1 A compound is made of magnesium and sulfur.

Give the correct molecular formula for this compound.

Explain your answer by taking into account the bonding ability and/or valence electrons of magnesium and sulfur.

2 The following electric circuit consists of a power source, three resistors (R_1, R_2 and R_3) and two voltmeters V_s (voltage at source) and V_3.
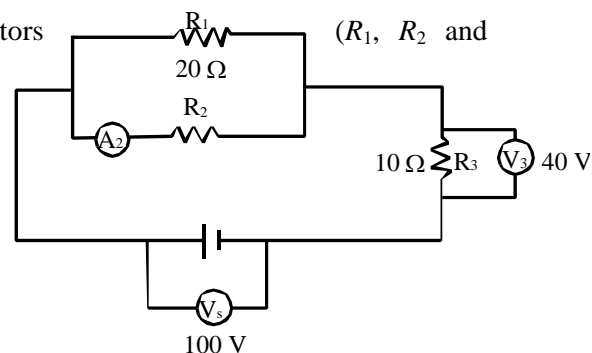
What is the current intensity, I_2, through resistor R_2?

Show all your work.

3 Your friend wants to add some electrical accessories to the circuit of his automobile. The circuit must supply 4 pieces of equipment : a de-mister (M), a small pump (M) and 2 bulbs. Each item can function with a 6 V or a 12 V power supply.

The car's circuits provide a maximum of 12 volts.

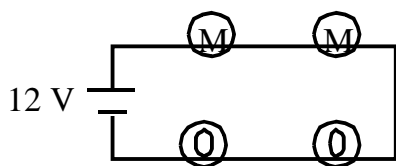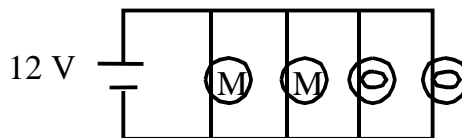He proposes two ways of connecting the equipment.
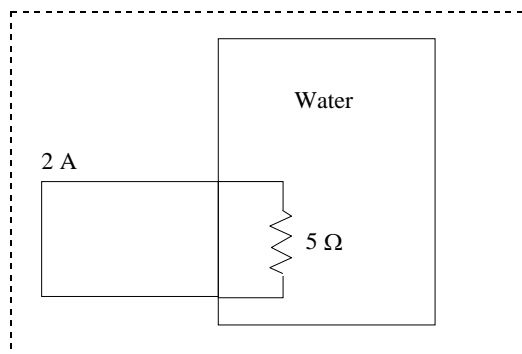
DIAGRAM A   DIAGRAM B

Which diagram must he choose for each item to function properly?

Justify your choice.

4   A hot water tank is installed in a new house. The resistance of its heating cable is 5 Ω and it is immersed in a certain volume of water at a temperature of 20°C as illustrated below :

When a 2 A current is allowed to run through the cable for a period of 5 minutes, the temperature of the water increased to 26°C.

What is the quantity of water, in grams, in the hot water tank?

Show all your work.

5   You wish to compare 3 filters to see which one provides the most chemically pure water.

You are given the following table of information about the filtered water provided by each filter.

	FILTER 1	**FILTER 2**	**FILTER 3**
Mass of the water	143.54 g	112.75 g	133.95 g
Volume of the water	137.0 mL	112.5 mL	126.0 mL
Conductivity	Yes	No	No

-    Using the table of information above, analyze the two characteristic properties of the water provided by each filter.

-    On the basis of your analysis, indicate which filter provides the most chemically pure water and justify your conclusion.

6 During an experiment you changed the potential difference (V) across a resistor and measured the current (*I*) through the resistor

The following results were obtained :

I (amperes)	0.37	0.72	1.08	1.48	1.80	2.16	2.59	2.96	3.33	3.60
V (volts)	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00

     a)   Draw a graph of the current as a function of the potential difference.

     b)   Calculate the conductance of the resistor.

7 Lavinia works in a bake shop during the summer. Her work consists of sprinkling icing sugar on doughnuts using a plastic sifter.

While continuing to sift the icing sugar in the same manner, she notes the following :

     -     at first, the sugar particles fall vertically;

     -     as time passes, the particles start to deviate from the vertical and they have a greater tendency to stick to the sides of the sifter.
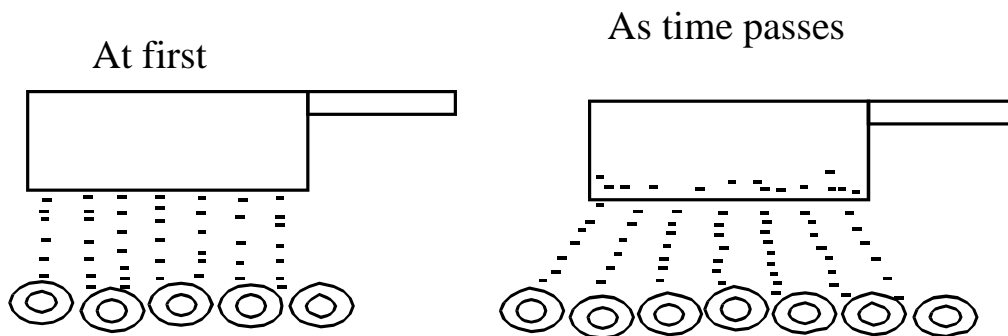
Why do the sugar particles move away from each other at the same time as they are attracted to the sifter?
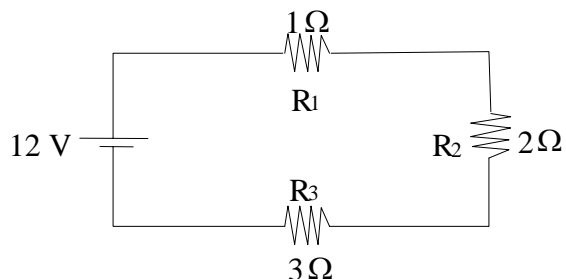
8 State the missing number.

The maximum number of electrons that can occupy the second energy level (n=2) is ...

9 The circuit illustrated below has a power supply fixed at 12 V.

What is the current intensity in resistor R_3?

$1\,\Omega$

R_1

12 V

R_2 $2\,\Omega$

R_3

$3\,\Omega$

10 How do the concentrations of H^+ ions and of OH^- ions change when the pH of a solution increases?

11 You are given three beakers containing different substances. You compile your observations in the table below :

Observations	Beaker 1	Beaker 2	Beaker 3
State	liquid	liquid	liquid
Colour	colourless	colourless	colourless
Volume	125 mL	120 mL	100 mL
Cobalt chloride paper	no change	turns pink	turns pink
Litmus paper	no change	turns red	no change
Electrical Conductivity	no	yes	yes

a)   In which of the beaker(s) was water present?

b)   Which of the beaker(s) contained an acid?

12   Find the missing number.

The third electron energy level can accept a maximum of ..... electrons.

13   Which element corresponds to each of the definitions below?

Write only the symbols of the elements in the answer booklet.

Definition

1.   The element has electrons in two energy levels (shells) and the outer level is full.

2.   The element has electrons in three energy levels (shells) and it has two valence electrons.

3.   The element has an atomic mass of 28 and its nucleus contains 14 neutrons.

4.   The element reacts vigorously with water and the electric charge of its nucleus is +19.

14   You are given an element and told it is a metal. You are to determine whether it a metal or not.

What are four properties this element will have if it is a metal?

15   Sulfur (S) has several isotopes. One of these isotopes is the sulfur atom which has a mass number of 34.

Draw a simplified atomic model (Bohr-Rutherford) to represent this isotope.

16   One way of producing copper (Cu) is to combine aluminum (Al) with copper chloride ($CuCl_2$). This reaction produces aluminum chloride ($AlCl_3$) and copper (Cu).

The unbalanced equation for this reaction is given below. :

$$Al + CuCl_2 \rightarrow AlCl_3 + Cu$$
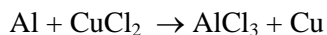
Balance this equation correctly.

NOTE :   If you make any mistakes in balancing this equation, you will be given 0 marks for this question.

17   A 1500 W hair dryer is used for 1 hour at a time, 5 times a week for 50 weeks.
Electricity costs $0.05/kW•h.

How much does it cost to use this hair dryer for 50 weeks?

End of Year Review Exercises

Show all your work.

18 How much NaCl, in grams, is needed to make 500 mL of a 0.50 mol/L solution of NaCl?

SHOW YOUR WORK.

19 What would be the potential difference reading of voltmeter V_1 in the circuit 1 and voltmeters V_2 and V_3 in circuit 2? Justify your answer.

Circuit 1

Circuit 2

6.0 V

V_1

V_2

2.0 V

6.0 V V_3 V_1 V_3 V_2

20 Using 300 mL of a 2.0 mol/L solution of copper sulfate, $CuSO_4$, a student must prepare a 0.50 mol/L solution of copper sulfate.

What volume of H_2O must be added to prepare the 0.50 mol/L solution?

Show all your work.

21   The following graph illustrates the change in the current intensity, I, in a circuit as a function of the potential difference (voltage), V, across its terminals.

What is the conductance, G, of this circuit?

     A)   0.33 S   C)   1.33 S

     B)   0.75 S   D)   3.00 S

22   Burning ethane, C_2H_6, in air containing oxygen, O_2, produces carbon dioxide, CO_2, and water, H_2O. You are to produce 32 mol of carbon dioxide.

What mass of oxygen is required?

Show all your work.

23   Iron, Fe, and carbon monoxide, CO, are produced when iron oxide, Fe_2O_3, reacts with carbon, C.

You would like to produce 50 mol of iron.

What mass of iron oxide is required?

Show all your work.

24 An electric circuit is illustrated below. The value of the resistance of the resistors is

$$R_1 = 50 \ \Omega$$
$$R_2 = 200 \ \Omega$$
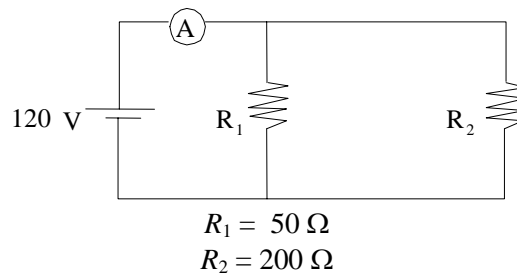
What is the value of the equivalent resistance of this circuit?

25 State the rule that shows the relationship between an electric current and the magnetic field associated with it by completing the sentence on your answer sheet. Insert the number for the correct term in each of the blanks.

1. electron flow   2. magnetic lines of force   3. the thumb

4. the fingers   5. right   6. left

26 The following electrical circuit consists of a power source, four resistors (R_1, R_2, R_3 $\quad R_1 = 20 \ \Omega$ and R_4) and a voltmeter V_4 ($V_s = V_{total}$).
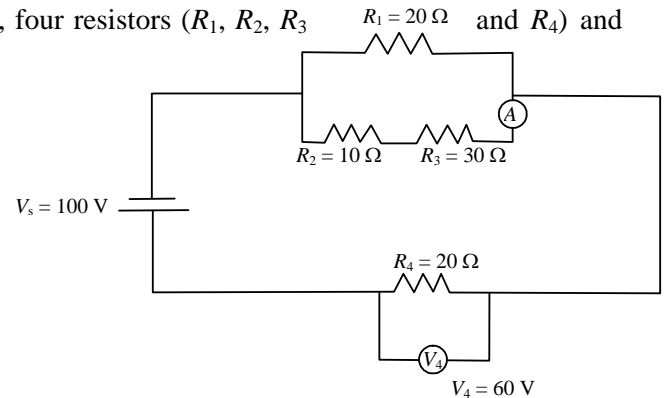
What is the current intensity (I_3) through R_3?

$V_s = 100 \ V$

$R_2 = 10 \ \Omega$ $R_3 = 30 \ \Omega$

$R_4 = 20 \ \Omega$

$V_4 = 60 \ V$

A) 3.0 A

B) 2.0 A

C) 1.5 A

D) 1.0 A

27 A student is asked to construct several electromagnets and to measure the strength of each using paper clips. Taking into account the current, the number of turns of wire around the core and the strength of the electromagnet, predict which of the electromagnets below would be the strongest and which would be the weakest.

Electromagnet	Current	n° of turns of wire	n° of paper-clips
n° 1	1A	10	4
n° 2	4A	10	?
n° 3	1A	30	?
n° 4	4A	30	?

28 In the laboratory, you are given a solid and told that it is a metalloid (semimetal).

In order to verify that this solid is, in fact, a metalloid:

- list three observations or tests you could use;
- describe a possible result for each observation or test;
- write a conclusion proving that this solid is a metalloid.