SURNAME ..... FIRST NAME .....

JUNIOR SCHOOL ..... SENIOR SCHOOL .....

Independent Schools Examinations Board

COMMON ENTRANCE EXAMINATION AT 13+

SCIENCE

CHEMISTRY

Tuesday 24 January 2012

Please read this information before the examination starts.

- This examination is 40 minutes long.
- The answers should be written on the question paper.
- Answer **all** the questions.
- Calculators may be required.

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1. Underline the option which best completes each of the following:

(a) A substance which only contains one sort of atom is

carbon **iron sulphide** **magnesium oxide** **water**

(b) Vinegar could have a pH value of

1 **3** **7** **10**

(c) A gas which causes acid rain is

methane **nitrogen** **oxygen** **sulphur dioxide**

(d) A material which is man-made and not found naturally is

coal **gold** **plastic** **wood**

(e) The salt in sea water is a

solute **solution** **solvent** **suspension** (5)

2.

mercury	**water**	**sulphur**
argon	**carbon (graphite)**	**sulphur dioxide**

From the box above, select ONE substance which, at room temperature, matches each of the descriptions (a) to (f) below.

(a) is a liquid compound .....

(b) will burn in air to produce carbon dioxide .....

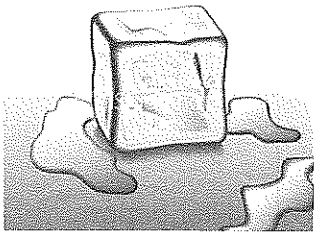
(c) is yellow .....

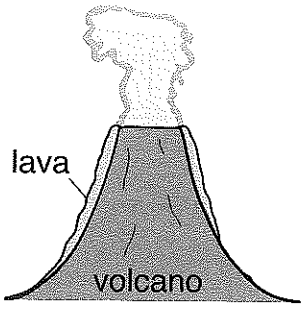
(d) conducts electricity well .....

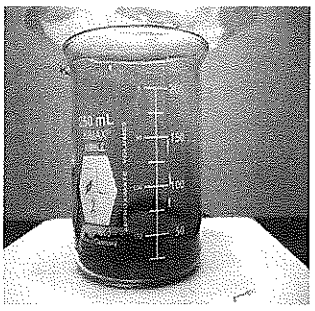
(e) consists of widely-spaced particles .....

(f) consists of regularly-arranged particles ..... (6)

3. Draw lines to match each example below with the correct physical change.





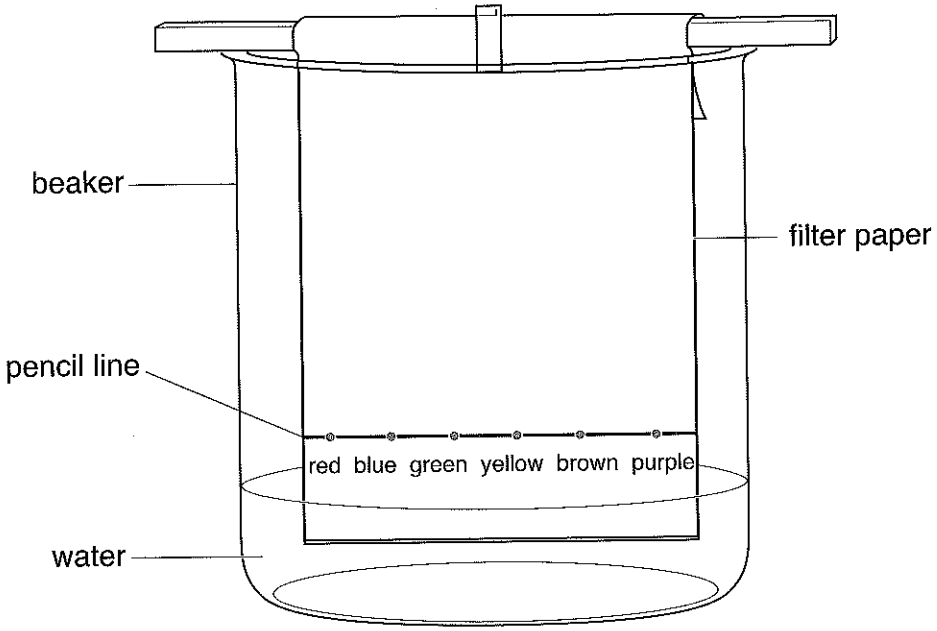


example	physical change
ice to water	freezing
molten lava to solid rock	melting
solid iodine to iodine vapour	boiling
	subliming

(3)

4. Lana wanted to investigate which dyes were present in her set of felt-tip pens.

She put a line of different coloured spots on a piece of filter paper and set up the following apparatus:



(a) (i) Name this method of separation.

..... (1)

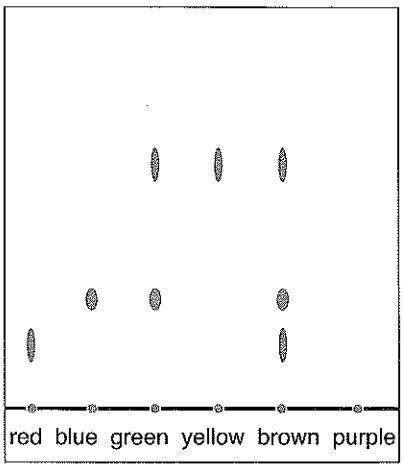
(ii) Describe the purpose of the water.

..... (1)

(iii) Explain why Lana drew the start line with a pencil rather than with a pen.

..... (1)

Here are her results:



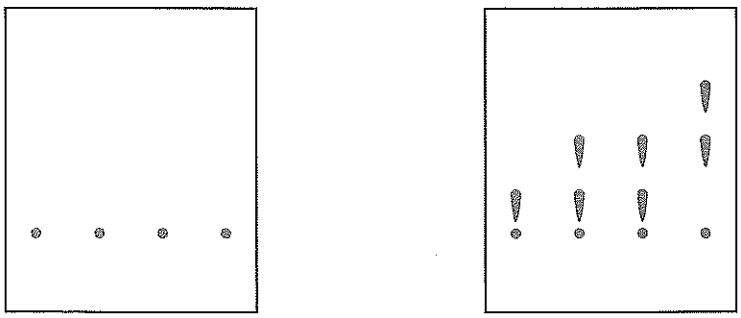
The purple pen was a mixture of red and blue dyes.

(b) On the diagram above, draw the result you would expect to see. (1)

(c) (i) Which colour pen had the most dyes in it? ..... (1)

(ii) Which dye was used in the most pens? ..... (1)

Next, she tried the same experiment on some permanent marker pens.
It did not work as the colours stayed on the pencil line.
Lana decided to use ethanol rather than water.
This experiment worked.



with water with ethanol

(d) Suggest why the change from water to ethanol made a difference.

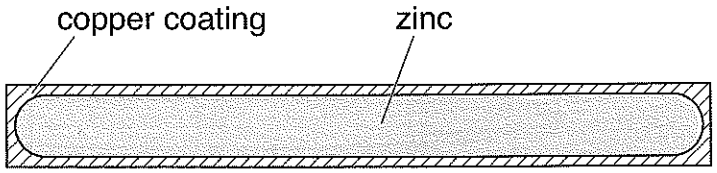
.....

..... (2)

5. Daniel read that US 1-cent coins are made of zinc coated with copper.



1-cent coin



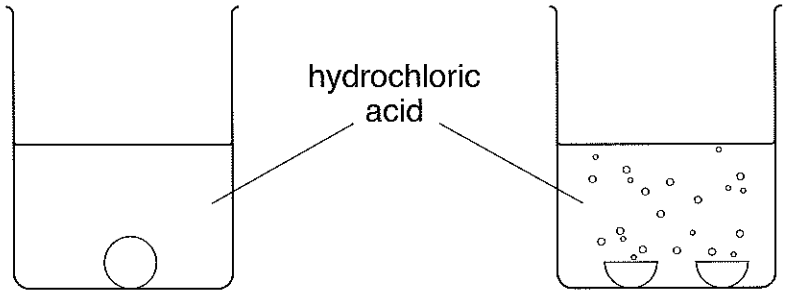
cross-section of 1-cent coin

He decided to investigate this, using two 1-cent coins.

He added one of the coins to some hydrochloric acid in a beaker.

He then weighed the other coin, cut it in half and added it to some hydrochloric acid.

Daniel recorded his observations in his notebook.



whole coin – no reaction

coin cut in half – reaction

The whole coin did not react with the acid.

When the coin was cut in half and put in the acid, bubbles of gas were formed and the zinc metal inside the coin dissolved, leaving a thin brown skin of copper metal.

The gas was found to burn with a 'pop' with a lighted splint.

When the reaction stopped, I removed the copper which was left, washed it and let it dry.

I then weighed the copper which remained.

mass of whole coin = 2.40 grams

mass of copper left = 0.12 grams

(a) State two safety precautions which Daniel should have taken during his experiment.

1: .....

2: ..... (2)

(b) (i) What does this experiment tell you about the difference in reactivity between copper and zinc?

..... (1)

(ii) Why did the coin only react with the acid when it was cut in half?

..... (1)

(iii) Why was Daniel scientifically incorrect to say that the zinc 'dissolved' in the acid?

..... (1)

(c) (i) Name the gas which was formed in the reaction.

..... (1)

(ii) Complete the word equation:

zinc + hydrochloric acid → ..... + ... (1)

(d) Use Daniel's results to calculate the percentage by mass of zinc in a 1-cent coin.

.....

.....

..... (3)

Before 1982, US 1-cent coins were made of brass – a mixture of copper (95%) and zinc (5%).

(e) (i) What do you understand by the word *mixture*?

..... (1)

(ii) Suggest a reason why the composition of the coins was changed in 1982.

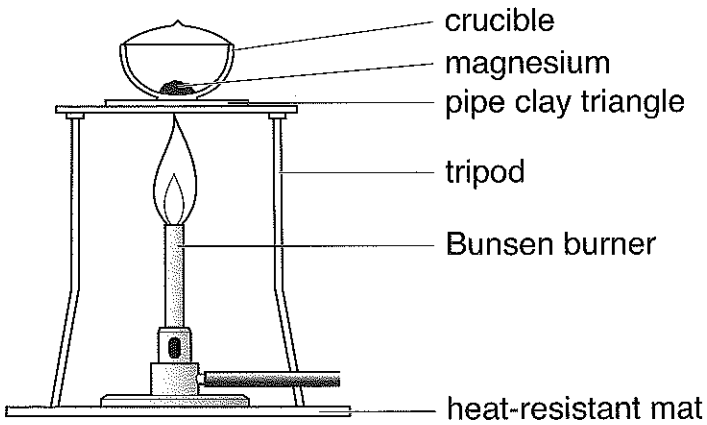
..... (1)

6. Sarah carried out an experiment to measure the change in mass when magnesium is heated in air.

She used the apparatus drawn below.

She lifted the crucible lid several times during the experiment.

When she did this, the magnesium burned brightly leaving a white solid in the crucible.



(a) (i) Explain why Sarah raised the crucible lid several times during each experiment.

.....

..... (2)

(ii) Name the white solid.

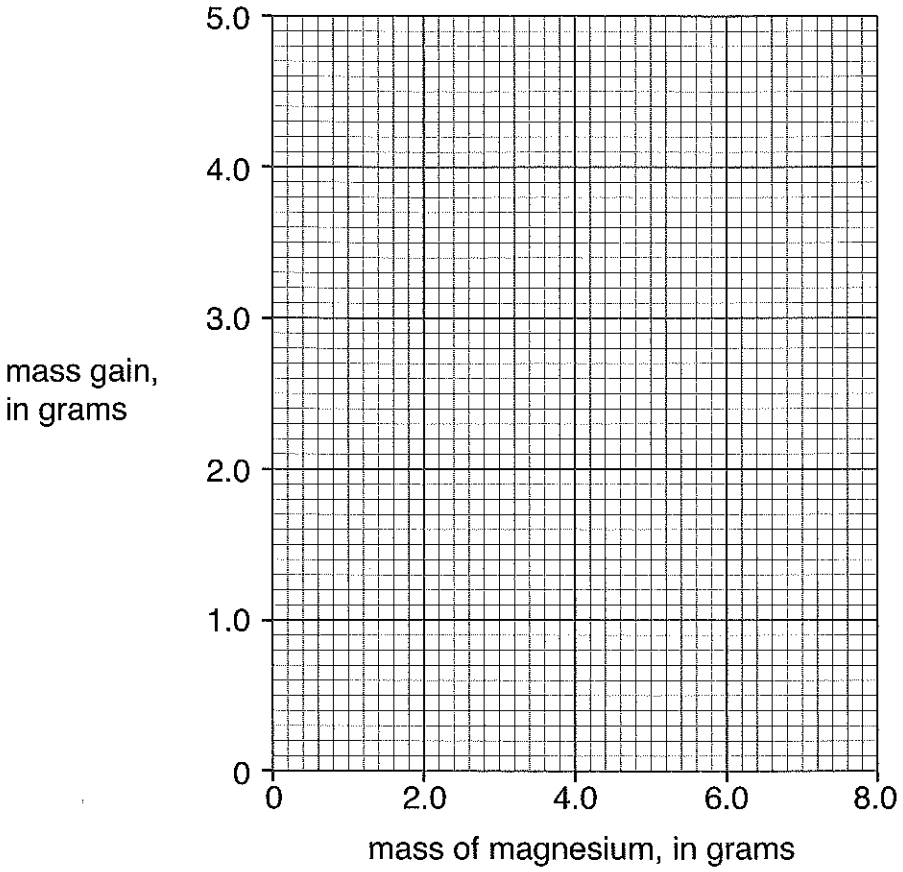
..... (1)

Her results are shown in the table below.

experiment	mass of magnesium, in grams	mass of white solid, in grams	mass gained, in grams
1	1.6	2.7	1.1
2	2.8	4.8	2.0
3	4.2	6.3	2.1
4	4.5	7.5	
5	5.8	9.5	
6	7.0	11.8	4.8

(b) Complete the table to show the mass gained in experiments 4 and 5. (2)

(c) (i) Plot a graph of the mass of magnesium against the mass gained. (2)



(ii) One point does not fit with the others.
Put a circle round that point. (1)

(iii) Give a reason why this experiment might have given a lower mass gain.

..... (1)

(iv) Explain why the graph should go through the origin (0, 0).

..... (1)

(v) Draw a straight line of best fit on your graph. (1)

(vi) Use your graph to work out the mass of white solid which would be formed if 5.0 grams of magnesium were burned.

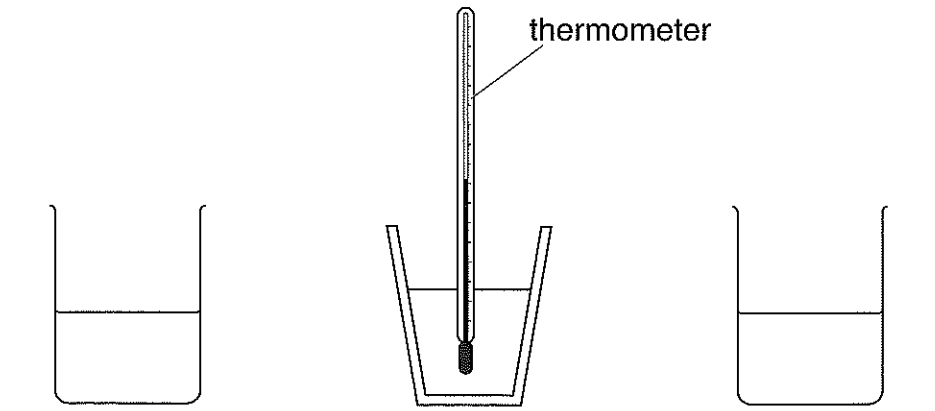
.....

..... (2)

7. Tommy carried out an experiment in which he investigated the effect on the amount of heat given out, during a reaction when he changed the volumes of alkali and acid used.

He measured out different volumes of the alkali, sodium hydroxide and hydrochloric acid which were kept in separate beakers.

He then added them together in a polystyrene cup and measured the temperature rise.



His results are shown below:

experiment	volume of alkali, in cm^3	volume of acid, in cm^3	temperature rise, in °C
1	10	30	8
2	20	20	16
3	30	10	8

(a) Which piece of equipment could Tommy use to measure the volumes?

..... (1)

(b) Why did he use a polystyrene cup to carry out the reaction?

..... (1)

(c) (i) What type of reaction occurs between an acid and an alkali?

..... (1)

(ii) Complete the word equation for the reaction:

sodium hydroxide	+	hydrochloric acid	→	.....	+	.....

(2)

(d) Explain carefully why the temperature rise in experiment 1 is half the value of the temperature rise in experiment 2.

.....

.....

..... (2)

(e) Predict the temperature rise when 10 cm^3 of the hydrochloric acid is added to 10 cm^3 of the sodium hydroxide.

.....°C

Explain your answer: .....

..... (2)

(f) At one stage in his experiment, Tommy forgot which substance was in each beaker.

(i) Why was Tommy not able to tell the difference between the two different liquids in the beakers?

..... (1)

(ii) Suggest a test which Tommy could do in order to tell the difference between the two liquids.

test:.....

result for acid: .....

result for alkali: ..... (3)

(Total marks: 60)