UNIVERSITY OF SWAZILAND

FACULTY OF EDUCATION

SUPPLEMENTARY EXAMINATION PAPER

July 2013

B. Ed. II and PGCE

Title of paper: Curriculum Studies: Chemistry

Course number: EDC 279

Time allowed: 3 hours

Instructions:

1. This paper contains SIX questions.
2. Question 1 is COMPULSORY. You may then choose ANY TWO questions from questions 2, 3, 4, 5.
3. Marks for each question are as indicated in the questions.
4. Any piece of material or work that is not intended for marking purposes should be clearly CROSSED OUT.
5. Ensure that responses to questions are NUMBERED CORRECTLY.
6. This paper comprises 4 pages and four attached information sheets

Special Requirements

SGCSE Physical Science syllabus 6888 (Chemistry section)

Four additional sheets attached

QUESTION 1

This question is compulsory

a) While teaching chemistry a teacher used this equation:

$$Na + H_2O \longrightarrow NaOH + H_2$$

i) Suggest a topic and a sub-topic for a lesson the teacher might be teaching. [2]

ii) What is missing from this equation? [2]

iii) Write **three** behavioural objectives for the teacher's lesson so that different cognitive levels of Bloom's taxonomy are represented. [6]

iv) Write **one structured** assessment item worth **about 5 marks** for the lesson and include a marking guide for the item. [5]

b) Standard practical is one approach that can be used to conduct chemistry practical work.

Discuss this approach to practical work and show its strengths and weaknesses in teaching chemistry. [10]

[25]

QUESTION 2

a) Debates on the nature of science indicate that science may be viewed as a "body of stable but tentative knowledge, as well as a process of inquiry". Discuss this statement and briefly indicate its implications for teaching science. [15]

b) Discuss the following concepts and the importance of considering them when constructing assessment tasks in chemistry.

i) content related validity [5]

ii) construct related validity [5]

[25]

QUESTION 3

a) Suppose you want to use the demonstration method to teach the chemistry concepts from the JC Science syllabus section presented below.

> *17. Metals*
>
> *Learners should be able to:*
>
> ...
>
> *c) investigate and place in order of reactivity: calcium, copper, (hydrogen), iron, magnesium, potassium, sodium and zinc by reference to the reactions , if any and where relevant, of the metals with water or steam, dilute hydrochloric acid (equations not required).*
>
> ...

Show, with justification, how you might go about using the demonstration method to ensure pupils attain the learning outcomes specified above. *(Information sheet is attached)* [10]

b) The question and answer method is a versatile technique in teaching as it complements most of the other methods of teaching used in chemistry.

Describe the characteristics of each of the three classes of questions presented below and give examples for each from chemistry, as specified.

i) Convergent questions with two examples [5]

ii) Divergent questions with one example [5]

iii) Evaluative questions with one example [5]

[25]

QUESTION 4

Refer to the **core content of the** syllabus section *C8.4 Identification of ions: C8.4.1 Aqueous cations and C8.4.2 Aqueous anions* (Syllabus is attached) *when answering the questions below*

a) Outline a plan for a practical activity you could run for a lesson on this topic.

(Additional information is provided as attached sheet on tests for common gases and ions.) [13]

b) Describe how this syllabus section may succeed in meeting the following aims of practical work:

i) stimulate pupils' interest and enjoyment of science? [4]

ii) develop laboratory skills? [4]

iii) learn chemical ideas [4]

[25]

QUESTION 5

a) Students come to class with different levels of motivation that influence their learning. Humanist and Behaviourist theories present motivation to learn from different perspectives.

i) Show how each theory presents motivation towards learning. [5]

ii) What are the implications of these perspectives of motivation for Chemistry lessons? [5]

b) Describe how the motivational strategies given below might promote pupils' motivation in learning chemistry:

i) Making the learning material relevant [5]

ii) Matching material to be learned to the pupils' ability. [5]

iii) Showing enthusiasm for Chemistry [5]

[25]

QUESTION 6

Attached is a lesson plan (*pages 7 & 8*) that was prepared by a student teacher during teaching practice.

Critique fully the lesson plan in terms of the following aspects:

General information [2]

Previous knowledge [2]

Objectives [6]

Teaching material and teaching method [3]

Lesson introduction [3]

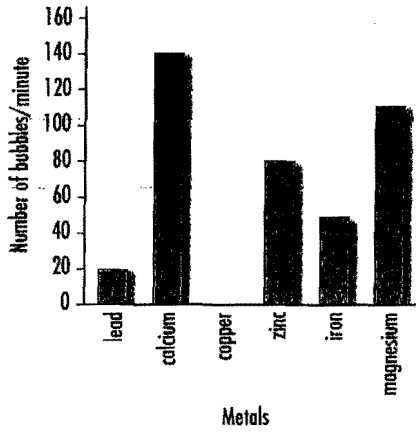
Lesson presentation and matching objectives [6]

Lesson summary [3]

[25]

Unit 4 Fast, faster, fastest

Mr Madolo, who runs a blacksmith shop, was advised by a friend to clean his metals with vinegar. Before cleaning them, he decided to test small pieces of all the metals he sells by dipping them in the vinegar. He noticed bubbles being formed at different rates when some of the different metals were dipped in the vinegar. Mr Madolo counted the number of bubbles formed by each metal per minute. His results are represented by the bar chart below.



OVER TO YOU

1. Why are bubbles produced when the vinegar comes into contact with some metals?
2. What will eventually happen to the pieces of metal that produced bubbles in the vinegar?
3. Using the information from Mr Madolo's bar chart, rearrange the metals in order of reactivity, starting with the most reactive one.
4. Some ornaments are made using copper:
   (a) Can these ornaments be cleaned using vinegar?
   (b) Explain your answer to (a) above.
5. Write the reactivity series of metals that you learnt about in Book 2. Compare it with the one in 2 above.
6. Where would you place the metals sodium and potassium in your list? Explain your answer.
7. Would it be appropriate for Mr Madolo to clean all his metals with the vinegar? Explain your answer.

Vinegar is an acid. Metals react with acids at different rates to form a salt and hydrogen gas. When metals are arranged in order of their reactivity, the list is called the **reactivity series of metals.** In addition to the acids, more reactive metals also react with water and steam.

Question 3(a)

ACTIVITY

Activity 4.5

Does water react more vigorously with metals compared to acids? Do the activity below to find out.

You will need: two test tubes, a test-tube rack, calcium granules, water, dilute hydrochloric acid and labels.

1. Label one test tube 'water' and the other one 'acid'.
2. Add about 5 ml water to the test tube labelled 'water' and about 5 ml dilute acid to the one labelled 'acid'.
3. Take ten large granules of calcium from its container. They should be more or less the same size.
4. Put five granules in each test tube at the same time.
5. Judge the rate at which these react by comparing the number of bubbles produced.

Now answer the following questions:

1. With which liquid does the metal react faster – water or dilute hydrochloric acid?

We know that steam is simply water in its gaseous state and has a higher temperature.

2. In which of the two do you think calcium would react faster – water or steam?

Generally, metals react more slowly with water than with steam. They react much more vigorously with dilute acids than with steam. In fact, highly reactive metals such as potassium and sodium should not be reacted with dilute acid in the school laboratory because the reaction is dangerously explosive. Less reactive metals react more slowly with dilute acid and they do not react with cold water at all.

Question 4 2013. EDC 277

Calculate the concentration of the sodium carbonate solution in grams of anhydrous sodium carbonate (Na_2CO_3) per litre.
(b) The sodium carbonate solution was actually made up by dissolving 49.6 g of a hydrated form of sodium carbonate, $Na_2CO_3.xH_2O$, in water and diluting the solution to 1 litre. Calculate x. (Relative atomic masses, H = 1.0, O = 16, C = 12.0, Na = 23.0.) (J.M.B.)

2. 10.0 cm^3 of a solution of sodium hydroxide required 25.0 cm^3 of a solution of hydrochloric acid of concentration 0.4 mol dm^{-3} for neutralization. Calculate the concentration of the alkali solution in mol dm^{-3}

3. The relative formula mass of lead nitrate is 331. 6.62 g of lead nitrate were dissolved in water and the volume of the solution made up accurately to 500 cm^3. What was the molarity of the solution? (W.J.E.C.)

4. The alkaline effluent from a certain paper-making factory has to be neutralized before it can be released into the normal sewage/drainage system. The alkali in the effluent is sodium hydroxide. Each day a 1000 litre tank of this effluent has to be treated with 120 litres of 2 M hydrochloric acid for neutralization. (a) Give the balanced equation for the reaction between sodium hydroxide and hydrochloric acid. (b) Calculate the mass of sodium hydroxide in the tank in the 1000 litres of effluent solution. (c) If the sodium hydroxide in the effluent were to be re-used it would have to be in a much more concentrated solution. How could this concentrating of the sodium hydroxide be carried out? (d) Suggest why this effluent is neutralized rather than concentrated and re-used. (e) If nitric acid were to be used in the neutralization rather than hydrochloric acid, what effect would this have on the sewage/drainage system? (A.E.B. 1978)

23.4 TESTS FOR COMMON GASES AND IONS

Some of these have been dealt with in other sections of the book, but they are collected and summarized here (Tables 23.1 to 23.4) both for reference and to reinforce your earlier work.

Table 23.1 Tests for some common gases

Gas	*Test*	*Result of test if positive*
Hydrogen	Trap gas in test-tube, apply lighted taper	Squeaky pop
Oxygen	Apply glowing taper to gas sample in test-tube	Taper relights
Carbon dioxide	Pass gas into calcium hydroxide solution (lime water), e.g. by collecting sample in teat pipette and ejecting into small volume of calcium hydroxide solution in test-tube	Calcium hydroxide solution goes 'milky' due to fine precipitate of calcium carbonate
Ammonia	1. Expose gas to damp red litmus paper, or 2. Expose gas to fumes of hydrogen chloride, e.g. from a bottle of concentrated hydrochloric acid	1. Paper goes blue 2. Dense white cloud of ammonium chloride formed
Chlorine	Expose gas to damp blue litmus paper	Paper goes pink and is then bleached
Hydrogen chloride	Expose gas to ammonia fumes, e.g. from bottle of concentrated ammonia solution	Dense white cloud of ammonium chloride
Nitrogen	Apply all other gas tests	If none positive, gas probably nitrogen
Sulphur dioxide	Expose gas to filter paper soaked in acidified potassium dichromate(VI) solution	Paper changes from orange to green
Hydrogen sulphide	Expose gas to filter paper soaked in lead nitrate (or ethanoate) solution	Dark coloured stain of lead sulphide forms on paper

Table 23.2 Tests for some common anions

Anion	*Test*	*Result of test if positive*
Soluble chloride	Acidify solution with dilute nitric acid and then add silver nitrate solution	White precipitate of silver chloride formed which easily dissolves in dilute ammonia solution
Soluble sulphate	Acidify solution with dilute hydrochloric acid and then add barium chloride solution	White precipitate of barium sulphate formed
Nitrates	Make solution alkaline with dilute sodium hydroxide solution, add Devarda's alloy, and warm. (See extra test to check ammonia gas does not come from ammonium ions, p. 333)	Ammonia gas formed (test in usual way)
Carbonates and hydrogen carbonates	Add a little dilute hydrochloric acid	Effervescence, carbon dioxide gas given off (test in usual way)

Table 23.3 Some flame tests for metal ions

Test	*Result if positive*	
Clean nichrome or platinum wire by repeated dipping in hydrochloric acid and heating in a roaring Bunsen flame. When no colour given to flame by wire, moisten the wire with dilute hydrochloric acid and pick up small sample of compound on it. Hold wire and sample in colourless flame, half way up the flame and to one side of the blue cone	Intense golden yellow: Apple green: Green-blue: Brick red: Lilac: Scarlet:	Na^+ Ba^{2+} Cu^{2+} Ca^{2+} K^+ Li^+

Table 23.4 Other tests for positive ions in solution

Ion	*Test*	*Result if positive*
Ammonium	Add dilute sodium hydroxide solution, then warm	Ammonia gas produced (test in usual way)
Copper(II)	Add dilute ammonia solution, dropwise, with stirring	Pale blue precipitate of copper(II) hydroxide formed initially, but then dissolves to form deep blue solution
Zinc	Add dilute ammonia solution, dropwise, with stirring to one sample and add dilute sodium hydroxide in a similar way to a second sample	In *both* samples, a white precipitate (zinc hydroxide) forms initially but then dissolves in excess alkali
Iron(II)	Add dilute ammonia or dilute sodium hydroxide solution	Dirty-green precipitate of iron(II) hydroxide
Iron(III)	As with iron(II)	Red-brown precipitate of iron(III) hydroxide
Aluminium and lead(II)	1. Do test as for zinc 2. If necessary (see results column) add dilute hydrochloric acid to a third sample	If white precipitate forms in both cases but only dissolves in excess sodium hydroxide, solution could contain Pb^{2+} or Al^{3+}. Do test (2), no precipitate if Al^{3+}, white precipitate (of lead chloride) if Pb^{2+} present

Question 6

Lesson Plan Class: Form 4B

Subject: Chemistry Date: 16/06/09

Topic: Atoms, element, compound Time: 50 minutes

Sub topic: Properties of ionic and covalent compounds

Previous knowledge: The learners had knowledge of ionic and covalent compounds

Learning objectives: By the end of the lesson learners should be able to:

- describe the differences in volatility including melting point and boiling point
- describe electrical conductivity between ionic and covalent compounds

Teaching materials: Periodic table, handout

Teaching methods: Discussion and Question & Answer.

Lesson Development

Duration	Phase	Teacher's activity	Learners's activity
5 min	Introduction	- Review previous lesson. - Reads learning objectives.	- listening
20 min	Presentation stage I	- Asks learners to give difference between ionic and covalent compounds - covalent bond holds atoms together.	- ionic compound is formed by combing metals with non metals - formed by two oppositely charged ions while covalent is formed by two or more non metals

Duration	Phase	Teacher's activity	Learners Activity
15 min	Stage II	- lead the discussion ionic compounds are composed of two or more different kinds of oppositely charged ions. - These oppositely charged ions attract each other and form a large three dimensional lattice called a giant structure - which held together by electrostatic attraction - crystalline solids - large amount energy - high melting point & boiling point. - when molten or in aqueous solution are electrolytes. soluble in H2O do not dissolve in organic solvents eg ethanol or benzene.	- making notes of key concepts. - Covalent compounds consist of two or more atoms linked together by covalent bonds. - the covalent bonds inside each molecule intramolecular bonds are very strong and can not easily be broken - the forces acting between the molecules (the intermolecular forces are weak & relatively easy to break. eg hydrogen bonds or van der waals forces. - molecular substances have low b.p & m.p
10 min	Summary	- Asks pupils to describe the electrical conductivity between ionic compounds and covalent compounds	- Answering the question.