the ammeter and voltmeters?

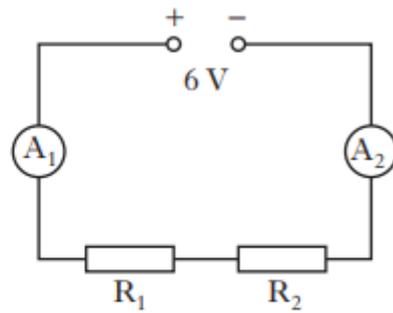
	Reading on Ammeter	Reading on Voltmeter, V_1	Reading on Voltmeter, V_2
A	increases	increases	increases
B	decreases	unchanged	decreases
C	increases	unchanged	decreases
D	decreases	increases	decreases
E	increases	decreases	increases

9. A student suspects that ammeter A_1 may be inaccurate. Ammeter A_2 is known to be accurate. Which of the following circuits should be used to compare the reading on A_1 with A_2 ?

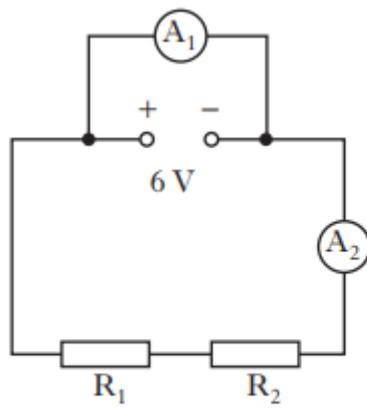
A



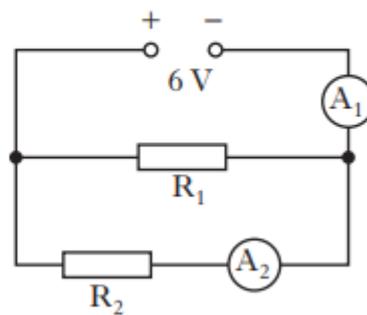
B



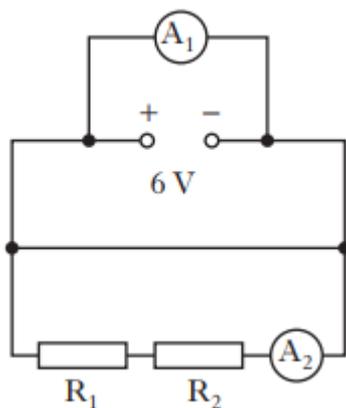
C



D



E



10. An ageing nuclear power station is being dismantled.



During the dismantling process a worker comes into contact with an object that emits 24000 alpha particles in five minutes. The worker's hand has a mass of 0.50 kg and absorbs $6.0 \mu\text{J}$ of energy. Calculate:

a) the absorbed dose received by the worker's hand.

3

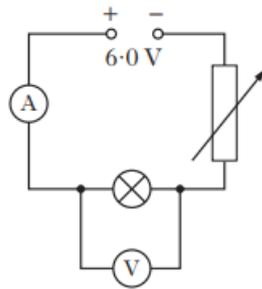
b) the equivalent dose received by the worker's hand.

3

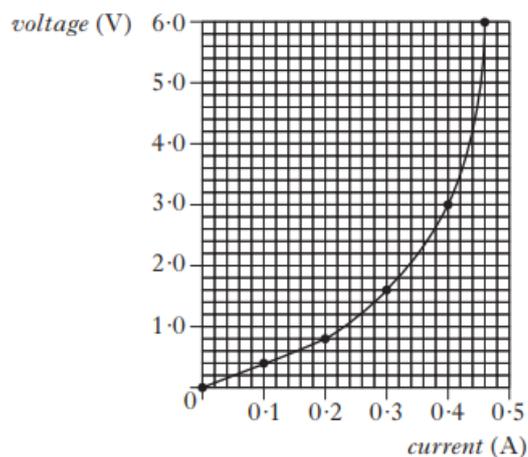
c) the activity of the object

3

11. The circuit shown is used to investigate the relationship between voltage and current for a filament lamp.



The variable resistor is altered and readings of current and voltage are taken. These values are plotted on the graph shown.



- a) Calculate the resistance of the filament lamp when the current is 0.4 A. **3**
- b) What happens to the resistance of the filament lamp as the voltage across it increases? You must justify your answer. **2**
- c) In many modern electronic systems, LEDs are used instead of filament lamps.
- i) Using a 6.0 V supply, a 2.0 V LED and one other suitable component, draw a circuit that would allow the LED to light. **2**
- ii) A red LED emits light of wavelength 6.0×10^{-7} m. Calculate the frequency of this light. **3**
- iii) Filament lamps and LEDs are examples of output devices. Name one other output device. **1**

12. A resistor is labelled: “ $10\ \Omega \pm 10\%$, 3 W”.



This means that the resistance value could be between $9\ \Omega$ and $11\ \Omega$.

a) A student decides to check the value of the resistance.

Draw a circuit diagram, including a 6 V battery, a voltmeter, and an ammeter, for a circuit that could be used to determine the resistance.

3

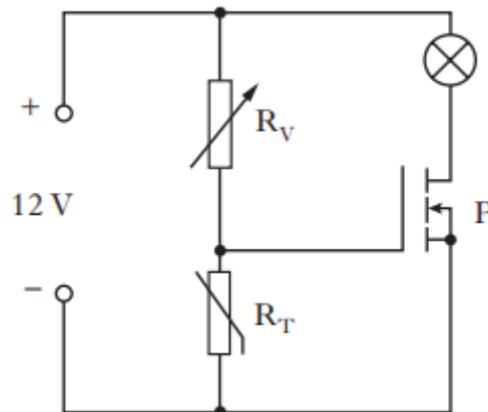
b) Readings from the circuit give the voltage across the resistor as 5.7 V and the current in the resistor as 0.60 A. Use these values too calculate the resistance.

3

c) During the experiment, the resistor becomes very hot and gives off smoke. By calculating the power dissipated in the resistor, explain why this happens.

4

13. The circuit shown switches a warning lamp on or off depending on the temperature.



a) Name component P.

1

b) As the temperature increases the resistance of thermistor R_T decreases. What happens to the voltage across R_T as the temperature increases?

1

c) When the voltage applied to component P is equal to or greater than 2.4 V, component P switches on the warning lamp lights. R_V is adjusted until its resistance is 5600Ω and the warning lamp now lights. At this point:

i) state the voltage across R_V

1

ii) calculate the resistance of R_T

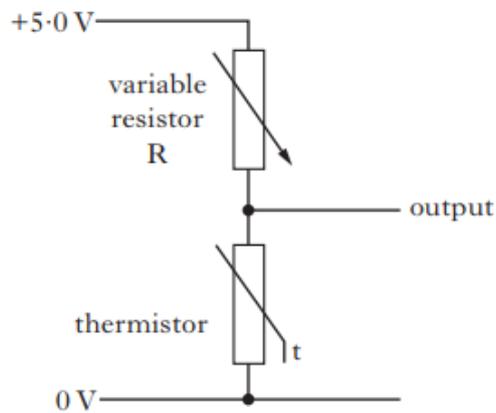
3

d) The temperature of R_T now decreases. Will the lamp stay on or go off?

You must explain your answer.

4

14. A thermistor is used as a temperature sensor in a circuit to monitor and control the temperature of water in a tank. Part of the circuit is shown.

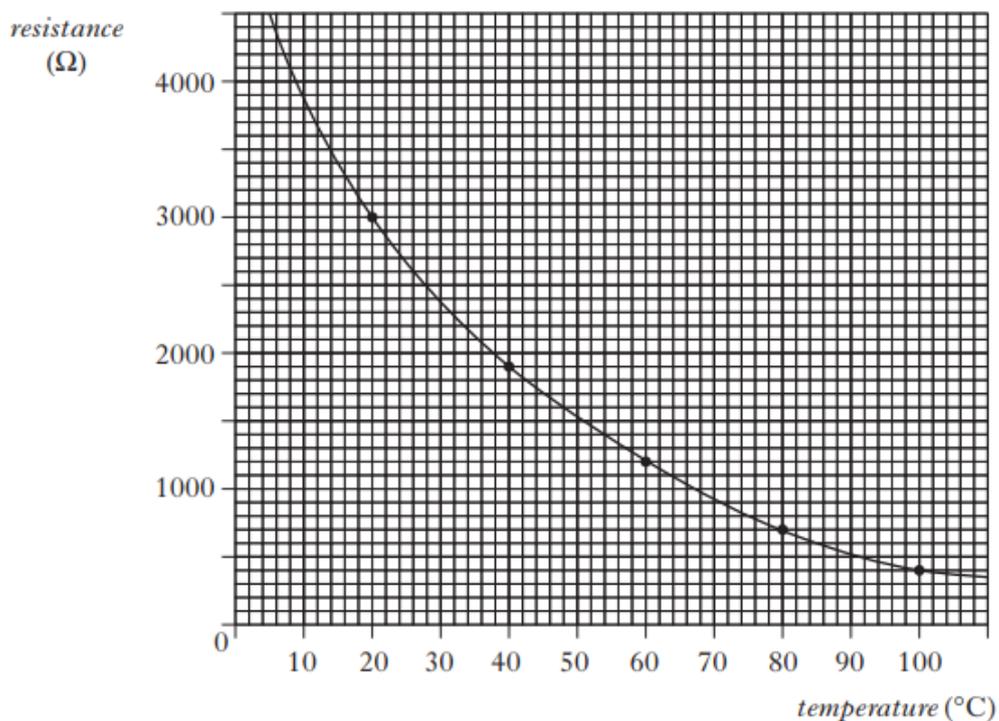


a)

i) The variable resistor R is set to a resistance of 1050Ω . Calculate the resistance of the thermistor when the voltage across the thermistor is 2.0 V .

3

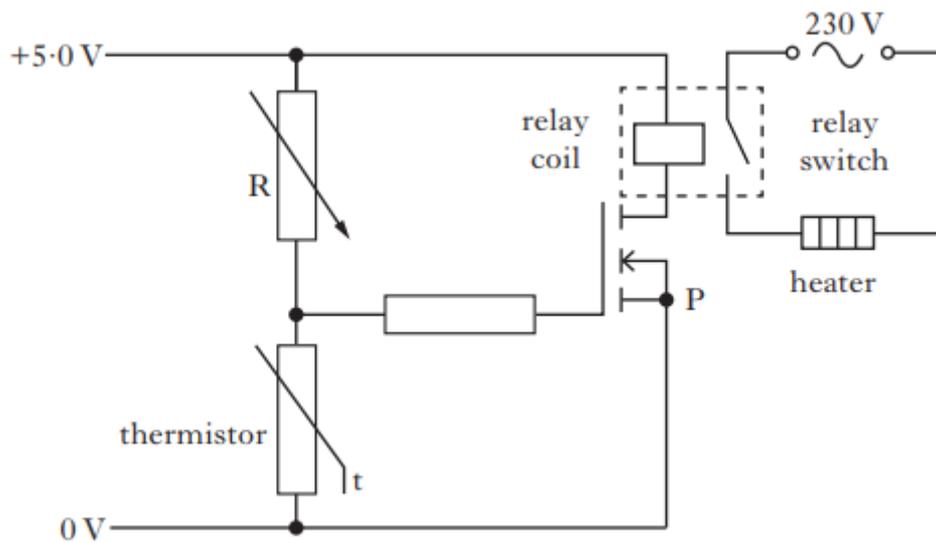
ii) The graph shows how the resistance of the thermistor changes with temperature.



Use the graph to determine the temperature of the water when the voltage across the thermistor is 2.0 V .

1

b) The circuit is now connected to a switching circuit to operate as a heater.



i) Name component P.

1

ii) Explain how the circuit operates to switch on the heater when the temperature falls below a certain value.

3

iii) The resistance of the variable resistor R is now increased.

What affect does this have on the temperature at which the heater is switched on?

You must explain your answer.

2