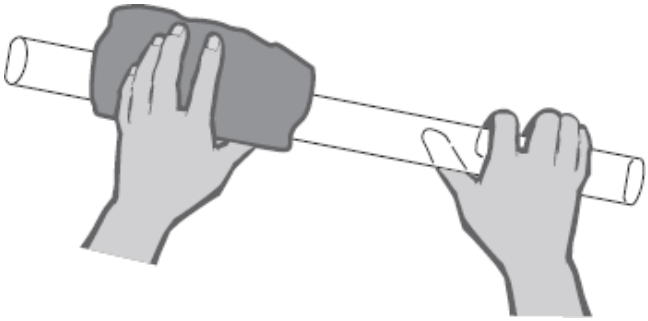
Q1. (a) The diagram shows a polythene rod being rubbed with a woollen cloth.



The polythene rod becomes negatively charged.

Explain how this happens.

.....

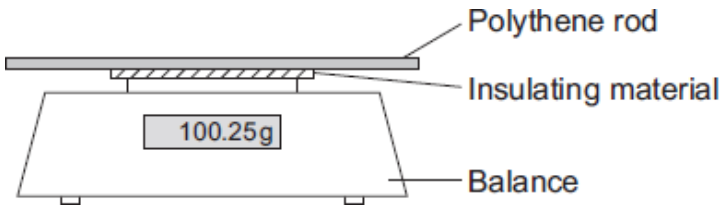
.....

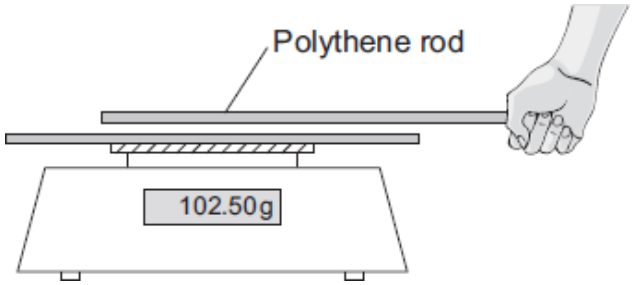
.....

.....

(2)

(b) A student put the charged polythene rod on to a balance. The rod was separated from the metal pan of the balance by a thin block of insulating material.
The student then held a second charged polythene rod above, but **not** touching, the first rod. The reading on the balance increased.





(i) Explain why the reading on the balance increases.

.....

.....

.....

.....

(2)

(ii) The student observed that the nearer the two rods are to each other, the bigger the increase in the balance reading.

What should the student conclude from this observation?

.....

.....

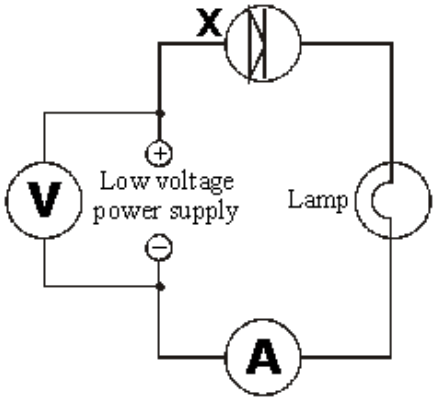
.....

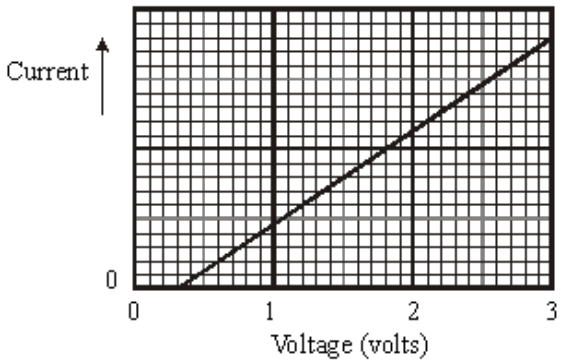
.....

(2)
(Total 6 marks)

Q2. 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.

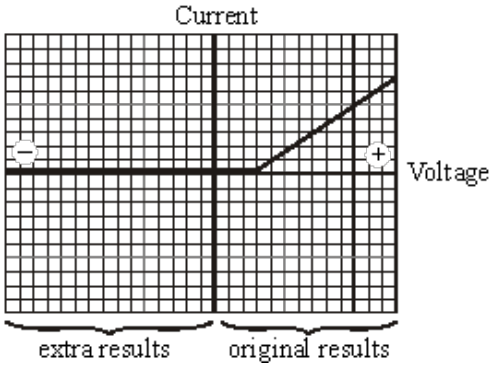
(i) How should they change the circuit to test this?

.....

(1)

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

What do the extra results tell you?



.....

.....

.....

(1)

(Total 6 marks)

Q3. If a fault develops in an electrical circuit, the current may become too great. The circuit needs to be protected by being disconnected.

A fuse or a circuit breaker may be used to protect the circuit.
One type of circuit breaker is a Residual Current Circuit Breaker (RCCB).

(a) (i) Use the correct answer from the box to complete the sentence.

earth	**live**	**neutral**

A fuse is connected in the ..... wire.

(1)

(ii) Use the correct answer from the box to complete the sentence.

are bigger	**are cheaper**	**react faster**

RCCBs are sometimes preferred to fuses because they ..... .

(1)

(iii) RCCBs operate by detecting a difference in the current between two wires.

Use the correct answer from the box to complete the sentence.

earth and live	**earth and neutral**	**live and neutral**

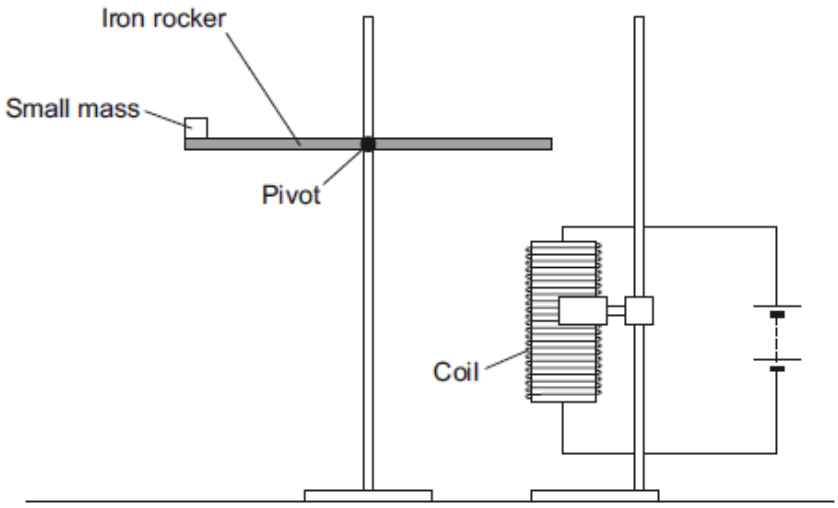
The two wires are the ..... wires.

(1)

(b) An RCCB contains an iron rocker and a coil.

A student investigated how the force of attraction, between a coil and an iron rocker, varies with the current in the coil.

She supported a coil vertically and connected it in an electrical circuit, part of which is shown in the figure below .



She put a small mass on the end of the rocker and increased the current in the coil until the rocker balanced. She repeated the procedure for different masses.

Some of her results are shown in the table below.

Mass in grams	**Current needed for the rocker to balance in amps**
5	0.5
10	1.0
15	1.5
20	2.0

(i) State **two** extra components that must have been included in the circuit in the figure above to allow the data in the above table to be collected.

Give reasons for your answers.

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(ii) A teacher said that the values of current were too high to be safe.

Suggest **two** changes that would allow lower values of current to be used in this investigation.

Change 1 .....

.....

Change 2 .....

.....

(2)
(Total 9 marks)

Q4. Read this statement from a website.

> Immediately after the 'big bang', at the start of the Universe, there were only atoms of the element hydrogen (H).
>
> Now there are over one hundred elements.
> Scientists think that all the elements on Earth are also present throughout the Universe.

(a) Explain how atoms of the element (He) are formed in a star.

.....

.....

.....

.....

(2)

(b) Explain how atoms of very heavy elements, such as gold (Au), were formed.

.....

.....

.....

.....

(2)

(c) Scientists have only examined a tiny fraction of the Universe.

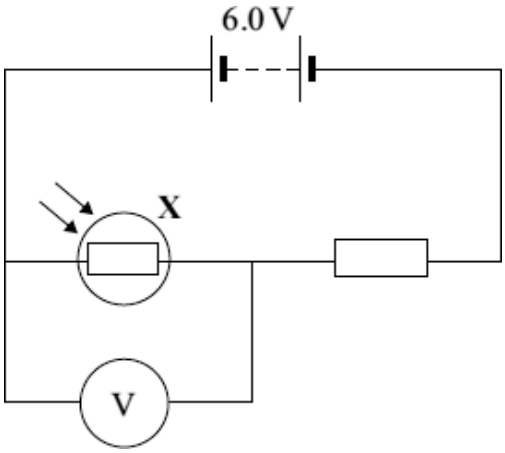
What is the basis for scientists thinking that the elements found on Earth are present throughout the Universe?

.....

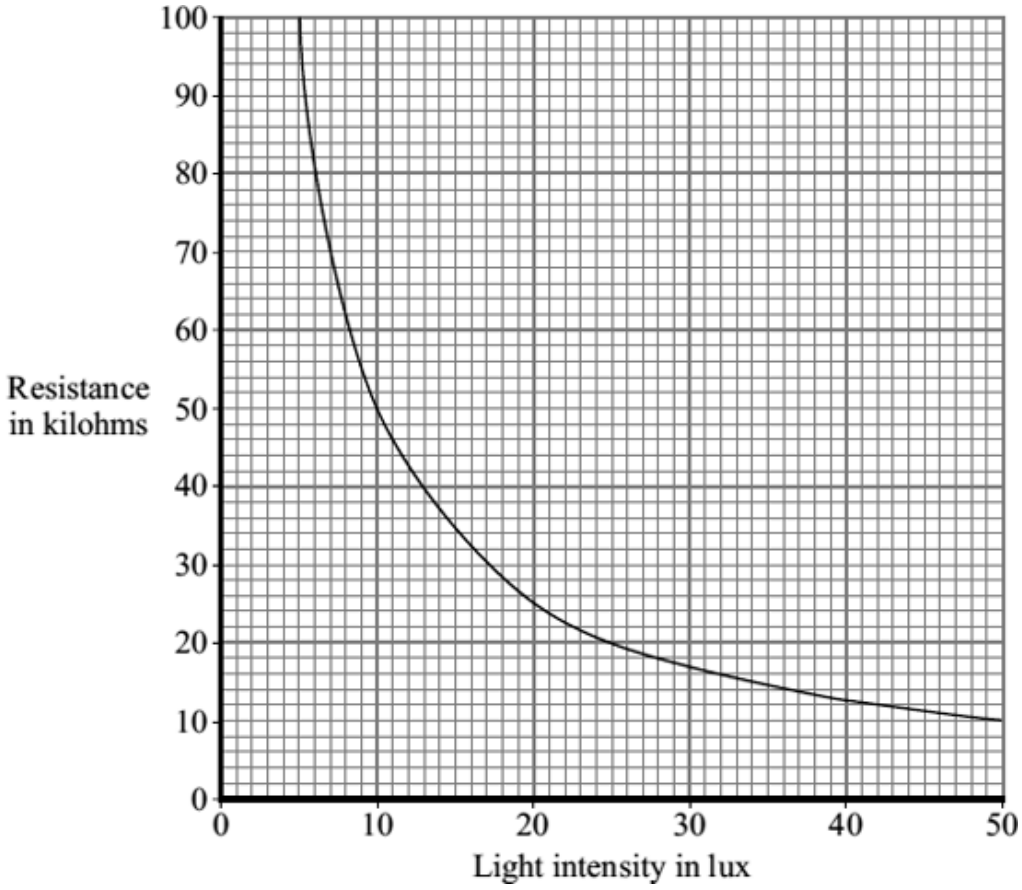
.....

(1)
(Total 5 marks)

Q5. The diagram shows a simple light-sensing circuit.



(a) The graph, supplied by the manufacturer, shows how the resistance of the component labelled **X** varies with light intensity.



(i) What is component **X**?

.....

(1)

(ii) Use the graph to find the resistance of component **X** when the light intensity is 20 lux.

.....

(1)

(iii) When the light intensity is 20 lux, the current through the circuit is 0.0002 A.

Use the equation in the box to calculate the reading on the voltmeter when the light intensity is 20 lux.

potential difference = current × resistance

Show clearly how you work out your answer.

.....

.....

Voltmeter reading =..... volts

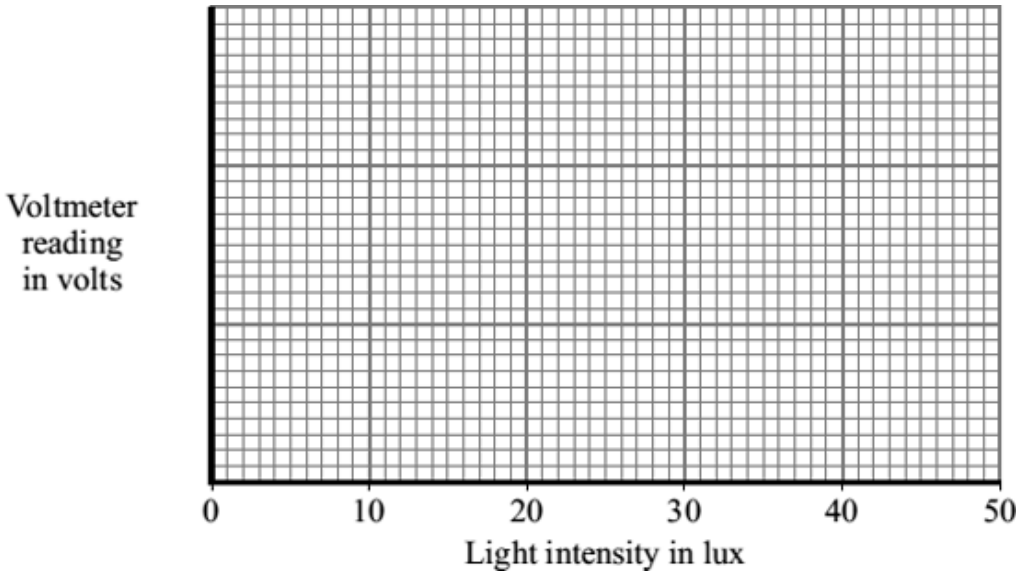
(2)

(b) Use the grid below to show how the voltmeter reading in the light-sensing circuit varies with light intensity.

(i) Add a suitable scale to the *y*-axis (vertical axis).

(1)

(ii) Complete the sketch graph by drawing a line on the grid to show how the voltmeter reading will vary with light intensity.



(2)

(c) The following passage is taken from the technical data supplied for component **X** by the manufacturer.

> For any given light intensity, the resistance of this component can vary by plus or minus 50% of the value shown on the **graph of light intensity and resistance**.

(i) Calculate the maximum resistance that component **X** could have at 20 lux light intensity.

.....

Maximum resistance =..... kilohms

(1)

(ii) Explain why this light-sensing circuit would **not** be used to measure values of light intensity.

.....

.....

.....

(2)

(Total 10 marks)

Q6. Stars are formed from massive clouds of dust and gases in space.

(a) What force pulls the clouds of dust and gas together to form stars?

.....

(1)

(b) Once formed a star can have a stable life for billions of years. Describe the **two** main forces at work in the star during this period of stability.

.....

.....

(2)

(c) What happens to this star once this stable period is over?

.....

.....

.....

.....

.....

(4)

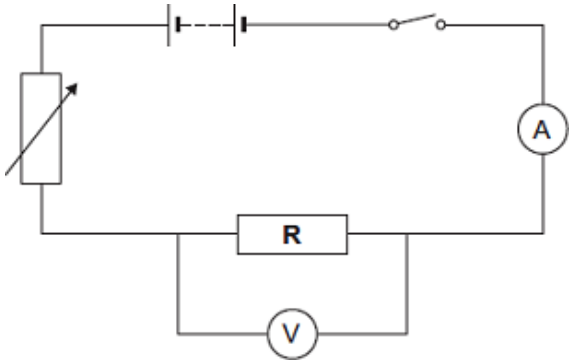
(d) Suggest what might then happen to a planet close to this star.

.....

.....

(1)
(Total 8 marks)

Q7. (a) A resistor is a component that is used in an electric circuit.



(i) Describe how a student would use the circuit to take the readings necessary to determine the resistance of resistor **R**.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6)

(ii) Explain why the student should open the switch after each reading.

.....

.....

.....

.....

(2)

(iii) In an experiment using this circuit, an ammeter reading was 0.75 A.
The calculated value of the resistance of resistor **R** was 16 Ω.

What is the voltmeter reading?

Use the correct equation from **Section C** of the Physics Equations Sheet.

.....

.....

Voltmeter reading = ... V

(2)

(iv) The student told his teacher that the resistance of resistor **R** was 16 Ω.

The teacher explained that the resistors used could only have one of the following values of resistance.

10 Ω **12 Ω** **15 Ω** **18 Ω** **22 Ω**

Suggest which of these resistors the student had used in his experiment.

Give a reason for your answer.

.....

.....

.....

.....

(2)

(b) The diagram shows a fuse.

Describe the action of the fuse in a circuit.

.....

.....

.....

.....

.....

.....

.....

.....

(3)
(Total 15 marks)

M1. (a) electrons transfer / removed

*do **not** accept negatively charged atoms for electrons*

this only scores if first mark given

1

to the rod / from the cloth

this does not score if there is reference to any original charge on cloth or rod

'it' refers to the rod

*accept negative charge transfer to rod / removed from cloth for **1** mark*

transfer of positive charge / positive electrons scores zero

1

(b) (i) rods / charges repel

1

creating downward / extra force (on the balance)

accept pushing (bottom) rod downwards

do not accept increasing the weight / mass

charges attracting scores zero

1

(ii) the (repulsion) force increases as the distance between the charges decreases

accept there is a negative correlation between (repulsion) force and distance between charges

or

(repulsion) force and distance between charges are inversely proportional

for both marks

*examples of **1** mark answers*

force increases as distance decreases

force and distance are inversely proportional

negative correlation between force and distance

repels more as distance decreases

if given in terms of attracting or attraction force this mark does not score

2

[6]

M2. (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]

M3. (a) (i) live

1

(ii) react faster

1

(iii) live and neutral

1

(b) (i) ammeter

1

to measure current

accept to measure amps

1

plus any **one** from:

- *variable resistor* (1)
  to vary current (1)
  accept variable power supply
  accept change or control
- *switch* (1)
  to stop apparatus getting hot / protect battery
  or
  to reset equipment (1)
- fuse (1)
  to break circuit if current is too big (1)

2

(ii) any **two** from:

- use smaller mass(es)
- move mass closer to pivot
- reduce gap between coil and rocker
- more turns (on coil)*coil / loop*
- iron core in coil

accept use smaller weight(s)

2

[9]

M4. (a) fusion

*do **not** credit any response which looks like 'fission'*

1

of hydrogen / H (atoms)

credit only if 1st mark point scores

1

(b) fusion of other / lighter atoms / elements

reference to big bang nullifies both marks

1

during supernova / explosion of star(s)

1

(c) the (available) evidence: supports this idea
or
does not contradict this idea
or
can be extrapolated to this idea
or
(electromagnetic) spectrum from other stars is similar to sun

1

[5]

M5. (a) (i) light dependent resistor / LDR

accept ldr

1

(ii) 25 (kilohms)

accept 24 - 26 inclusive

accept 25 000 Ω

1

(iii) 5 (V) or their (a)(ii) correctly converted to ohms × 0.0002 correctly calculated

*allow **1** mark for converting 25 kΩ / their (a)(ii) to ohms*

or

*allow **1** mark for correct substitution*

ie 0.0002 × 25(000)

***or** 0.0002 × their (a)(ii)*

allow an incorrect conversion from kilohms providing this is clearly shown

2

(b) (i) linear scale

using all of the available axis

must cover the range 4 - 6 v

***or** their (a)(iii) - 6 v and lie within the range 0 - 15 inc.*

1

(ii) negative gradient line

*do **not** allow lines with both positive and negative gradients*

1

passing through 20 lux and their (a)(iii)

only scores if the first mark is awarded

only scores if line does not go above 6 volts

1

(c) (i) 37.5 (kΩ) or their (a)(ii) + 50 % (a)(ii) correctly calculated

1

(ii) light intensity value would be unreliable / not accurate

1

due to variation in <u>resistance</u> value

accept because resistance varies by ± 50 %

accept tolerance of resistor is too great

*do **not** accept results are not accurate*

1

[10]

M6. (a) gravitational attraction

for 1 mark

1

(b) gravitational (in);
high internal temperature generates force (out)

for 1 mark each

2

(c) star expands;
to form red giant;
then contracts/collapses;
to form white dwarf/neutron star/black hole/pulsar;
they may explode/become supernova
any four for 1 mark each

4

(d) engulfed by red giant/blown up by star/hit by debris from star; sucked into black hole
for 1 mark

1

[8]

M7. (a) (i) any **six** from:

- switch on
- read both ammeter and voltmeter
  allow read the meters
- adjust variable resistor to change the current
- take further readings
- draw graph
- (of) V against I
  allow take mean
- R = V / I
  allow take the gradient of the graph

6

(ii) resistor would get hot if current left on

1

so its resistance would increase

1

(iii) 12 (V)
*0.75 × 16 gains **1** mark*

2

(iv) 15 (Ω)

1

16 is nearer to that value than any other

1

(b) if current is above 5 A / value of fuse

1

fuse melts
allow blows / breaks
*do **not** accept exploded*

1

breaks circuit

1

[15]