Week 5 Learning Check
Chemistry Higher

Name: _____

Class: _____

Date: _____

Time: **30 minutes**

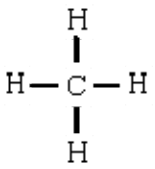
Marks: **31 marks**

Comments:

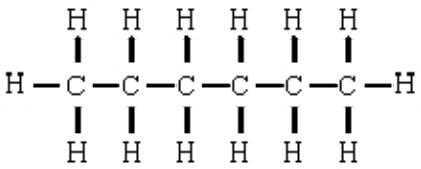
Q1.

The structural formulae of two saturated hydrocarbons are shown below.

compound A



compound B



Describe **two** ways in which they will differ in their physical properties.

1. _____

_____

2. _____

_____

(Total 2 marks)

Q2.

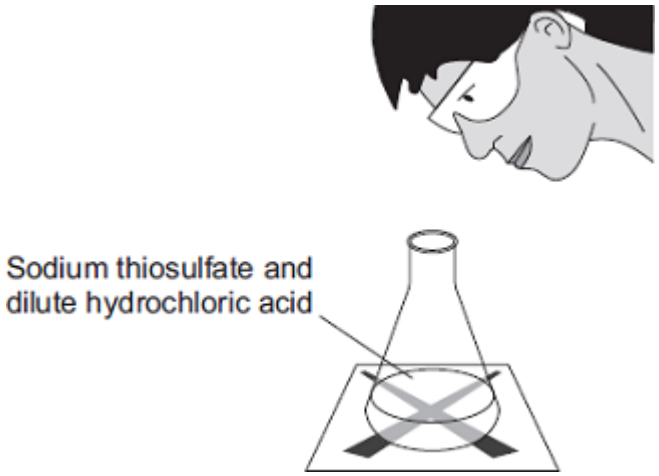
A student investigated the rate of reaction between sodium thiosulfate and dilute hydrochloric acid.

The student placed a conical flask over a cross on a piece of paper.

The student mixed the solutions in the flask.

The solution slowly went cloudy.

The student timed how long it took until the cross could not be seen.



The equation for the reaction is:

$Na_2S_2O_3(aq)$	+	2 HCl(aq)	→	2 NaCl(aq)	+	H2O(l)	+	SO2(g)	+	S(s)
sodium thiosulfate	+	hydrochloric acid	→	sodium chloride	+	water	+	sulfur dioxide	+	sulfur

(a) Explain why the solution goes cloudy.

_____

_____

_____

_____

(2)

(b) The student repeated the experiment with different concentrations of sodium thiosulfate.

Concentration of sodium thiosulfate in moles per dm^3	**Time taken until the cross could not be seen in seconds**			
	Trial 1	**Trial 2**	**Trial 3**	**Mean**
0.040	71	67	69	69
0.060	42	45	45	44
0.080	31	41	33	

(i) Calculate the mean time for 0.080 moles per dm^3 of sodium thiosulfate.

_____

_____

_____

Mean = _____ seconds

(2)

(ii) Describe and explain, in terms of particles and collisions, the effect that increasing the concentration of sodium thiosulfate has on the rate of the reaction.

_____

_____

_____

_____

_____

_____

(3)

(Total 7 marks)

Q3.

Hydrated copper sulphate is a blue solid. When it is heated, white solid anhydrous copper sulphate is made. This is a reversible reaction.

hydrated copper sulphate [+ heat energy] ⇌ anhydrous copper sulphate + water
(blue) (white)

(a) To make the forward reaction work, the hydrated copper sulphate must be heated all the time.

What type of reaction is this?

_____

_____

(1)

(b) Anhydrous copper sulphate can be used in a test for water. What **two** things will happen when water is added to anhydrous copper sulphate?

1. _____

_____

2. _____

_____

(2)

(Total 3 marks)

Q4.

Read the passage, which is from the start of a magazine article. It will help you to answer the questions.

Third rock from the Sun

Geologists now have evidence that the Earth's crust began to form about four and a half billion years ago. The surface of the Earth was then at temperatures well above 100 °C and the atmosphere was mostly carbon dioxide with some ammonia, methane and water vapour. About a quarter of a billion years after it had first formed, the crust had become thicker and had cooled down to below 100 °C.

Slowly, over a period of about three billion years, oxygen became established in the atmosphere. Some was released from the Earth's interior by volcanoes and some was produced, by the process of photosynthesis, by algae which had evolved in the seas.

(a) Explain how the first seas formed.

_____

_____

_____

(2)

(b) Briefly describe **two** processes which reduced the proportion of carbon dioxide in the Earth's atmosphere over the period of three billion years.

1. _____

_____

2. _____

_____

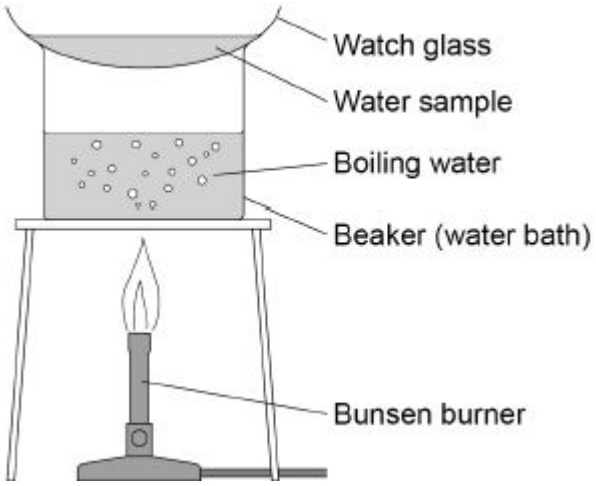
(2)

(Total 4 marks)

Q5.

A student investigated the mass of dissolved solids in 5 cm^3 samples of water.

The diagram below shows the apparatus.



The table below shows the student's results.

Type of water	Mass in g			
	Watch glass	**Watch glass and dissolved solids**	**Dissolved solids in 5 cm^3 of water**	**Dissolved solids in 1000 cm^3 of water**
Sea water	9.34	9.48	0.14	28.00
River water	9.15	9.23	0.08	**X**
Rainwater	8.93	8.93	0.00	0.00

(a) Calculate mass **X** in the table above.

_____

_____

Mass **X** = _____ g

(1)

(b) 5 cm^3 is a small volume of water for each experiment.

Give **one** advantage and **one** disadvantage of using a larger volume.

Advantage _____

_____

Disadvantage _____

_____

(2)

(c) Potable water is **not** pure water.

Describe the difference between potable water and pure water.

_____

_____

_____

(1)

(d) Potable water is obtained from both groundwater **and** from sea water.

Describe how groundwater and sea water are treated to produce potable water.

_____

_____

_____

_____

_____

_____

(3)

(e) The percentage by mass of dissolved solids in a 6.50 g sample is 2.2%

Calculate the mass of the dissolved solids.

_____

_____

_____

_____

Mass of dissolved solids = _____ g

(2)

(Total 9 marks)

Q6.

Why blue sweets are turning white

A recent study identified a possible harmful effect on children's nervous systems by some artificial colours. Two of these colours are Brilliant Blue (E133) and Quinoline Yellow (E104). Both are artificial colours because they are made from coal. The company is to stop producing the blue sweets because it is removing all artificial colours and there is no natural blue alternative.

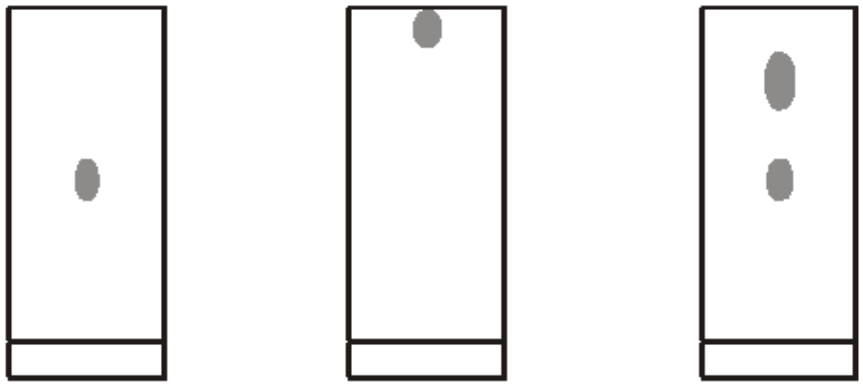
(a) Suggest why it is important to be able to identify the colour additives in food.

_____

_____

(1)

(b) A brown colour used in sweets was analysed using chromatography. The results were compared with those from E104 and E133.



What do the results tell you about the brown colour and its suitability for use in sweets?

_____

_____

_____

_____

_____

_____

(3)

(c) Once all the unsuitable colours are removed, the company claims that its sweets are now 'free from artificial colours'.

Does this mean that the sweets contain no additives? Explain your answer.

_____

_____

_____

_____

(2)

(Total 6 marks)

Q1.

B will have higher melting point
higher boiling point
be less volatile
be more viscous (allow less flammable)
any two for 1 mark each

[2]

Q2.

(a) because sulfur / S forms

1

which is insoluble / a solid / a precipitate

1

(b) (i) 32

*correct answer with or without working gains **2** marks*
*accept evidence of 31 + 33 / 2 for **1** mark*
*allow 35 for **1** mark*

2

(ii) reaction rate increases
*if incorrect reference to energy = max **2***

1

because of more particles (per unit volume)
allow because particles are closer together

1

and because there is an increase in frequency of collisions
*accept because particles are more likely to collide **or** higher chance of collision*
ignore more (successful) collisions

1

[7]

Q3.

(a) endothermic (reaction)
accept thermal decomposition

1

(b) gives out heat (energy)
accept exothermic (reaction)

1

turns blue
accept goes to hydrated copper sulphate

1

[3]

Q4.

(a) **either** any **two** points (1) each from

* (surface) below 100 °C (the surface) below the boiling point of water

* (allowed the) condensation (of water vapour)
accept (rate of) condensation greater than (the rate of) evaporation

* from the atmosphere
accept from the air

or condensed water (vapour) (1)
was pulled by gravity into depressions (1)
***or** idea of impervious sea bed*

or from comets (which crashed on the Earth) (1)

ice (from these) melted (1)

2

(b) any **two** processes (1) each from

* dissolving in (sea) water

* (taken in during) photosynthesis
*accept taken in by algae **or** plants*

• formation of carbonate(s)
or calcium carbonate **or** chalk **or** calcite
*accept formation of shells **or** bones **or** corals*

2

[4]

Q5.

(a) 16(.0)

1

(b) advantage: more accurate result
*do **not** accept reliable*

1

disadvantage: takes a long(er) time, more energy needed (to heat more water)
ignore expensive

1

(c) pure: no dissolved solids / impurities
or no (dissolved) chlorine
allow only water / H_2O
ignore safe to drink

and

potable: has dissolved solids / impurities
or has (dissolved) chlorine

ignore safe to drink

1

a clear comparative statement referring to solutes gains the mark

(d) groundwater:

- filtered

allow acceptable method of filtration

1

- sterilised

allow acceptable method of sterilisation

1

groundwater:

- distilled **or** reverse osmosis

allow desalination
ignore salt removed
ignore boiling alone
ignore filtering
*do **not** accept fractional distillation*

1

(e) $\frac{2.2}{100} \times 6.50$

1

(=) 0.143 (g)

1

an answer of 0.143 (g)
***or** 0.14 (g) scores **2** marks*

[9]

Q6.

(a) check if safe to eat / healthy

or

permitted

accept references to allergies / medical problems

1

(b) any **three** from:

accept dye for colour

- made up of <u>two</u> colours / dots
- contains an unknown colour / dot
- contains a harmful <u>colour</u>
- contains E104 / quinoline yellow
  or does not contain E133 / brilliant blue

- further analysis needed

3

(c) ignore No or Yes but No must be implied

there could be <u>other</u> additives (in the sweets)

*accept any other type of additives but **not** colourings*

1

could still contain / use / add <u>natural</u> colours

accept non-artificial for natural

or

named natural colours

1

[6]

Q1.

This question was generally well answered by the majority of candidates who referred to macroscopic physical properties (amongst which flammability was allowed). A large minority of candidates described the difference at the molecular level e.g. in chain length or numbers of atoms.

Q2.

(a) Most answers showed a lack of knowledge and understanding with many students thinking that a gas or sulfur dioxide made the solution go cloudy.

Many students listed all the products of the reaction e.g. 'sodium chloride, sulfur, water and sulfur dioxide are formed'. References to carbon dioxide were frequent showing confusion with the limewater test. Few specific references to the formation of sulfur were seen.

(b) (i) Generally not well answered. Few students recognised the anomalous point and the majority included it and calculated the mean time as 35 seconds for partial credit.

(ii) A good discriminating question. The more able students referred to the increased frequency of collisions. Reference to more collisions unqualified was ignored. The complete range of marks was seen with credit often being given for the idea of more particles and increasing the rate of the reaction. A large number of students answered the question in terms of increasing the temperature of the reaction and wrote at length about increased energy and particles moving faster. These answers scored partial credit according to the statements made.

Q3.

(a) The majority of candidates could not recall that a reaction that needs to be heated continuously is an endothermic reaction.

(b) Very few candidates used the term exothermic. Most candidates did not use the information given in the stem and stated that 'it changes colour', 'fizzes' or 'swells up'. The better candidates did recognise the significance of the reversible reaction and gained full credit by answering that 'it becomes hot and changes back to blue'.

Q4.

In part (a), although it was possible to gain both marks without doing so, it was surprising that so few candidates mentioned the significance of surface temperatures falling below 100 °C.

In part (b) nearly all candidates understood that the process of photosynthesis would remove carbon dioxide from the atmosphere. Dissolving in sea water or the formation of carbonates was less frequently mentioned.

Q5.

(a) 76% of students correctly calculated the mass as 16. Some students incorrectly

calculated the mass to be 14.

(b) 56% of students achieved at least one mark; 16% achieved both. Incorrect responses describing the length of time ‘for the solids to dissolve’ were regularly seen. Marks were awarded more often for students who correctly gave a disadvantage of using a larger volume of water than those who attempted to give an advantaged by creating a list of reasons, for example reliable, accurate and precise.

(c) 27% of students correctly described the difference between pure water and potable water. ‘Dissolved’ was omitted from the majority of descriptions about potable water having chemicals, minerals or even vitamins and nutrients ‘in it’. A number of students answered in terms of the pH of the two waters.

(d) 70% of students achieved at least one on this question. 25% gave responses that gained either all three marks or two marks. Students failed to separate out their answers highlighting the differences in the treatment methods to produce potable water from ground water and seawater. ‘The water’ was filtered, sterilised and distilled to produce potable water was a common response. The higher-attaining students gave clear, succinct responses using the correct terminology.

(e) 56% of students achieved full marks on this question. The most common mistake was not converting 2.2 into a percentage (0.022 or 2.2 ÷ 100) when multiplying by 6.50 to calculate the mass of dissolved solids.

Q6.

The majority of candidates gave a suitable explanation of the importance of identifying colour additives in food in part (a). It was not enough to just say to know what’s in it. Amplification was needed, such as a safety point, a health point or a permitted point which could include religious or ethical reasons.

For part (b) many candidates answered purely in terms of E104 and made no reference to the other colour. Many also, incorrectly, identified the large spot as the brown colour. Several candidates thought that the inclusion of the unknown colour would make the brown colour safe. There was a disappointing number of candidates who identified it as containing both E104 and E133 and an equally surprising number who said it contained neither. Some candidates seemed to think that the dot at the same level as E104 was an additive similar to but not the same as E104, showing that they did not fully understand the science.

One mark was the most common outcome of part (c), usually for stating that there could be other additives in the sweets. Several candidates thought that if an additive is not harmful, then it cannot be an additive or if it is natural it is not harmful. Many candidates realised that colour additives were only one type of additive and most of these candidates provided examples of other categories of additives. Very few candidates suggested that natural colours could be used.