

AQA GCSE PHYSICS (HIGHER) • 8463

PHYSICS



EXAM QUESTION PACK

4.2.1 CURRENT, POTENTIAL DIFFERENCE AND RESISTANCE (PACK 3)

SCORE

/174

PERCENTAGE

%

STEMUP

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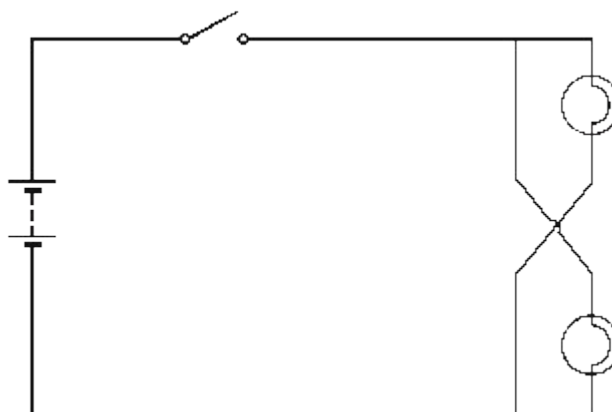
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Q1.

The circuit diagram below shows a circuit used to supply electrical energy to the two headlights of a car.



The current through the filament of one car headlight is 3.0 A. The potential difference across each of the two headlights is 12 V.

- (a) Suggest a suitable fuse for the circuit. _____

(1)

- (b) Calculate the resistance of the headlight filament when in use.

Answer _____ W

(2)

- (c) Calculate the power supplied to the two headlights of the car.

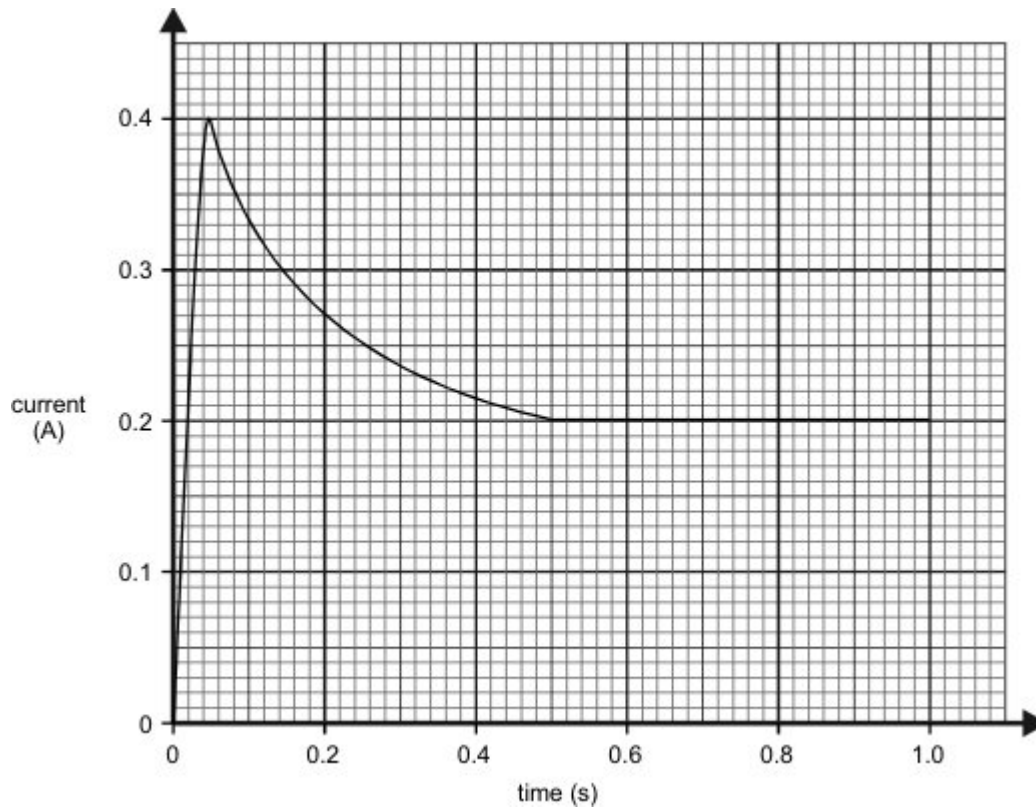
Answer _____ W

(2)

- (d) The fully charged car battery can deliver 72 kJ of energy at 12 V. How long can the battery keep the headlights fully on?

Q2.

When a mains lamp is switched on it takes 0.5 seconds for the filament to reach its normal operating temperature. The way in which the current changes during the first second after switching on is shown in the sketch graph below. Mains voltage is 240 V.



- (a) Calculate the resistance of the filament whilst the lamp is drawing the **maximum** current.

(3)

- (b) Describe how the resistance of the lamp changes after the current has reached its maximum value.

(2)

- (c) Calculate the **maximum** power taken by the lamp.

(2)

- (d) Calculate the power of the lamp in normal use.

(2)

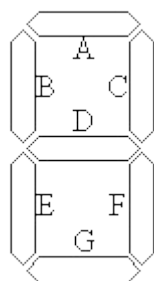
- (e) Calculate the energy used by the lamp in six hours of normal use.

(3)

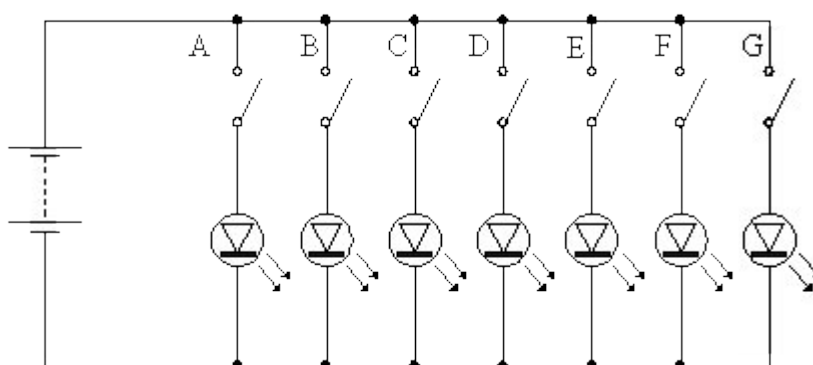
(Total 12 marks)

Q3.

Some electronic calculators use light emitting diodes (LEDs) to display numbers. Each number in a display consists of up to seven LEDs. The LEDs are arranged as shown in the diagram below. The different numbers are formed by switching different LEDs on at the same time. The LEDs are labelled A to G.



A simplified circuit to provide power to the LEDs is shown below.



- (a) Explain why each LED has its own switch.

(2)

- (b) What number is displayed when all switches except E are closed?

(1)

- (c) Which switches would be open if the number 3 is to be displayed?

(1)

- (d) Which of the numbers 0 to 9 draws least current from the battery? Explain your answer.

Number _____

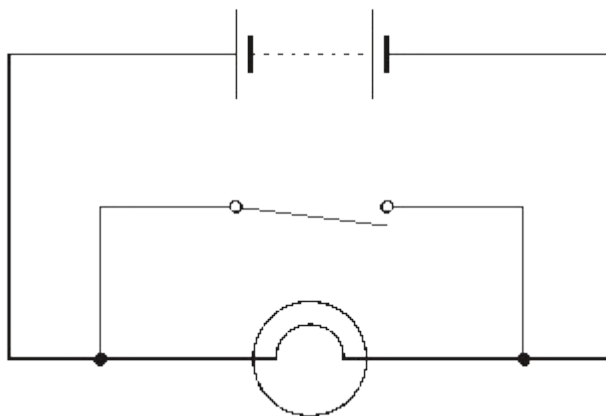
Explanation _____

(2)

(Total 6 marks)

Q4.

The circuit diagram below shows a battery connected to a lamp and a switch.



- (a) State what happens to the lamp when:

- (i) the switch is open (OFF);

- (ii) the switch is closed (ON).

(2)

- (b) When the switch is closed what problem is caused in the circuit?

(1)

- (c) In the space below draw a circuit diagram to show how the switch should be correctly connected to the lamp and battery.

(1)

(Total 4 marks)

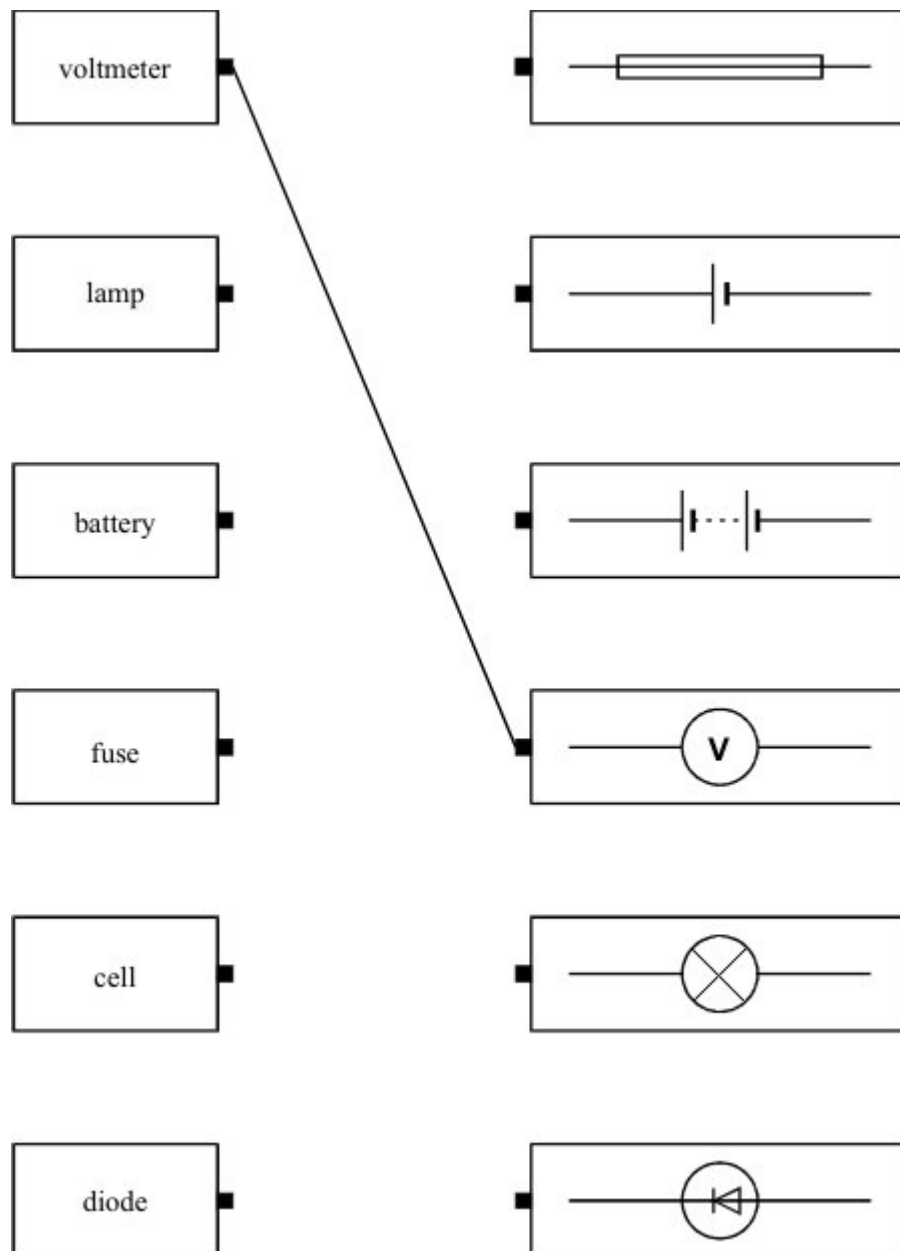
Q5.

- (a) Complete the sentence below to name the instrument used to measure electrical current.

The instrument used to measure electrical current is called _____

(1)

- (b) In the diagram below each box contains an electrical component or a circuit symbol. Draw straight lines to link each electrical component to its circuit symbol. The first one has been done for you.

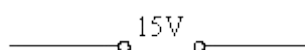


(4)
(Total 5 marks)

Q6.

A student investigates how the current flowing through a filament lamp changes with the voltage across it.
She is given a filament lamp and connecting wires.
She decides to use a 15V power supply, a variable resistor, an ammeter, a voltmeter and a switch.

- (a) Complete the circuit diagram to show how she should set up the circuit.

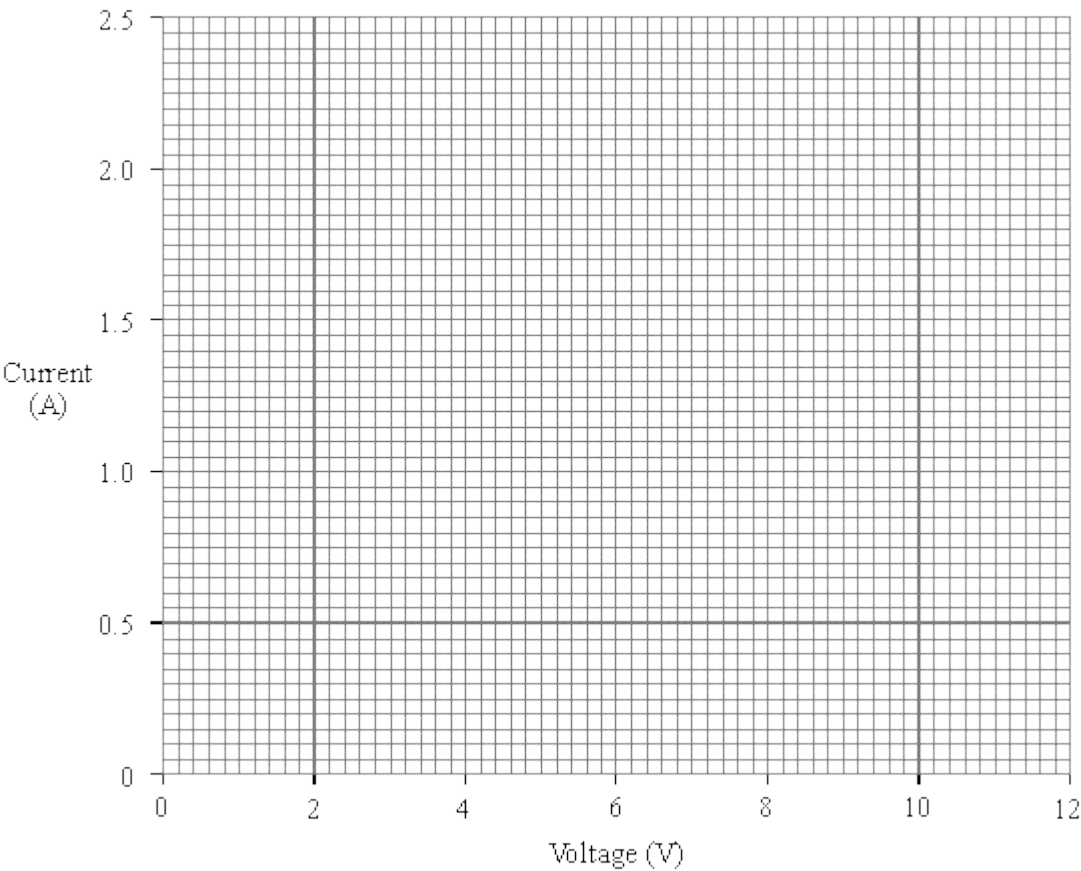


(4)

(b) The student obtains the following results.

VOLTAGE (V)	0.0	3.0	5.0	7.0	9.0	11.0
CURRENT (A)	0.0	1.0	1.4	1.7	1.9	2.1

(i) Plot a graph of current against voltage.



(3)

(ii) Use your graph to find the current when the voltage is 10V.

Current _____ A

(1)

(iii) Use your answer to (ii) to calculate the resistance of the lamp when the voltage is 10V.

(2)

- (c) (i) What happens to the resistance of the lamp as the current through it increases?

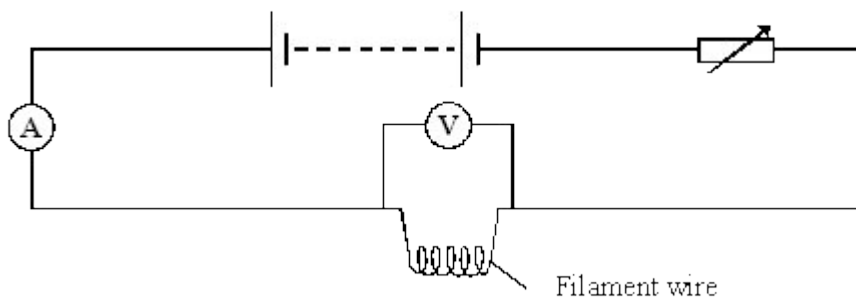
- (ii) Explain your answer.

(2)

(Total 12 marks)

Q7.

A bulb heats up when an electric current passes through the filament wire. The current was measured when different voltages were applied across the filament wire shown in the diagram below.



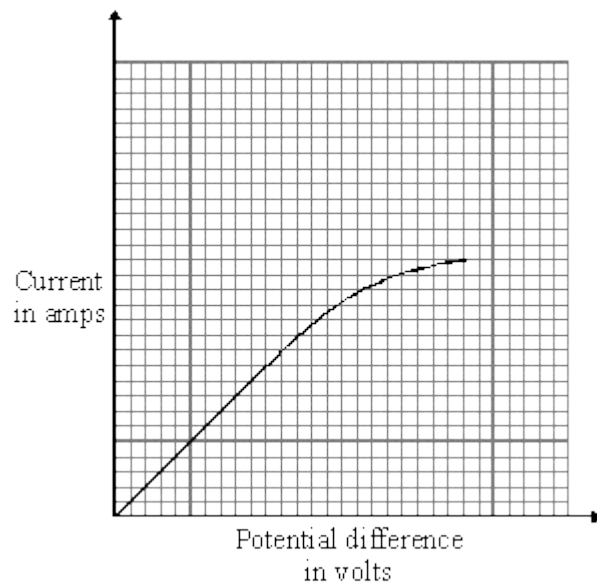
- (a) (i) Look at the circuit diagram. How was the voltage changed?

(1)

- (ii) Write an equation that shows the relationship between *current*, *potential difference* and *resistance*.

(1)

- (b) The graph shows how the current through the filament wire changed as the potential difference across it changed.



- (i) Describe the effect of increasing the potential difference on the current flowing through the filament wire.

(2)

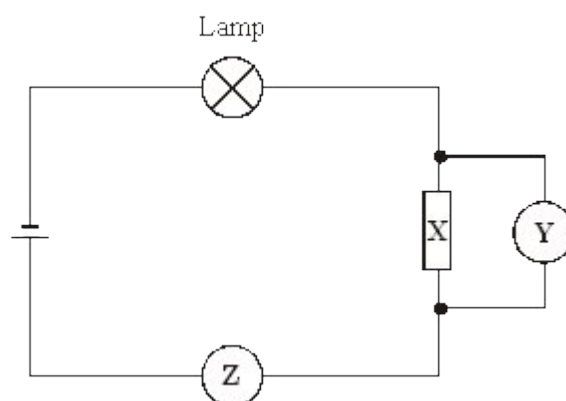
- (ii) Explain this effect in terms of the resistance of the filament wire.

(2)

(Total 6 marks)

Q8.

The diagram shows a circuit.



- (a) (i) Name component **X**. _____

(ii) What does meter **Y** measure? _____

(iii) What does meter **Z** measure? _____

(3)

- (b) Which of the equations shows how current, potential difference and resistance are related?

Tick the box against the correct equation.

current = potential difference $\times$ resistance ☐

potential difference = current $\times$ resistance ☐

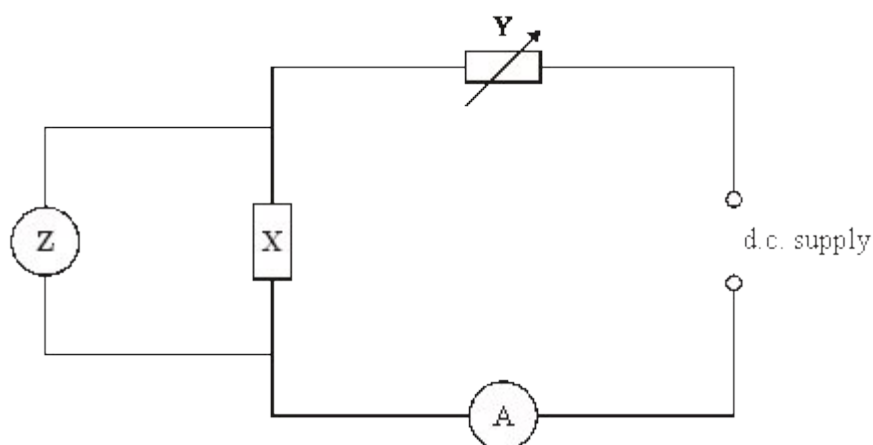
resistance = current $\times$ potential difference ☐

(1)

(Total 4 marks)

Q9.

The current through component **X** is measured when different voltages are applied across it.



- (a) Name the component labelled **Y** in the circuit.

(1)

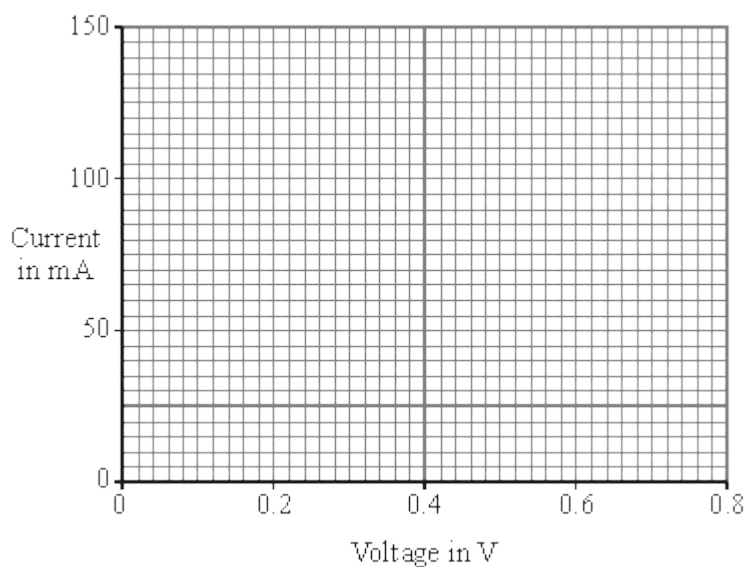
- (b) What type of meter is **Z**?

(1)

- (c) The table shows the measurements obtained in this experiment.

Voltage in V	0	0.2	0.4	0.6	0.8
Current in mA	0	0	50	100	150

Draw a graph of the measurements.



(2)

- (d) Use the shape of the graph to name component **X**.

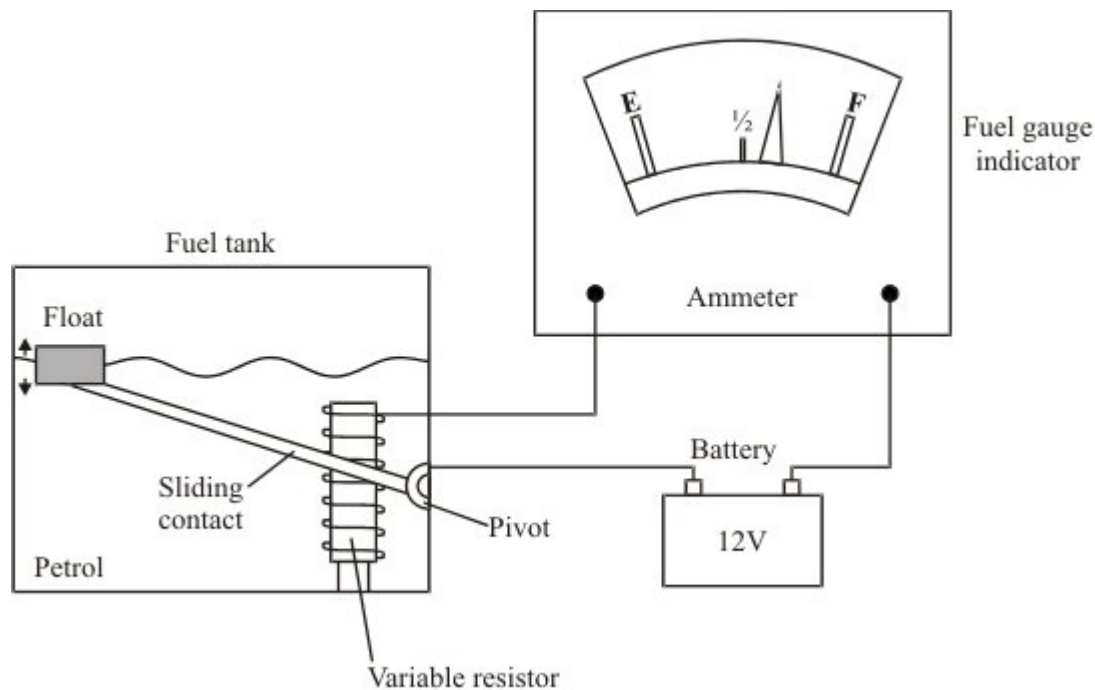
(1)

(Total 5 marks)

Q10.

The diagram shows the fuel gauge assembly in a car.

- The sliding contact touches a coil of wire and moves over it.
- The sliding contact and the coil form a variable resistor.
- The sliding contact is connected to a float via a pivot.
- The fuel gauge indicator is an ammeter.
- When the petrol level changes, the resistance of the circuit changes.
- This causes the pointer in the fuel gauge indicator to move.



- (a) Use standard symbols to draw a circuit diagram for the fuel gauge assembly.

(3)

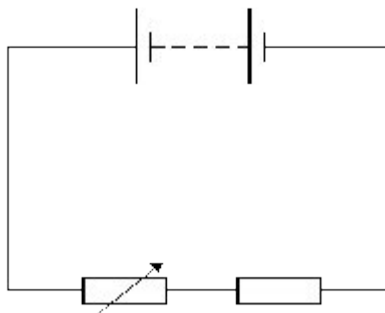
- (b) How will the current in the circuit change as the level of petrol in the tank falls?

Explain the reason for your answer.

(2)
(Total 5 marks)

Q11.

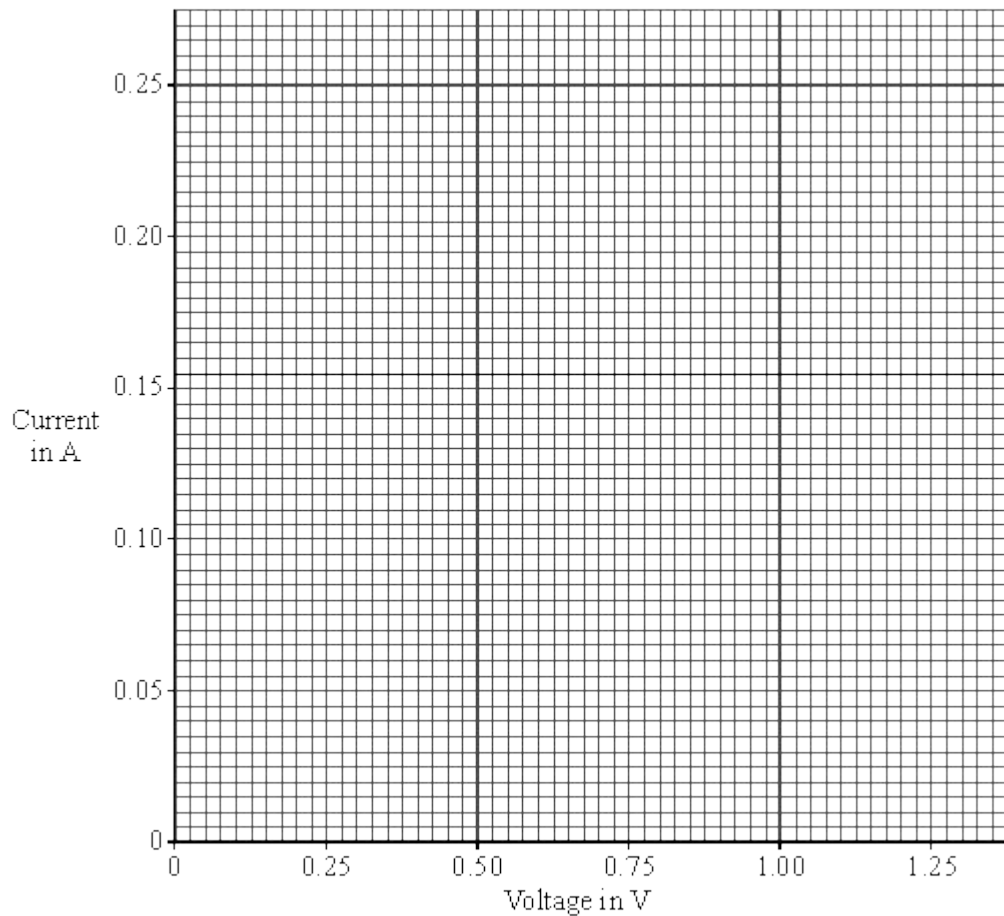
- (a) The diagram shows a simple circuit. Add an ammeter and a voltmeter to the circuit to show how to measure the current through the fixed resistor and the voltage across it.



(2)

- (b) An experiment using a circuit like the one above was set up. The following results were obtained when the resistance of the variable resistor was decreased.
- (i) Draw a graph of the results below.

Voltage across fixed resistor in volts	Current in amps
0.50	0.10
0.75	0.15
1.00	0.20
1.25	0.25



(2)

(ii) Use the graph to find the voltage when the current is 0.05 A.

Voltage = _____ V

(1)

(Total 5 marks)

Q12.

The following specification is taken from the instruction booklet of a combination microwave oven.

AC voltage	240 V 50 Hz
Power required	
Microwave	1.5 kW
Dual (Roast/Bake)	2.8 kW
Dual (Grill)	2.5 kW
Convection	1.35 kW
Grill	2.3 kW
Output power	

Microwave	850 W
Convection heater	1350 W
Grill heater	1000 W
Microwave frequency	2450 MHz

- (a) (i) What is the current when the oven is being used to cook in the dual (roast/bake) mode? Show clearly how you work out your answer.

Current = _____ A

(2)

- (ii) Calculate the resistance of this combination microwave oven when it is being used in the dual (roast/bake) mode. Show clearly how you work out your answer and give the units.

Resistance = _____

(3)

- (b) What is the percentage efficiency of the oven when it is working in the microwave mode?

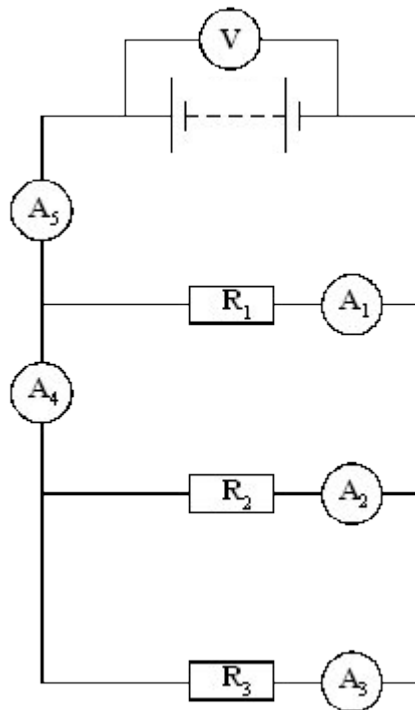
Percentage efficiency = _____ %

(2)

(Total 7 marks)

Q13.

A circuit was set up as shown in the diagram.



- (a) The table gives the current through three of the ammeters. Complete the table to show the current through the other two ammeters.

Ammeter	Reading on ammeter in amps
A_1	0.2
A_2	0.6
A_3	0.3
A_4	
A_5	

(2)

- (b) The reading on the voltmeter is 12 V.

What is the resistance of R_2 ?

Show your working and include the correct unit.

Resistance = _____

(3)

- (c) In the circuit above, the resistor R_2 burned out and current stopped flowing in it. There was no other change to the circuit.

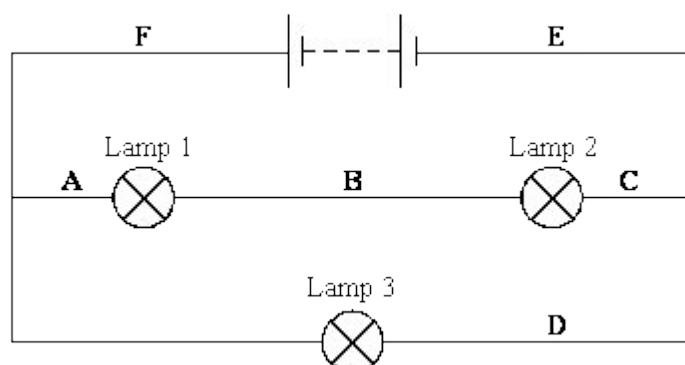
Complete the table below to show the readings on the ammeters after this took place.

Ammeter	Reading on ammeter in amps
A_1	0.2
A_2	0.0
A_3	
A_4	
A_5	

(3)
(Total 8 marks)

Q14.

The circuit contains three identical lamps.



- (a) Complete each of the sentences about the circuit, using one of the phrases in the box.

more than less than the same as

- (i) The current at **A** is _____ the current at **B**. (1)
- (ii) The current at **A** is _____ the current at **D**. (1)
- (iii) The current at **F** is _____ the current at **E**. (1)
- (iv) The current at **F** is _____ the current at **D**. (1)

(b) In the circuit, which lamp is brightest? _____

Give a reason for your answer.

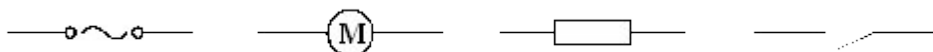
(2)

(Total 6 marks)

Q15.

In a hairdryer circuit there is a heater and a motor. It is important that the motor is always running when the heater is switched on.

(a) Using the symbols shown below only **once** each, draw a circuit for a hairdryer.



(2)

(b) Modern hairdryers are described as *double insulated*.

Explain what this term means.

(2)

(c) On a modern hairdryer handle it states:

1600 W

230 V

50 Hz

(i) [A] Write an equation which shows the relationship between current, power and voltage.

(1)

[B] Calculate the current in the hairdryer when it is on full power.
Show clearly how you get your answer.

Current = _____ A
(2)

- (ii) [A] Write an equation which shows the relationship between current, resistance and voltage.

(1)

- [B] The resistance of the heater is 20 ohms. Calculate the resistance of the motor.

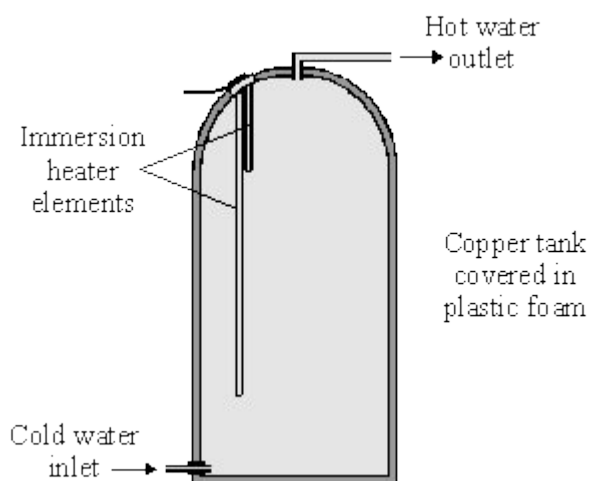
Show clearly how you get your answer.

Resistance = _____ ohms
(2)

(Total 10 marks)

Q16.

The diagram shows a type of electric immersion heater in a hot water tank. These hot water tanks are normally found in airing cupboards.



Information on the immersion heater states:

230 V
10 A

- (a) (i) What is the equation which shows the relationship between power, current and voltage?

(1)

- (ii) Calculate the power of the heater. Show clearly how you get to your answer and give the units.

Power = _____

(2)

- (b) (i) What rating of fuse should be in the immersion heater circuit?

(1)

- (ii) There are three wires in the cable to the immersion heater. Two of the wires are connected to the immersion heater. The third wire is connected to the copper tank.

Explain the function of this third wire and the fuse in the circuit.

(3)

- (c) (i) What is the equation which shows the relationship between resistance, current and voltage?

(1)

- (ii) Calculate the resistance of the heater. Show clearly how you get to your answer and give the units.

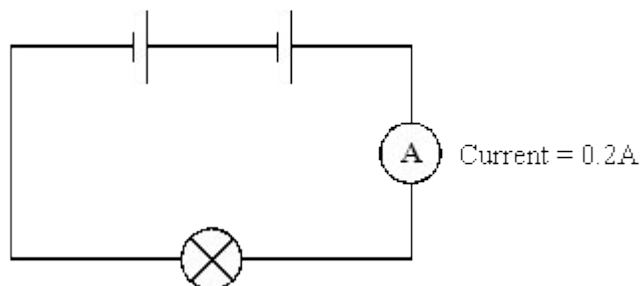
Resistance = _____

(2)

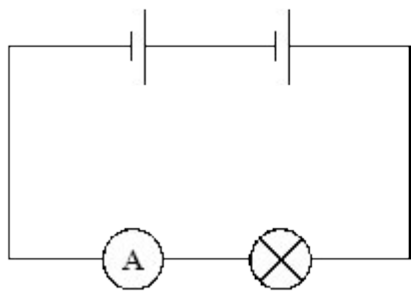
(Total 10 marks)

Q17.

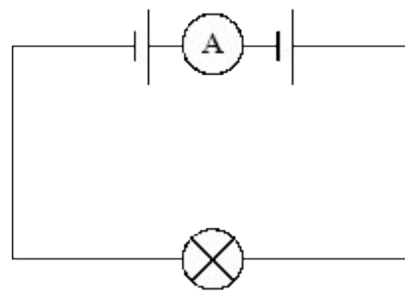
The circuit contains two cells, an ammeter and a lamp. The reading on the ammeter is 0.2 A.



- (a) What will be the reading on the ammeters in each of the circuits below?



(i) Current is _____ A



(ii) Current is _____ A

(2)

(b) An ammeter was in a series circuit with two cells and a variable resistor.

The ammeter showed a reading of 0.3 A.

(i) Draw a circuit diagram for the circuit.

(2)

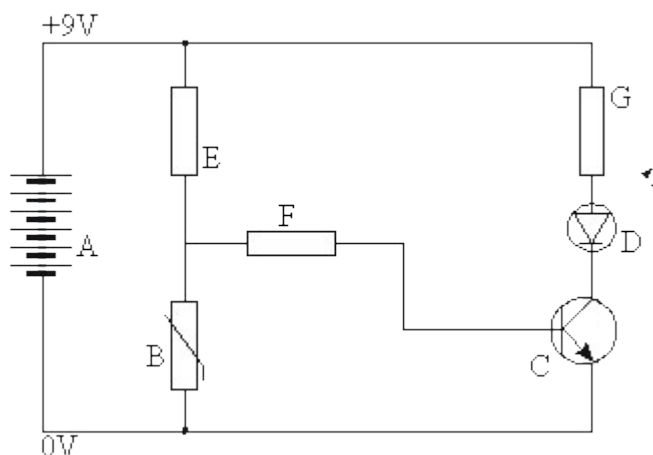
(ii) What will happen to the reading on the ammeter if the resistance of the variable resistor is **increased**?

(1)

(Total 5 marks)

Q18.

The diagram shows an electronic circuit.



(a) Write down the names of the components in the list below.

A = _____

B = _____

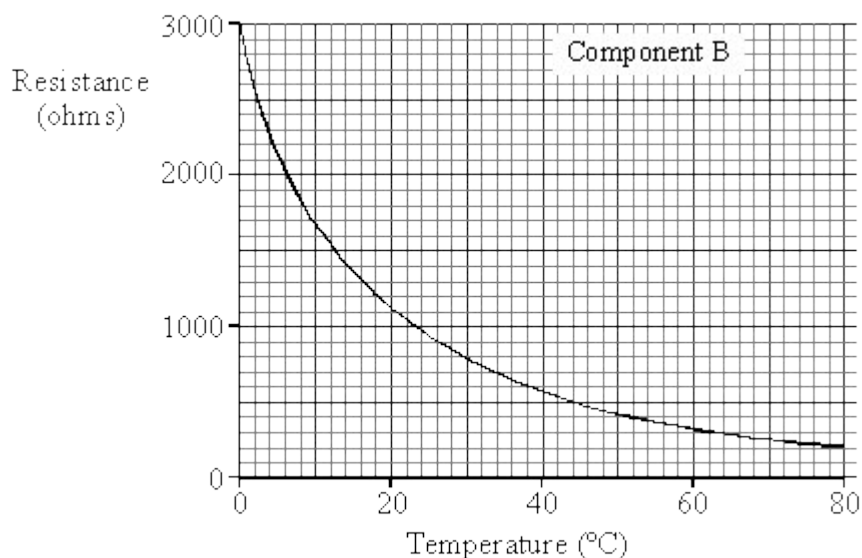
C = _____

D = _____

E, F and G = _____

(5)

(b) The graph shows how the resistance of component B depends on its temperature.



Describe, in as much detail as you can, how the resistance of component B changes as its temperature rises from 0°C to 80°C.

(4)

(c) At what temperature does component B have a resistance of 1000 ohms?

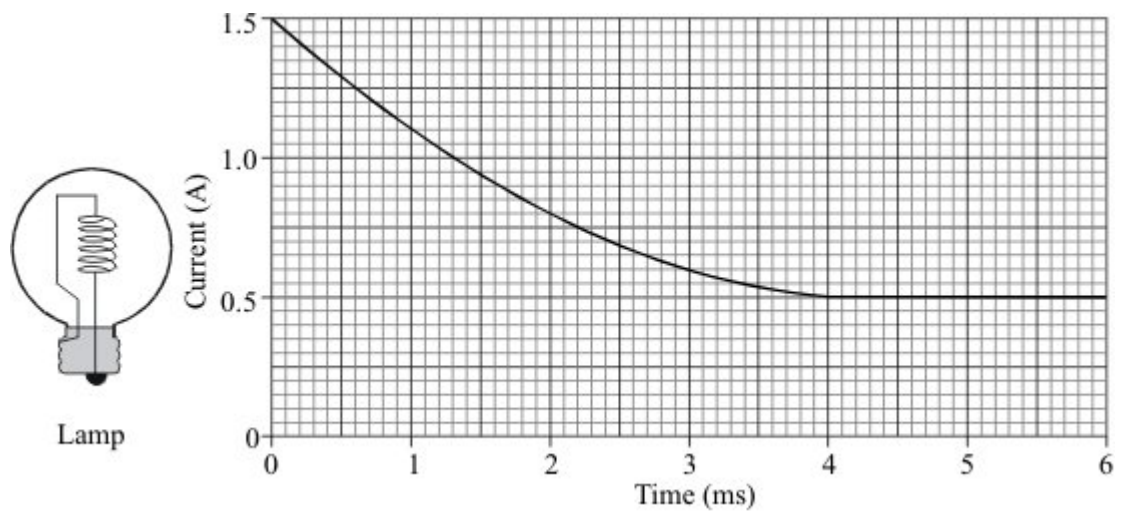
Answer _____ °C .

(2)

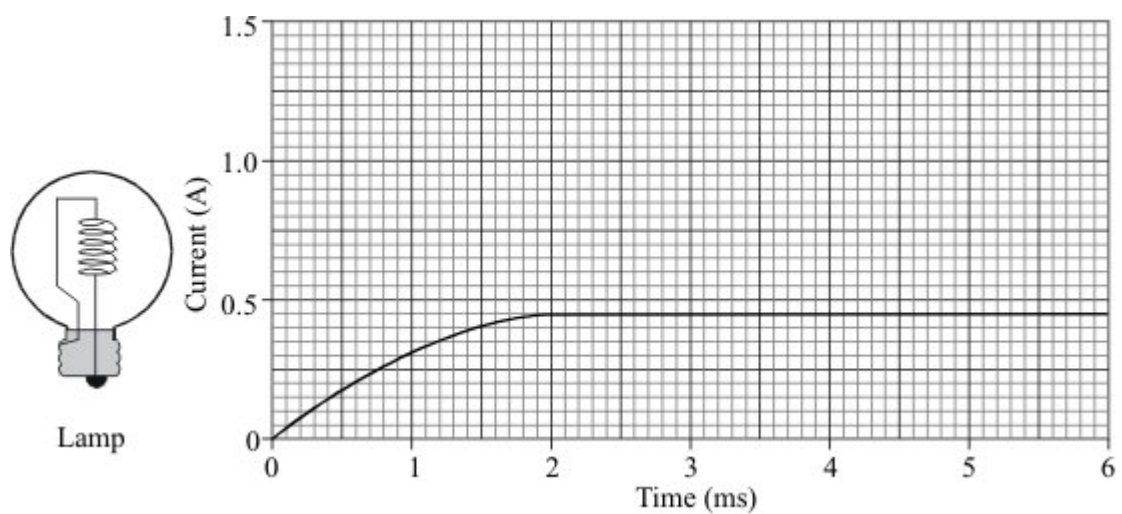
(Total 11 marks)

Q19.

A computer is set up to produce a graph of the current through an electric lamp during the first few milliseconds after it is switched on.



The lamp is modified then tested in the same way.



(a) Describe **three** differences in the way the lamp behaves after it has been modified.

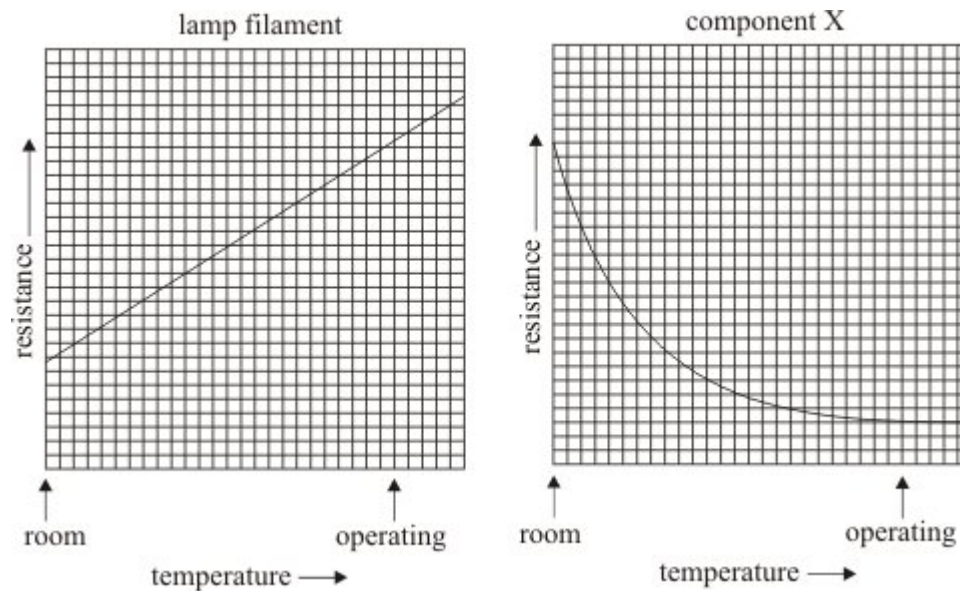
1. _____
2. _____
3. _____

(3)

(b) The current through the modified lamp depends on the total resistance of the filament and component X.

The smaller this total resistance is, the greater the current.

The following graphs show how the resistance of the lamp filament and component X change as the lamp heats up to its operating temperature.

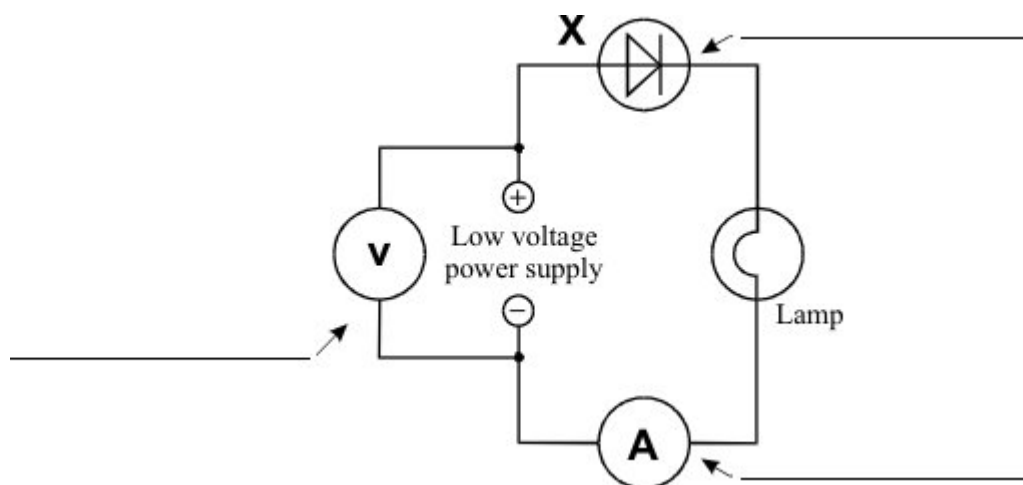


Use the information shown on the graphs to explain the behaviour of the modified lamp.

(4)
(Total 7 marks)

Q20.

- (a) Add the missing labels to the diagram.

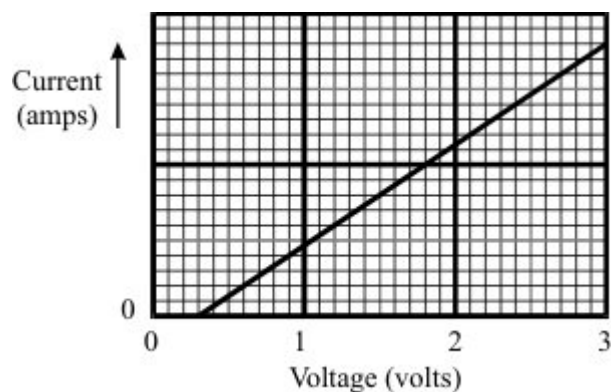


(3)

- (b) Some students use the circuit shown above.

They want to find out how the current through component X changes as they change the voltage.

The graph shows their results.

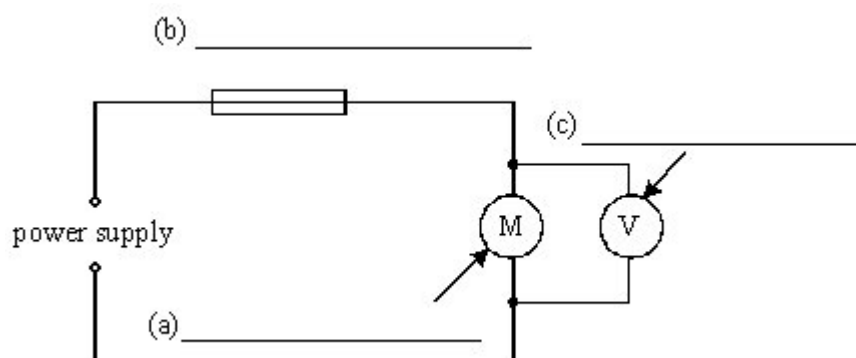


Describe, as fully as you can, what happens to the current through component X as the students increase the voltage.

(4)
(Total 7 marks)

Q21.

Label the parts of the electric circuit below.

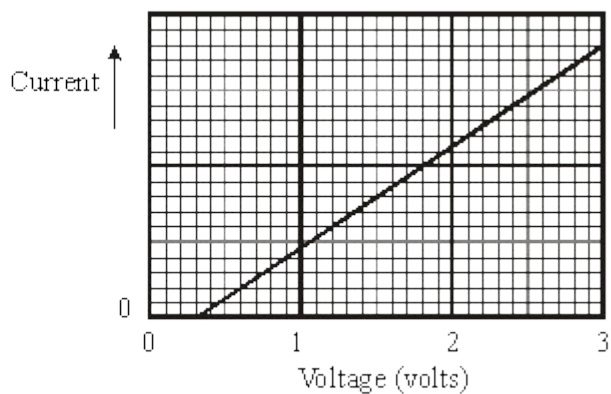
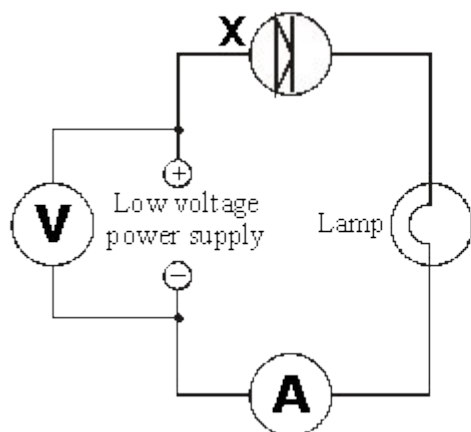


(Total 3 marks)

Q22.

Some students want to find out how the current through component X changes with the voltage they use.

The diagram shows their circuit. The graph shows their results.



- (a) Describe, as fully as you can, what happens to the current through component X as the students increase the voltage.

(4)

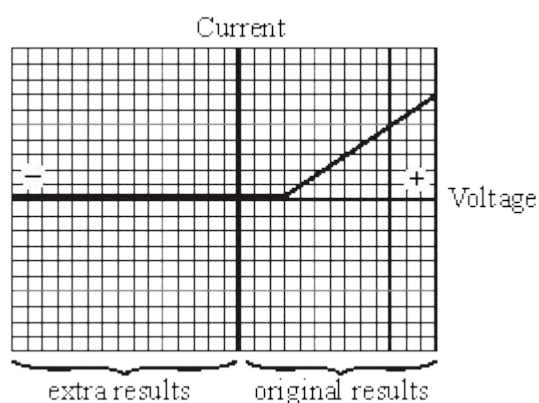
- (b) The students want to find out whether component X allows the same current to flow through it in the opposite direction.

- (i) How should they change the circuit to test this?

(1)

- (ii) The graph shows the students' extra results.

What do the extra results tell you?

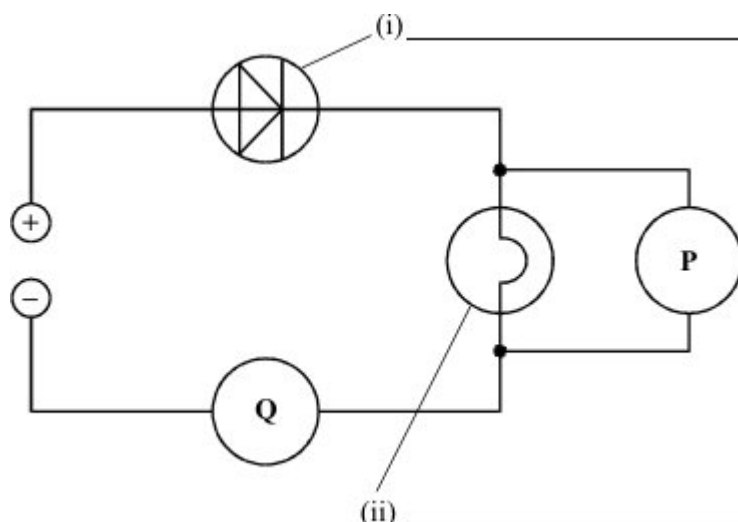


(1)

(Total 6 marks)

Q23.

The diagram shows an electrical circuit.



- (a) Complete the two labels on the diagram.

(2)

- (b) **P** and **Q** are meters.

What is meter **P** measuring? _____

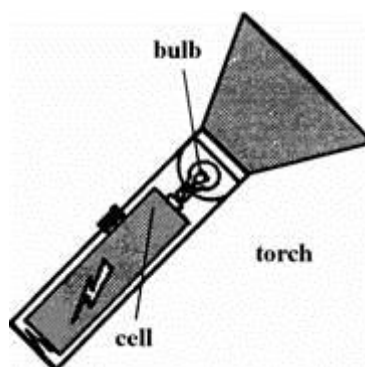
What is meter **Q** measuring? _____

(2)

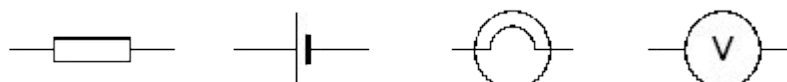
(Total 4 marks)

Q24.

A small torch uses a single cell to make the bulb light up.

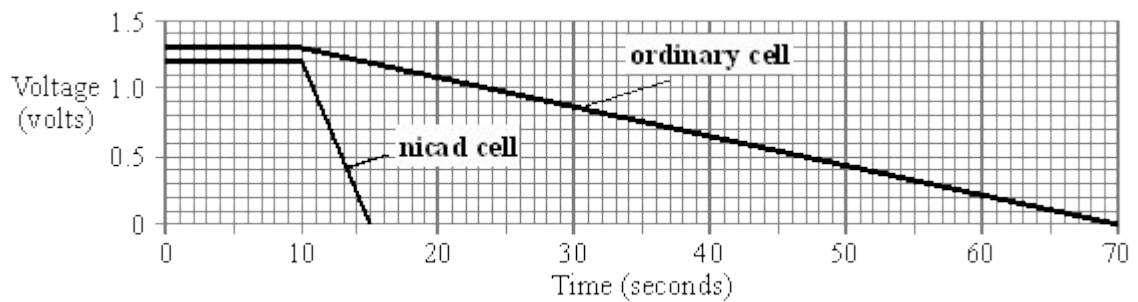


- (a) Label the symbol for a cell and the symbol for a bulb (lamp)



(2)

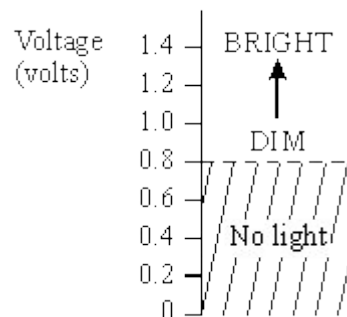
- (b) The graphs show the voltage across two different types of cell as they transfer the last bit of their stored energy through the torch bulb.



Describe the differences that the graphs show between the two types of cell.

(3)

- (c) The diagram shows how bright the torch bulb is for different voltages.



From the point when the voltage of each cell starts to fall, how long will the bulb stay lit:

- (i) with the ordinary cell?

- (ii) with the nicad cell?

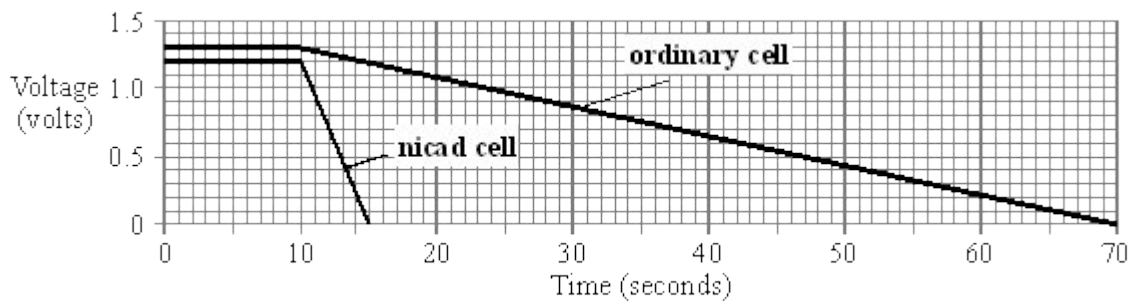
(4)

(Total 9 marks)

Q25.

A small torch uses a single cell to make the bulb light up.

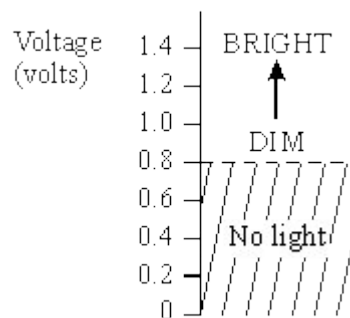
- (a) The graphs show the voltage across two different types of cell as they transfer the last bit of their stored energy through the torch bulb.



Describe the differences that the graphs show between the two types of cell.

(3)

- (b) The diagram shows how bright the torch bulb is for different voltages.



From the point when the voltage of each cell starts to fall, how long will the bulb stay lit:

- (i) with the ordinary cell?

- (ii) with the nicad cell?

(4)

- (c) When the voltage across the bulb falls to half, the current through the bulb falls by **less than** half. Why is this?

(3)

(Total 10 marks)

Mark schemes

Q1.

- (a) in range $6 < I \leq 13 \text{ A}$
for 1 mark
(no unit no mark) 1
- (b) 4
gains 2 marks
 (else working
gains 1 mark
 (resistance of circuit correctly worked (2Ω)) 2
- (c) $72 (I^2 R)$ ecf
gains 2 marks
 else working
gains 1 mark
 an answer of 36W (ie for one lamp) – (1) 2
- (d) 1000 or 16.7 min (ecf from (c))
gains 2 marks
 else working
gains 1 mark
(formula with incorrect substitution – no mark (12V)) 2

[7]

Q2.

- (a) Current = 0.4A (1)
 $R = V/I$ or $240/0.4$ (1)
 $R = 600 \text{ ohm}$ (1) 3
- (b) Doubles
gets 2 marks
 OR gets bigger
gets 1 mark 2
- (c) $P = V.I$ or 240×0.4
 $P = 96\text{W}$
for 1 mark each 2

- (d) $I = 0.2\text{A}$
 $P = 48\text{W}$
for 1 mark each
BUT may get equation mark here if not in (c)

2

- (e) $P = V.I.t$ (1)
 $P = 240 \times 0.2 \times 6 \times 3600$
OR $P = 48 \times 6 \times 3600$
gets 1 mark

$P = 1036800\text{ W}$
gets 1 mark

3

[12]

Q3.

- (a) to switch on/off
independently OWTTE
for 1 mark each

2

- (b) 9
for 1 mark

1

- (c) B and E
for 1 mark

1

- (d) 1
Two/least number of LED used
for 1 mark each

2

[6]

Q4.

- (a) (i) the lamp will be on/will give out light
(ii) the lamp will be off/will not give out any light
(b) (very) large current flows
or damage the battery/overheat the battery
or short circuit
or wire get hot
(c) switch connected in series with lamp and battery

1

1

1

Q5.

- (a) ... ammeter

for 1 mark

1

- (b) 5 right

gains 4 marks

4 right

gains 3 marks

3 right

gains 2 marks

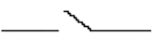
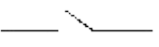
2 right

gains 1 mark

4

Q6.

- (a) 4 symbols correct accept

*(accept  for bulb; lose 1 mark if line through symbols, lose 1 mark if circuit incorrect, switch may be open or closed)**(allow  or )**gains 1 mark*

4

but

all correct

gains 2 marks

ammeter in series with lamp

for one mark

voltmeter in parallel with lamp / lamp and switch / lamp, switch and ammeter

for one mark

- (b) (i) 5 points correctly plotted
-
- allow (0, 0) correct if graph goes through the origin even if no × or O*
-
- gains 1 mark*

but

6 points correctly plotted

gains 2 marks

smooth curve through points – not straight line / curve + straight line

for one mark

3

(ii) 2 (A)

*allow ± 0.05 ($\frac{1}{2}$ square) from candidates' graph
for one mark*

1

(iii) $R = V / I$ **or** $R = 10 / 2$
gains 1 mark

but
 $R = 5$ (Ohms) ecf
gains 2 marks

2

(c) (i) resistance increases
for one mark

(ii) temperature (of filament) has increased / filament gets hot
for one mark

2

[12]

Q7.

(a) (i) variable resistor
accept rheostat

1

(ii) potential difference = current $\times$ resistance
*accept $V = IR$ **or** any correct combinations*

1

(b) (i) as the potential difference increases, the current increases
accept it increases

1

at low values of the potential difference the current is (directly) proportional
*accept at low values of the potential difference (the filament)
obeys Ohm's law*

1

or

at higher values of potential difference the current is not (directly) proportional
or
*accept at higher values of the potential difference (the filament) does not obey Ohm's law
accept it increases but not proportionally for 2 marks*

(ii) the resistance (of the filament) increases

1

the temperature (of the filament) increases

1

[6]

Q8.

(a) (i) resistor

1

(ii) voltage / potential difference / volts / v

1

(iii) current / amps / A

1

(b) potential difference = current $\times$ resistance

no mark if more than one box ticked

1

[4]

Q9.

(a) variable resistor

accept rheostat

1

(b) voltmeter

1

(c) straight line correct between 0.2 and 0.8

if line incorrect, or no line, and correct plots 0.2 to 0.8 award 1 mark

2

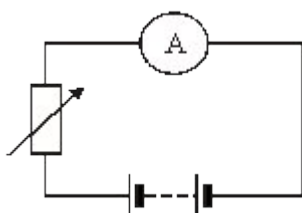
(d) diode / rectifier

1

[5]

Q10.

(a)



3

one mark for each symbol
allow more than 2 cells joined

max. 2 marks if symbols incorrectly allow rheostat arrow in either direction

(b) current will decrease

1

since resistance greater

1

[5]

Q11.

- (a) ammeter anywhere in series in the circuit
accept just letter A or box with A

voltmeter across **or** in parallel with the fixed resistor only
accept just letter V or box with V

2

- (b) (i) four correct plots
deduct one for any incorrect plot

a straight line through the points
no requirement to extrapolate through origin
*do not credit bar charts unless correct line drawn **or** correct points*

2

- (ii) 0.25
ecf rule applies if graph is wrongly plotted

1

[5]**Q12.**

- (a) (i) power ÷ voltage = current **or**
 $2800 \div 240 = 11.6 - 11.7$ **or** 12
2 marks for correct answer 1 mark for $2.8 \div 240$

2

- (ii) resistance = voltage ÷ current

$240 \div 11.7$
(efc here)

1

20.5 **or** 20.57 **or** 20.6 **or** 21
2 marks for correct answer

1

ohms **or** Ω
do not credit R

1

- (b) $850 \div 1500 \times 100$
marks only available for division of power

1

= 56.7
2 marks for correct answer
for 1 mark accept 5670

1

[7]**Q13.**

(a)	0.9		1
	1.1	<i>accept the value of $A_4 + 0.2$</i>	1
(b)	$V = I R$ or $12 = 0.6 R$ or $\frac{12}{0.6} = ?$	<i>accept $V = A R$ $V = I \times \text{ohm's sign}$ do not credit Ohm's law triangle</i>	2
	$R = 20$	<i>correct numerical answer earns both marks</i>	
	ohms		1
(c)	$A_3 = 0.3$		
	$A_4 = 0.3$	<i>accept the same numeric value as A_3</i>	
	$A_5 = 0.5$	<i>accept the value of $A_4 + 0.2$</i>	3

[8]

Q14.

(a)	(i)	the same as	1
	(ii)	less than	1
	(iii)	the same as	1
	(iv)	more than	1
(b)	3	<i>accept D</i>	
		<i>because there is more or twice the current in this part of the circuit or the resistance is less</i>	
		<i>accept only one lamp to go through, (not two) or on its own not sharing the voltage or energy with another do not credit one lamp to go through or sharing current</i>	2

[6]

Q15.

- (a) series circuit

*all four components must be included**if a battery included the neatness mark may still be awarded*

1

circuit fully functional **or** properly connected*this is the neatness mark**do not credit a parallel circuit with one switch controlling both components*

1

- (b) case
- or**
- outer parts are made of plastic
- or**
- insulator
- or**
- non-metallic

1

there is no electrical pathway between inner and outer insulation

*accept no connection between inner and outer part**do not credit two layers of insulation*

1

- (c) (i) [A] power = voltage
- $\times$
- current

*accept $P = V I$ **or*** *$W = V \times A$* ***or** any transformation*

1

- [B]
- $1600 \div 230 = \text{current}$

1

6.96 **or** 7*accept with no working for two marks**accept 6.95**in [A] award a mark for a triangle if calculation correctly performed*

1

- (ii) [A] voltage = current
- $\times$
- resistance

*accept $V = I R$ **or** any transformation*

1

- [B]
- $230 \div 7 = \text{overall } R = 33$

accept $230 \div 6.96 = \text{overall } R = 33$

1

resistance of motor = $33 - 20 = 13$ *accept with no working for two marks**do not credit negative answer**accept consequential errors from c(i)**in [A] award a mark for a triangle if calculation correctly performed*

1

[10]**Q16.**

- (a) (i) $P = V \times I$
or equivalent
credit a triangle if part (ii) correctly uses the relationship
*credit power = volts $\times$ amps **or** watts $V \times A$*
do not accept C for current 1
- (ii) $(P = 230 \times 10 =) 2300$
credit 2.3 1
- W **or** J/s
kW 1
- (b) (i) 15 A
*credit 13 A **or** amps* 1
- (ii) any **three** from
earth
any short (to the metal tank) causes fuse to blow
fuse is in the live wire
to prevent damage to the heater
credit to stop the current 3
- (c) (i) $V = I \times R$
or equivalent
credit a triangle if part (ii) correctly uses the relationship 1
- (ii) $(230 = 10 \times R =) 23$
ohms **or** Ω 2
- [10]**
- Q17.**
- (a) (i) 0.2 1
- (ii) 0.2 1
- (b) (i) a series circuit must contain two cells the correct way round and an ammeter
accept the components in any order in the series circuit but there must be no obvious gaps in the wires at corners
or joins

1

the symbol for a variable resistor a rectangle with a diagonal arrow drawn through it

accept a diagram for a 'slide resistor'

1

(ii) decrease

1

[5]

Q18.

- (a) A = battery (of cells)/cells/cell
B = thermistor/temperature dependent resistor
C = transistor
D = LED/light emitting diode
E, F, G = resistors

each for 1 mark

5

- (b) *ideas that* (resistance) falls from 3000 to 200 units – ohms/ Ω – referred to at least once

each for 1 mark

(credit quickly at first then more slowly with 2 marks) (max 4 for part (b))

4

- (c) any figure in the range 22 – 26 (inclusive)

gains 1 mark

but 24

gains 2 marks

2

[11]

Q19.

- (a) current rises/starts lower/starts from zero

for 1 mark

*ideas that: **

smaller/only 0.45 (A) change in current

quicker/only 2 (ms) for current to settle

slightly lower/0.45 (A) final current

maximum only 0.45 (A) rather than 1.5 (A)

(*must **compare** e.g. "only..." or state figure from first graph)

any 2 for 1 further mark each

3

- (b) resistance of filament rises as temperature rises/higher at operating temperature
resistance of X falls as temperature rises/low(er) at operating temperature
total resistance stays roughly the same as temperature rises
so current stays roughly the same as temperature rises
(must be related to previous point)

resistance of X falls faster at first than resistance of filament rises
 so current rises (*must be related to previous point*)
 operating resistance slightly increased
 so operating current slightly reduced
 (*must be related to previous point*)
 resistance of X high at start
 so current zero/low

each gains 1 mark
(must be related to previous point)
(to a maximum of 4)

4

[7]

Q20.

- (a)
- diode
 - voltmeter
 - ammeter

for 1 mark each

3

- (b) *idea that*

- current increases or goes up (with voltage)
gains 1 mark
- 'It' refers to current
but current increases steadily (with voltage)
gains 2 marks
- (*allow* in proportion) – but not simply a description of the shape of the graph
gains 1 mark
- no current at first
but no current until voltage is more than 0.3 (volts)
gains 2 marks

4

[7]

Q21.

- (a) motor

1

- (b) fuse or circuit breaker

1

- (c) voltmeter

each for 1 mark

1

[3]

Q22.

- (a) *idea that*

it/current increases (with voltage)
gains 1 mark

but

current increases steadily (with voltage)
(allow in proportion)
gains 2 marks

4

no current at first

gains 1 mark

but

no current until voltage is more than 0.3 (volts)
gains 2 marks

- (b) (i) reverse component X/power supply/change battery round
for 1 mark

- (ii) *idea that*
 X doesn't conduct in opposite/let current through/no current
 (in opposite direction)
(credit X is a diode)
for 1 mark

2

[6]

Q23.

- (a) (i) diode

[Do not accept 'rectifier' or LED]

- (ii) lamp / bulb / light

each for 1 mark

2

- (b) • $P = \text{voltage} / \text{potential difference} / \text{p.d.} / \text{volts} / V$
[Allow 'Voltmeter']

- $Q = \text{current} / \text{amperes} / \text{amps} / A$
[Allow 'ammeter']
each for 1 mark

2

[4]

Q24.

- (a) cell and bulb / light correctly labelled
for 1 mark each

2

- (b) ordinary cell has higher voltage (normally / at start)
for 1 mark

or

ordinary cell 1.3V nicad 1.2V (normally / at start)

voltage of ordinary cell falls more slowly (*accept* lasts longer)
gains 1 mark

but

as above with relevant quantification e.g. falls to zero in 60 seconds compared to 6 seconds e.g. falls to zero in 70 seconds compared to 16 seconds – from time zero

or

nicad falls to zero 10 times as fast
gains 2 marks

3

- (c) (i) answer in range 32-34 (seconds) (inclusive)
gains 1 mark

but

answer in range 22-24 (seconds) (inclusive)
gains 2 marks

- (ii) 12 (seconds)
gains 1 mark

but

2 (seconds)
units not required in (c)
gains 2 marks

4

[9]

Q25.

- (a) ordinary cell has higher voltage (normally / at start)
or
ordinary cell 1.3V nicad 1.2V (normally / at start)
for 1 mark

voltage of ordinary cell falls more slowly
gains 1 mark

(*accept* ordinary cell lasts longer)

but

as above with relevant quantification e.g. falls to zero in 60 seconds compared to 6 seconds

or

nicad falls to zero 10 times as fast
gains 2 marks

3

- (b) (i) answer in range 32-34 (seconds) (inclusive)

gains 1 mark

but

answer in range 22-24 (seconds) (inclusive)

gains 2 marks

(ii) 12 (seconds)

gains 1 mark

but

2 (seconds)

gains 2 marks

4

(c) resistance of the lamp / filament changes / increases

gains 1 mark

but

resistance of the lamp / filament decreases

gains 2 marks

because the temperature of the filament falls / filament cools

for 1 mark

3

[10]