education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Grades 8 & 9
Just-in-Time Training Workshop
2018: No.1

Participants' Handout

Natural Sciences

Jika iMfundo
what I do matters

Endorsed by:

SADTU
NAPTOSA
NATU

Improving Learning Outcomes in Natural Sciences

Objective of Workshop

This workshops aims to equip HODs and lead teachers in the use of different tools so that teachers are supported and learners' understanding of Chemistry topics taught in Grade 8 & 9 can be strengthened.

Workshop Outline

There are three parts to this workshop.

In the first session, **The Circle of (a teacher's) Life**, we explore how planning, tracking, assessment and reflections are related in an ongoing cycle. We explore different tools that can be used to assist in each stage of the teaching and learning process. This session is planned to take no more than 1 hour.

In the 2nd session, **Reflections on Basic Chemistry concepts**, we explore the power of reflection as a vehicle to improve content knowledge and skills. We use the Planners and Trackers to identify chains of concept development and show where these lead to in Grades 10 to 12. We also identify weak links in the chains of concept development andcompare these to common errors Grade 12 learners made in the November 2017 NSC exam. This session is planned to take about 2 hours.

The 3rd session of the workshops focuses on **Planning for Teaching Term 2 Chemistry in 2018.** We begin this session by exploring practical strategies to strengthen weak links in the chain of concept development and also look at ways to reduce common errors and misconceptions. We compare these to suggested improvement strategies found in the Diagnostic Report. One way of strengthening the process of learning is to focus on informal assessment. This is a critical part of the cycle of learning and will help us track the concept development process. In this session we design activities that will strengthen areas of weakness and try to eliminate misconceptions.

Reflection:

By the end of this workshop I would like to:

Jika iMfundo Workshop Programme		
	Description	**Resources**
Session 1 (1 hour)	**The Circle of (a teacher's) Life**	
30 min	Activity 1: Jig Saw on Planning Tools	Flip chart paper Markers ATP Trackers & Planners Diagnostic Report
30 min	Activity 2: Designing Cycles	
Session 2 (2 hours)	**Reflections on Basic Chemistry concepts**	
45 min	Activity 1: Identify key Chemistry concepts taught in Term 2	Coloured rectangular cards White card Prestik Pens / Markers
45 min	Activity 2: Building inter-related concept chains	Wool / String Tape Prestik Coloured rectangular cards White card Red markers
30 min	Activity 3: Examine common errors and misconceptions	Prestik Flip Chart Paper
Session 3 (2 hours)	**Planning for Teaching Acids & Bases 2018**	
45 min	Activity 1: Recommended Action Steps to build a solid foundation	
60 min	Activity 2: Informal Assessment Strategies	
15 min	Closure & Thanks	

Session 1: The Circle of (a teacher's) Life

Introduction

Science teachers are very familiar with the idea that life is full of cycles. We all know the steps of the water cycle and can explain the carbon or nitrogen cycle. But do we always recognise the different parts of a teaching cycle? The cycle or circle illustrated in this session is not by any means the only cycle but is a useful framework for integrating the Annual Teaching Plan (ATP), Planner and trackers, feedback and reflections from different sources including the National Senior Certificate Examinations Diagnostic Report written in November of the previous year, in our preparation for teaching different topics.

Activity 1 Jig Saw on Planning Tools 30 min

1. Discuss in groups of three what you understand is found in each of the documents listed below and suggest the purpose of each. **10 min**

   - **Annual Teaching Plan**

   - **Planner and Tracker**

   - **NSC Diagnostic Report**

2. **Form specialist groups** **10 min**

Each participant will be assigned to one document. We re-group and have all participants now focus on one of the documents. Use flip chart paper to collate all the ideas. Use different coloured pens to note the description and purpose.

3: **Presentations** **10 min**

Ask each group to display their flip chart paper. Stick the flip charts on different walls in the room. Each group must select one representative who stands next to the chart and discusses the group's ideas. Allow participants to move around the room and make suggestions / comments about each other's charts.

Ask participants to add answers that are displayed on the charts to suggested answers given in Appendix 1 on page 10

Activity 2 Designing Cycles **30 min**

Work in different groups of between 3 and 4 participants. 10 min

1. Draw a circular flow diagram on a sheet of flip chart paper to illustrate the process of teaching and learning. You may want to include the following activities:

   - Planning
   - Teaching
   - Reflection
   - Assessment

2. Show when you will use the three documents discussed in Activity 1 as well as any other resources. 10 min

Flow diagram that shows stages of cycle and resources used

3. What activities would take place at each step of the cycle? 10 min

Session 2: Reflections on Basic Chemistry concepts

Introduction

The focus in both Grade 8 and Grade 9 in Term 2 is on building a solid foundation in concepts of Chemistry. This will be important for learners who continue to study either Life Sciences or Physical Sciences in Grade 10 – 12. In this session we identify the critical concepts required and see how concepts are related to each other. We will also identify how these concepts are used in Physical Sciences in Grade 10 – 12 and reflect on areas in which Grade 12 learners struggle in their final exam.

Activity 1 Identify core chemistry concepts 45 min

Part 1 20 min

Refer to the Term 2 trackers and planners and identify 5 key concepts taught in Grade 8 or Grade 9. Take note of the Grade and week these concepts are taught in. Write down the name of a key concept on a sticky note.

Part 2 25 min

Place the card with the core concept written on it in the centre of the table. On different coloured card write down the building blocks linked to the key concept. Place the cards in the order you think they should be introduced. Build a concept chain using these cards and stick these on to the wall.

Planning of Concept Chain

Activity 2 Building inter-related concept chains 45 min

You need to work together as a large group. Take the chain of concept development and build a network of related concepts across the Senior phase. You need to link the building blocks to the Grades these concepts are taught in. The concept chains must not have repeated building blocks. Use pieces of string to join cards. Take a photo showing the network of concepts.

Activity 3 Examine common errors and misconceptions 30 min

Part 1 15 min

Refer to Activity 2 and identify the weak links in the conceptual chains.
Weak links are points where learners struggle and may be the source of misconceptions or common errors. Mark these using a red marker and make a list of these below:

Weak links in Concept Chain

Part 2 15 min

Refer to the National Diagnostic Report (2017) in Appendix 3 page 23 - 26.
Identify errors / misconceptions Grade 12 learners have in Chemistry.

Reflection Question

Are any of these errors / misconceptions related to the weak links you identified when looking at the concept chains for Grade 8 & 9 Chemistry?

Grade 12 errors linked to Grade 8 & 9 work

Session 3 Preparations for teaching Basic Chemistry in 2018

Activity 1 Recommended Actions Steps **45 min**

Part 1 30 min

Reflection on the common errors you have identified in the previous activity. Fill in a grid to show what strategies you could use to correct the common errors / misconceptions

Part 2 15 min

Compare your strategies for improvement to those mentioned in the **Diagnostic Report 2017: Physical Sciences Paper** found in Appendix 3, page 23 - 26

Question for reflection

What can Grade 8 & 9 teachers do to strengthen concept development and eliminate common errors?

Common Error / Misconception	Strategy to support improvement

Activity 2 Informal Assessment Strategies 60 min

Introduction

After implementing a new strategy to strengthen chains of concept development, you will need to assess if learners have changed their conceptions. Informal assessment can provide feedback to both teachers and learners about their progress.

Instructions

Work as group to design a series of informal assessment activities that a teacher can use to make sure the error and misconceptions are addressed in each of the grades and that the chain of conceptual development is strengthened.

Guidelines

- Reflect on the strategies you identified in Activity 1 of this session and include some of these.
- Take note of the cognitive demand of question used in your informal assessments and link this to the stage of concept development.
- Consider a range of activities including practical work.
- Consider language across the curriculum too

Notes on Informal Assessment Tasks

Notes on Informal Assessment Tasks

Closure & thanks 15 min

Please complete the questionnaire at the end of this manual on page 27.
Before you start writing review the expectations they wrote down at the beginning of the workshop.

Appendix 1

Session 1 Activity 1

Annual Teaching Plan

- A provincial plan on the sequence of teaching topics based on CAPS
- Provides guidelines on what needs to be taught and what assessments need to be completed during specified time frames.
- A document used to record progress of curriculum delivery

Planner and Tracker

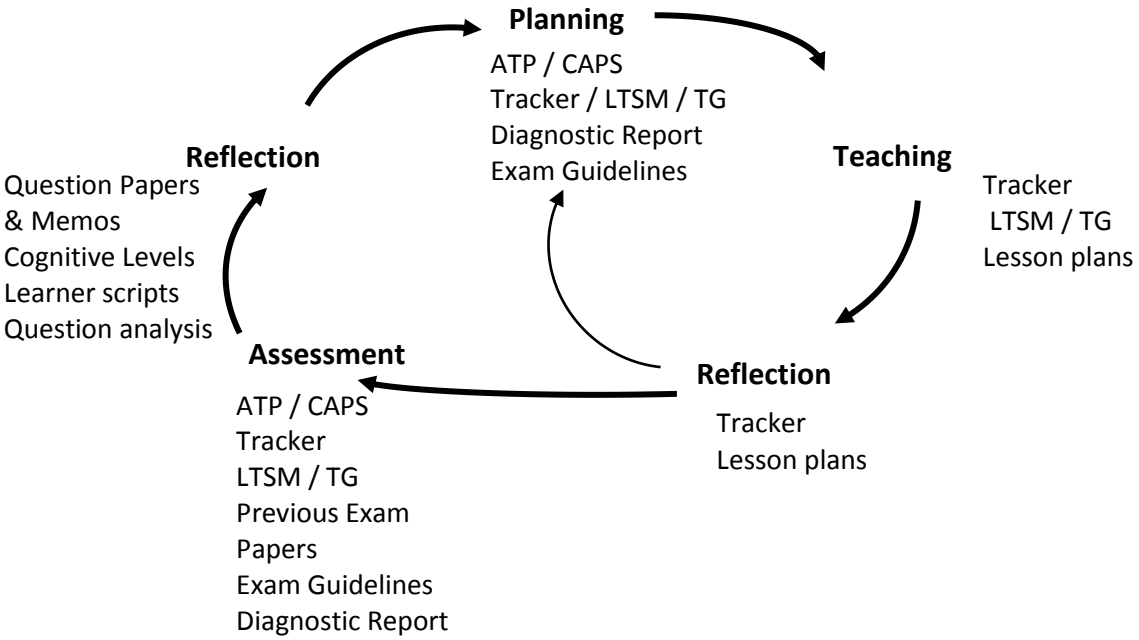
- A planning tool that links CAPS and approved Learners & Teachers Support Materials (LTSMs) to assist teachers, HODs and district specialists to measure curriculum coverage.
- A dynamic tool that encourages **authentic reflection** on weekly progress by teachers so that HODs and district specialists can improve support of teachers so that greater curriculum coverage is achieved.
- A tool that gives details on assessment task and provides alternative resources that can be used for assessment where there may be gaps in particular LTSMs.

NSC Diagnostic Report

- A summary of the NSC examination learner performance based on a sample of 100 learners scripts from each province that shows the trends in learner performance over multiple years.
- A detailed question by question analysis that highlights misconceptions, common errors and provides suggestions on how to remediate these for future Grade 12 learners.
- A tool aimed to improve learner performance in the future. Targets specific areas of weakness and seeks to remedy these by providing suggestions teachers should implement when teaching specific topics.

Session 1 Activity 2

Suggested answer that shows stages of cycle and resources used:



Part 3: Activities that teachers need to include in different stages of the cycle

Planning:

- Annual planning – consider diagnostic report and plan to include recommendations
- ATP / CAPS – review sequence of topics and assessment requirements
- Tracker / LTSM / TG – refer to activities for each lesson to develop lesson plans that need to include recommended learner activities.
- Create lesson plans & presentations
- Develop open & closed questions
- Plan for informal & formal assessments – theory & practical investigations
- Check new Exam Guidelines – make these available to learners
- Review tracker reflections from previous year's
- Review learner performance and plan remediation, revision and new assessment
- Revise lesson plans based on learner feedback

Teaching

- Implement lesson plans
- Engage learners in activities & by using questions
- Include practical activities
- Formative assessment activities
- Answer learner questions

Reflection

- Review tracker and record progress on curriculum coverage
- Answer reflection questions
- Discuss areas of concerns with HOD
- Suggest strategies to stay on track
- Evaluate learners progress in terms of areas highlighted in Diagnostic Report
- Reflect on learner responses after both formal and informal assessment

Assessment

- Check requirements for CAPS ATP using Tracker
- Check levels for informal assessments
- Use questions from previous exams for informal assessment to focus on areas in diagnostic report.
- Evaluate questions with respect to Exam Guidelines

Appendix 2

Grade 8 Term 2 Planner & Tracker

Week 1: Atomic structure								
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB Act.**	**TG pp.**	**SASOL/INZALO LB pp.**	**SASOL/INZALO TG pp.**	**Date completed**
1	Atoms are **building blocks of matter**; matter is made of tiny particles called atoms.	40	64		54-55	120	160	
2	Elements made of atoms of the same kind; elements cannot be broken down into other substances.	40	64		55-56	121	161	
Resources: textbooks and reference materials, video clips from the internet showing animations of atoms and molecules								
3	Atoms of one element differ from atoms of all other elements; all known elements are listed on the periodic table.	40	64-65	*	56	122	162-163	
4	Sub-atomic particles; atoms made of smaller particles (protons, neutrons, electrons); central region is the nucleus of positive protons and neutral neutrons.	40	66-67		56	123-124	163-165	
5	Making a drawing of an atom of one of first 20 elements of the periodic table.	40	67	Act. 1	56-58	126	167-169	
6	Making and describing a 2D model of an atom of one of first 20 elements of the periodic table.	40	67	Act. 1	56-57	126	167-169	
Resources: beads, dried lentils, peas, paper plates, glue								

WEEK 2: Pure substances and mixtures								
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB Act.**	**TG pp.**	**SASOL/INZALO LB pp.**	**SASOL/INZALO TG pp.**	**Date completed**
1	Elements and compounds are pure substances; an element is a material that consists of atoms of only one kind, such as hydrogen (H), oxygen (O).	41	68		57-58	127-128	170-171	
2	Some elements on the periodic table of elements form diatomic molecule; sometimes atoms react together chemically to form molecules of compounds; making models showing the atoms which make up molecules.	41	69	PA 1	58	129-131	172-174	
3	A compound is a material that consists of atoms of two or more different elements chemically bonded	41	70-71	Act. 2	58-59	132-138	174-183	

	together; the atoms in a given compound are always combined/bonded in a fixed ratio.							
4	Demonstrating and recording observations of how a compound can be broken down into elements by electrolysis.	41	72	PA 3	59	139-140	183-187	
Resources: copper chloride solution, 250 ml beaker, two connecting wires, graphite electrodes in a holder, a 4,5-6 V battery								
5	Demonstrating and recording observations of how a compound decomposes into elements by heating potassium permanganate ($KMnO_4$) to obtain oxygen.	41	73	PA 4	60	Not provided. See https://en.wikipedia.org/wiki/Potassium_permanganate		
Resources: potassium permanganate (solid), Bunsen burner, boiling tube, test tube holder, wooden splint, matches								
6	Mixtures of elements and compounds; elements and compounds are often found mixed together, such as in air, sea water, rocks, and in living things.	41	71	*		142-146 Revision pp.148-151	187-190 Revision pp.194-196	

Week 3: Particles in solids, liquids and gases; and diffusion

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB Act.	TG pp.	SASOL/INZALO LB pp.	SASOL/INZALO TG pp.	Date completed
1	The concept of the particle model of matter; atoms and molecules are referred to as particles in the particle model of matter.	42	74-75		60	152-153	198-202	
2	The particle model of matter is a scientific theory used to explain that all matter (solids, liquids and gases) is made up of particles.	42	75	Act. 1	61	153-154	198-204	
3	Drawing up a table comparing the particles of gases, liquids and solids.	42	75	Act. 2	62	159	209-220	
4	These particles are too small to see; the spaces between the particles are empty; drawing diagrams to represent particles in solids, liquids and gases.	42		*		155-158	205-208	
5	Diffusion is a process in which particles in liquids and gases move (separate and spread) from a highly-concentrated area to an area with a lower concentration of those particles; diffusion is faster in gases compared to liquids.	43	76	*	63	160	211	
6	Investigating diffusion in a liquid.	43	76-77	PA 1	63	160-161	211-212	
Resources: large glass jar, potassium permanganate, water								

Week 4: Diffusion and change of state								
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB Act.**	**TG pp.**	**SASOL/INZALO LB pp.**	**SASOL/INZALO TG pp.**	**Date completed**
1	Investigating diffusion in a gas.	43	77	PI 2	64	161-167	212-220	
Resources: ether or perfume or deodorant, measuring cylinder/large glass jar								
2	Investigating diffusion.	43	*			161-167	212-220	
Resources: gelatine, water, test tube or glass bottle, crystal of potassium permanganate								
3	**Drawing** diagrams to explain particles in three states, terms of arrangement, movement, forces and spacing using the particle model of matter.	43	*			167-168	220-221	
Resources: blocks of ice, water, glass bottle with lid								
4	Change of state; heating and cooling can cause a material to change state; solid material first changes to a liquid and then it changes to a gas on further heating.	43	78-79		65	167-168	220-221	
5	Investigating change of state by heating solid candle wax in an empty tin or small tin foil pie dish.	43	79	PA 1	65-66	169-170	223-224	
Resources: empty tins, spirit burners, foil pie dishes, tripod stands, gauze wire mats, candle wax, matches								
6	Ice can be heated to melt the ice and to make the water evaporate or boil.	43	*			169-170	223-224	
Resources: blocks of ice, old cups or styrofoam containers; blocks of ice, water, glass bottle with lid								

Week 5: Change of state and density in three states of matter								
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB Act.**	**TG pp.**	**SASOL/INZALO LB pp.**	**SASOL/INZALO TG pp.**	**Date completed**
1	**Formal Assessment Test.** Set your own Test							
2	Drawing diagrams to explain particles in three states, terms of arrangement, movement, forces and spacing using the particle model of matter.	43	*		*	170-174	225-227	
3	Density, mass and volume; the density of a material describes the amount of mass in a given volume of that material.	43	81	PA 1	67	175-189	229-245	
4	Density and states of matter; in general, gases are less dense than liquids which are less dense than solids.	43	81-82	PA 1	*	175-189	229-245	

5	Density of different materials; some materials have low density and some have high density; **comparing** the densities of different materials.	43	82-83	Act. 2 Act.3	67-68	175-189	229-245	
Resources: paper/plastic cups (of identical size) water, sand, flour								
6	Return and review tests with learners							

Week 6: Density and expansion and contraction

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB Act.	TG pp.	SASOL/INZALO LB pp.	SASOL/INZALO TG pp.	Date completed
1	A material which has lower density will float on a liquid which has higher density.	44	84-85			175-189	229-245	
2	**Mixing** oil and water to show that oil is less dense than water and therefore oil floats on the water; **drawing** diagrams to represent particles.	44	85	Act. 5	69	175-189	229-245	
Resources: water, cooking oil, beaker or other container								
3	**Reading** about pollution of water by oil.	44	85*	Act. 4	69	Not provided. See https://en.wikipedia.org/wiki/Oil_spill		
4	Comparing the densities of different materials. **Possible Formal Assessment**	44	97		77	175-189	229-245	
5	Expansion and contraction of materials; solids, liquids and gases tend to expand when heated and contract when cooled**.**	44	86-87		70-71	189-195	246-253	
6	As a material is heated it expands; as a material is cooled it contracts.	44	*		70-71	189-195	246-253	

Week 7: Expansion and contraction and pressure; reactants and products

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB Act.	TG pp.	SASOL/INZALO LB pp.	SASOL/INZALO TG pp.	Date completed
1	Use a metal ball and ring apparatus for demonstration of expansion of solids.	44	87	Act. 1*	71	192-193	249-250	
Resources: ball and ring apparatus, heating source								
2	**Drawing and explaining** how expansion and contraction takes place in terms of the particle model of matter.	44	87	Act. 1	71	189-195	246-253	
3	Pressure; a gas exerts a pressure because of the collisions of the particles with each other and against the sides of the container.	45	88	Act. 1	72	196-200	253-258	

4	Demonstrate what happens as we blow up a balloon or pump up a soccer ball or bicycle tyre using a hand pump; draw and write to explain why it becomes more difficult as we keep blowing/pumping.	45	89	Act. 2	73	196-200 Revision pp.205-207	253-258 Revision pp.264-265	
Resources: balloons, soccer ball, bicycle tyre, hand pump								
5	Reactants and products; substances can react with each other to form products with different chemical properties.	45	90-91		74	208-209	268-270	
6	**Investigating** the chemical reaction that takes place when a whole egg is placed in white vinegar; make drawings to show what was observed; show reactants (before) and products (after) the reaction has taken place.	45	91	PI 1	74-75	210-213	271-274	
Resources: white vinegar, egg, beaker								
Week 8: Reactants and products								
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB Act.**	**TG pp.**	**SASOL/INZALO LB pp.**	**SASOL/INZALO TG pp.**	**Date completed**
1	Investigating what happens when you blow with a drinking straw through clear limewater in a beaker/flask; make drawings to show what was observed; show reactants and products.	45	92	PI 2	75	217	271-274	
Resources: clear lime water, drinking straw, beaker								
2	Indigenous knowledge includes some examples of useful chemical reactions such as fermentation in brewing (which produces carbon dioxide and ethanol).	45	93*	*		214-216	276-280	
3	**Discussing/reading** about careers in inorganic and organic chemistry, mining, engineering, materials development and in the bio-fuels industry.	45	94-95	Act. 3	76	218-219	281-283	
4	**Discussing/reading** about careers in inorganic and organic chemistry, mining, engineering, materials development and in the bio-fuels industry.	45	94-95	Case study	76	218-219	281-290	
5-6	Revision See printable resources					Revision pp.221-223	Revision pp.286-288	

Grade 9 Term 2 Planner & Tracker

Top Class: Compounds								
Week 1: The periodic table and names of compounds								
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB Act.**	**TG pp.**	**SASOL/INZALO LB pp**	**SASOL/INZALO TG pp**	**Date completed**
1	**The periodic table;** the elements can be classified into metals, non-metals and semi metals; the elements found in groups have similar chemical properties.	63	85-90	WS 6.1 TG 138	39-41	151-153	206-215	
2	**Memorising** the name and the symbol of each of the first 20 elements, on the periodic table, as well as iron (Fe), copper (Cu), zinc (Zn).	63	87	Act. 6.1	40	154-159	215-219	
3	Each element on the periodic table has an atomic number, mass number, name and symbol; a formula is the ratio of the symbols of the elements and the number of atoms for each symbol in a compound.	63	85-87	*	40-41	146-147	199-201	
4	**Names of compounds;** many compounds are named according to their elements, such as sodium chloride (table salt) which is made of the elements sodium and chlorine; but others have common names such as water and ammonia.	63	88-89		40-41	148-149	203-204 / 215	
5	**Naming, writing** symbols, and **drawing** pictures **or making models** of several elements and compounds.	63	89	Act. 6.2	41-42	150-160	205-218	
Resources: beads, beans, lentils, glue, pins, toothpicks, sticky dots								
6	**Naming, writing** symbols, and **drawing** pictures **or making models** of several elements and compounds.	63	89	Act. 6.2	41-42	150-160	205-218	

Week 2: Chemical reactions								
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB Act.**	**TG pp.**	**SASOL/INZALO LB pp**	**SASOL/INZALO TG pp**	**Date completed**
1	**Chemical equations to represent reactions;** chemical reactions can be represented with models; chemical reactions are usually represented with symbols.	64	90-93		43	159-163	214-222	

2	N**aming, writing** symbols, and **drawing** pictures or **making models** of the chemical reactions.	64	94	Act. 7.1	44-46	159-165	214-223	
Resources: beads, beans, lentils, glue, pins, toothpicks, sticky dots								
3	**Naming, writing** symbols, and **drawing** pictures or **making models** of the chemical reactions.	64	94	Act. 7.1	44-46	165-172	222-228	
4	**Naming, writing** symbols, and **drawing** pictures or **making models** of the chemical reactions.	64	94	Act. 7.1	44-46	172-177	228-234	
5	**Balanced equations;** chemical equations must be written as balanced chemical equations; the total number and type of atoms of the reactants is the same as in the products.	64	95	Act. 7.1 *	44-46	177-182 Revision 168-170	234-240 Revision 225-227	
6	**Balanced equations.**	64	95	Revision	46	Revision 168-170	Revision 225-227	

Week 3: The reaction of metals with oxygen

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB Act.	TG pp.	SASOL/INZALO LB pp	SASOL/INZALO TG pp	Date completed
1	**The general reaction of metals with oxygen;** some metals react with oxygen during combustion; when a metal reacts with oxygen, a metal oxide is formed.	65	96-97		47-48	182	240	
2	**Reaction of iron with oxygen;** when the metal iron is burnt in air, the reaction forms iron oxide as a product.	65	96-97	Act. 8.1	48-49	182-186	240-245	
Resources: heat source, steel wool, matches, tongs or pliers, safety glasses								
3	Word equation: iron + oxygen---------- iron oxide; chemical equation: Fe + O_2 ----------Fe_2O_3 [unbalanced].	65	97	*	48-49	182-186 Revision 189-191	240-245	
4	**Reaction of magnesium with oxygen;** when the metal magnesium is burnt in air, the reaction forms magnesium oxide.	65	98	Act. 8.2	49-50	198-199	237-240	
Resources: heat source, steel wool, matches, tongs or pliers, safety glasses								
5	Word equation: magnesium + oxygen-------magnesium oxide; chemical equation: Mg + O_2 ----------MgO [unbalanced].	65	98	*	49-50 *	194-197	250-260	
6	**Formation of rust;** rusting is a slow chemical reaction of iron metal, with oxygen and moisture (water) to form a complex compound.	66	99		50	202-205	260-264	

Week 4: Rusting and the reactions of non-metals with oxygen								
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB Act.**	**TG pp.**	**SASOL/INZALO LB pp**	**SASOL/INZALO TG pp**	**Date completed**
1	Rust only occurs at the surface of the iron exposed to the air; steel (which consists mostly of iron) is an essential material in modern construction; equipment and structures can rust, and weaken.	66	99-100	Extra Act. 8.1 TG 133	50	202-205	260-264	
2	**Ways to prevent rusting;** iron and steel can be painted to keep away moisture and oxygen; iron and steel can be coated with a thin layer of chromium or zinc (metals which do not rust).	66	101	Revision	50-51	205-207 Revision 210-211	260-264 Revision 270-271	
3	**The general reaction of non-metals with oxygen;** non-metals react with oxygen to form non-metal oxides.	66	102	*	52	212-213	274-276	
4	**Reaction of carbon with oxygen;** when the non-metal carbon is burnt in oxygen, carbon dioxide is produced.	66	102	Extra Act. 9.1	54, 134	212	274	
5	**Naming, writing** symbols, and **drawing** pictures or **making models** of the chemical reactions.	66	103	Act. 9.1	52-54	214-216	276-279	
6	**Naming, writing** symbols, and **drawing** pictures or **making models** of the chemical reactions.	66	103	Act. 9.1	52-54	216-218	279-282	
Resources: beads, beans, lentils, glue, pins, toothpicks, sticky dots								

Week 5: Reactions of non-metals with oxygen; and acids, bases and pH								
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB Act.**	**TG pp.**	**SASOL/INZALO LB pp**	**SASOL/INZALO TG pp**	**Date completed**
1	Reactions of non-metals with oxygen.	66	105	Revision	54	Revision 221-223	Revision 285-286	
2	**The concept of pH value;** pH is a measure of how acidic or basic a substance is; the pH scale ranges from 1 to 14.	67	106		55	224-226	308-314	
3	Acids have a pH in the range of 1 to 7; bases have a pH in the range of 7 to 14; a neutral substance has a pH of 7.	67	106	*	55	227	294	
4	We use chemical indicators to tell us whether a substance is an acid, base or neutral; universal indicator has the ability to indicate the full range of pH values on the pH scale by colour changes.	67	107-108	*	55	227-230	294-296	
5	**Investigating** a selection of household substances to test whether they are acids, bases or neutrals using universal	67	109	Act. 10.1	56	230-236	296-307	

	indicator and at least one other indicator; record results on a table and draw conclusions (acid, base or neutral).							
Resources: universal indicator, red cabbage/red onion/turmeric/bromothymol blue or phenolphthalein, test tubes, test tube racks, glass containers, liquids such as tea/rooibos/coffee/milk/fruit juices/fizzy drinks, household substances such as vinegar/tartaric acid/lemon/soap/bicarbonate of soda/liquid soap								
6	**Formal Assessment Test** Set your own test							

Week 6: Acids, bases and pH value								
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS pp.**	**LB pp.**	**LB Act.**	**TG pp.**	**SASOL/INZALO LB pp**	**SASOL/INZALO TG pp**	**Date completed**
1	**Sequencing** substances according to the colour change of the universal indicator, from the most acidic to the most basic. **Possible Formal Assessment**	67	110	Act. 10.2	57	236-237	302-304	
2	**Acids, bases and pH.**	67	111	Revision	58	Revision 239-241	Revision 306-307	
3	**Neutralisation and pH;** acids and bases react together; we call this a neutralisation reaction; a base reacts with an acid, to make it less acidic/neutral; an acid reacts with a base, to make it less basic/neutral; acids commonly used in the laboratory include sulphuric acid and hydrochloric acid.	67	112-113	WS 11.1 TG 139	59-60	242-243	308-311	
4	**Investigating** neutralisation by reacting vinegar (acid) with bicarbonate of soda (base).	67	113	Act. 11.1	60	244-246	308-314	
Resources: beakers/glass jars, test tubes, vinegar, bicarbonate of soda, water, universal indicator								
5	**The general reaction of an acid with a metal oxide (base);** when metals react with *oxygen*, they tend to form oxides which are bases; bases (high pH) include metal oxides, metal hydroxides, metal carbonates.	67	114-115	Act. 11.2	61	253-255	325-328	
6	**Return and review tests with learners**							

Week 7: Reactions of acids with bases								
S #	**CAPS concepts, practical activities and assessment tasks**	**CAPS**	**LB pp.**	**LB Act.**	**TG pp.**	**SASOL/INZALO LB pp**	**SASOL/INZALO TG pp**	**Date completed**
1	Burning wood and fossil fuels releases carbon dioxide and sulfur dioxide into the atmosphere; **reading** about the causes and consequences of acid rain.	67	116-117	Act. 11.3	61-62	250-253	317-319	
2	**The general reaction of an acid with a metal hydroxide (base).**	68	118-120	Act. 11.4	62	260-266	328-333	
3	When any acid reacts with a metal hydroxide, the products	68	118-120	Act. 11.4	62	260-266	328-333	

	formed are *a salt* and *water.*							
4	The general equation is always: acid + metal hydroxide ---------- salt + water.	68	121	Act. 11.5	63	260-266	328-333	
5	The general equation is always: acid + metal hydroxide ---------- salt + water.	68	121	Act. 11.5 *	63	260-266	328-333	
6	**The general reaction of an acid with a metal carbonate (base);** metal carbonates are bases; when any acid reacts with a metal carbonate, the products formed are *a salt*, *carbon dioxide* and *water.*	69	122-123	Act. 11.6	63-64	266-273	333-340	

Week 8: Reactions of acids with bases

S #	CAPS concepts, practical activities and assessment tasks	CAPS pp.	LB pp.	LB Act.	TG pp.	SASOL/INZALO LB pp	SASOL/INZALO TG pp	Date completed
1	**investigating** neutralisation of metal carbonates by reacting chalk dust (calcium carbonate) with dilute hydrochloric acid (HCl).	69	122-123	Act. 11.6	63-64	266-273	333-340	
Resources: chalk dust, dilute hydrochloric acid, water, universal indicator, beakers, glass jars, test tube with stopper and delivery tube; lime water								
2	The general equation is always: acid + metal carbonate ---------- salt + carbon dioxide + water.	69	123	WS 11.1 TG 139 *	64	266-273	333-340	
3	**The general reaction of an acid with a metal carbonate (base).**	69	124	Revision	64-65	Revision 275-277	Revision 346-348	
4	**The general reaction of an acid with a metal;** when any acid reacts with a metal, the products formed are *a salt* and *hydrogen gas*; **investigating** reactions of acids with metals by reacting dilute hydrochloric acid (HCl) with magnesium; test for H_2 gas.	69	125-127	Act. 12.1	66-67	278-283	346-348	
Resources: magnesium, dilute hydrochloric acid; water, beakers/glass jars, test tubes, wooden splint, matches								
5	**Writing a summary** of the general chemical reactions, using words and chemical equations.	69	128	Act. 12.2 WS 12.1 TG 140	67-68	Revision 288-289	Revision 358-359	
6	Read about careers in the chemical industry; chemical reactions.	69 63-69	128-129 130	Act. 12.3 Revision	68 69	284-286	353-355	

Appendix 3

OVERVIEW OF LEARNER PERFORMANCE IN PAPER 2

General Comments

(a) The question on organic nomenclature (Q2) was answered the best by candidates. Performance in organic reactions (Q4) has improved compared to previous years.

(b) Performance in questions on reaction rate (Q5), chemical equilibrium (Q6) and electrolytic cells (Q9) was very poor.

(c) There was a steady improvement in performance in galvanic cells (Q8) over the years and the question on fertilisers (Q10) was answered much better than in previous years.

(d) Questions pertaining to pure recall of content were answered very poorly.

(e) Grade 11 work (Stoichiometry) is poorly understood. Grade 11 work should be included in classwork, homework and tests in Grade 12.

(f) Interpretation of graphs is a challenge for many learners.

(g) Some learners still cannot work with scientific formulae correctly.

Recommendations

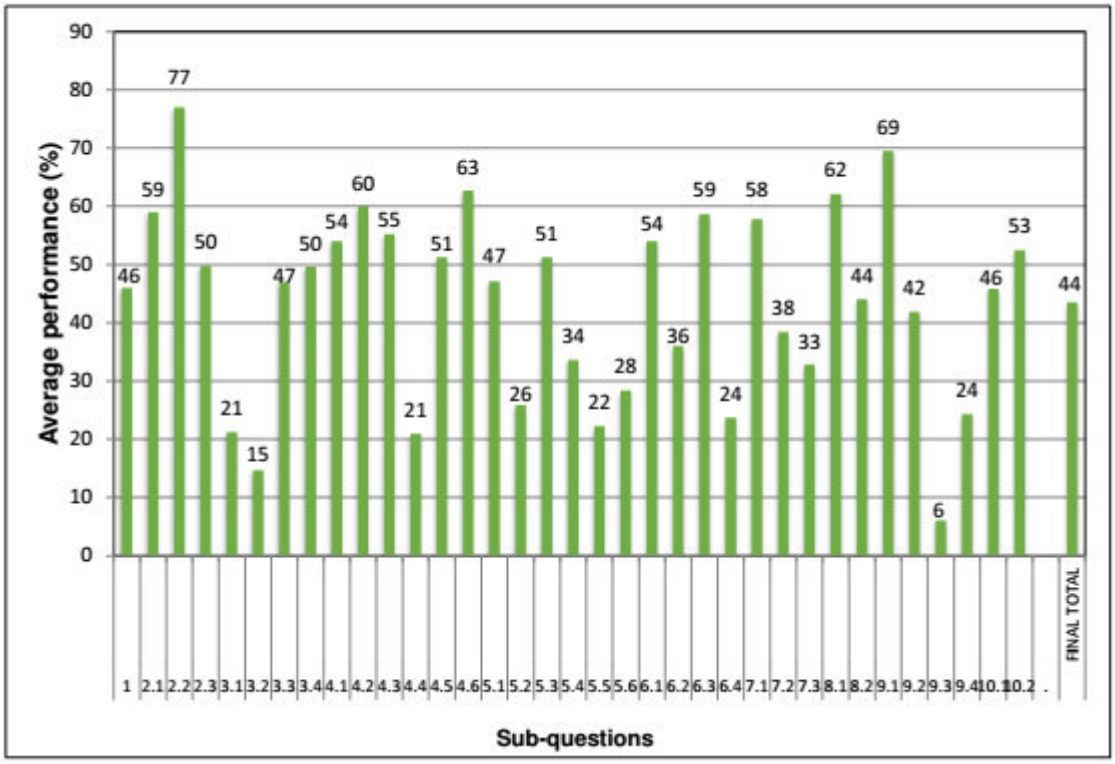
(a) Teachers are advised to use more short informal assessment tasks in order to reinforce basic concepts and principles, e.g. short speed tests (± 10 minutes). This can be used to good effect in content relating to definitions and laws listed in *CAPS* and the *Examination Guidelines*.

(b) Grade 11 work should be included in classwork, homework and tests in Grade 12.

(c) Problem-solving exercises that involve graphs should be done in a variety of topics. The scale of graphs, gradient, ordered-pairs and x and y-intercepts need to be emphasised within problem solving in science contexts.

(d) Teachers should emphasise the use of the relevant formula provided on the formula sheet, correct substitution and providing the answer with the correct unit and direction, if required.

Graph 11.6.2 Average marks per sub question expressed as a percentage: Paper 2



QUESTION 1: MULTIPLE Choice Questions

Common errors and misconceptions

(a) In Q1.3, candidates failed to understand that after the cracking process, the number of atoms of hydrogen and carbon remains the same.

(d) In Q1.7, candidates could not identify the given compounds as either acid or base. Na_2CO_3 was the only base given and therefore had the highest pH. The highest pH was incorrectly associated with the strongest acid.

(e) In Q1.9, candidates were not familiar with the products of the electrolysis of NaCℓ and as a result they expected sodium to be part of the products.

Suggestions for improvement

QUESTION 1: MULTIPLE Choice Questions

(c) Electrolytic cells need more attention in class. Learners have a poor understanding due to too little time spent on this topic in most schools. Learners should be supplied with summaries on electrolytic cells and then guided on how to study and distinguish among the different electrolytic cells prescribed.

QUESTION 3: PHYSICAL PROPERTIES OF ORGANIC COMPOUNDS

Common errors and misconceptions

(b) Candidates experienced difficulty to provide a definition of vapour pressure in Q3.2.

(c) Interpretation of the graph in Q3.3.2 was a challenge for many candidates. They failed to see that the boiling points of the compounds are the temperatures at which each of the graphs cuts the dotted line which represents atmospheric pressure.

(d) In Q3.3.3, many learners failed to refer to the variables (labels on the axes of the graph) in their explanations. Most learners failed to compare the vapour pressures of the four compounds at a particular temperature.

Suggestions for improvement

(b) Ensure that learners understand the meaning of a particular definition. For example, the definition of vapour pressure is about the pressure exerted by a vapour in equilibrium with its liquid phase (liquid ⇌ vapour) in a closed system.

(c) When using a graph to answer a particular question, learners should be taught to refer to the variables.

QUESTION 5: REACTION RATE

Common errors and misconceptions

(a) The definition of reaction rate in Q5.1 is still a challenge to many candidates.

(b) In Q5.2, many candidates failed to identify the dependent and independent variables correctly.

(f) A poor understanding of the use of the collision theory to explain why the rate in experiment III is higher in Q5.6 was evident.

Suggestions for improvement

(a) When stating a definition that can be expressed as a mathematical equation, learners should be taught to define in terms of the quantities in the expression. For example, reaction rate has the unit of concentration per second/volume per second/moles per second/mass per second.

(b) When stating an investigative question, learners should be taught that when the answer to the question can be 'YES' or 'NO', the question does not ask for a relationship between the variables. The best way to formulate an investigative question, after identification of the dependent and independent variables, is to start with ‘What is the relationship between ...’.

(c) Learners should get more exposure to reading, interpretation as well as drawing of graphs.

QUESTION 8: GALVANIC CELLS

Common errors and misconceptions

(c) Common errors in Q8.1.4 were: Failing to copy the correct equation from the formula sheet; swapping the reduction potential of the anode with that of the cathode when substituting; substituting the reduction potential of the Aℓ half-reaction as a positive value instead of -1,66 V and omitting / providing the unit at the final answer.

Suggestions for improvement

(b) Ensure that learners use formulae on the formula sheet. This will prevent the use of an incorrect formula for the calculation of the cell potential.

QUESTION 10: FERTILISERS

Common errors and misconceptions

(a) In Q10.1.1 many candidates wrote the formula instead of the name.

(b) In Q10.1.2 many candidates wrote NO_3 instead of NO_2 as the formula of the gas.

(c) In Q10.1.3 most candidates did not know that the name of the process

(d) In Q10.1.4 most candidates did not know the catalyst used in the catalytic oxidation of ammonia

(e) In Q10.1.7 many candidates wrote the incorrect formula for ammonium nitrate.

Suggestions for improvement

(a) Teachers should provide learners with more flow diagrams of the processes to practice.