SECTION 3

PHYSICAL SCIENCES CONTENT (GRADES 10 –12)

TERM 1 GRADE 10

GRADE 10 CHEMISTRY *(MATTER & MATERIALS)* TERM 1					
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
2 HOURS	**Revise Matter & classification (from grade 9)**	Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.			Observing, describing, classifying and using materials – a macroscopic view (do this in detail in grade 9 if possible)
0.25 hour	The material(s) of which an object is composed.	• Revise the properties of material, e.g. 1. Strength 2. Thermal and electrical conductivity 3. Brittle , malleable or ductile 4. Magnetic or non-magnetic 5. Density (lead / aluminium) 6. Melting points and boiling points	**Activity:** If you have a sand dune the material out of which the dune is made is sand. (1) Look at the labels on the containers of food or on medicine bottles, or the wrapper of chocolate. Note the ingredients of the material in the container. What do the different compounds tell you about the material in the container? Why do the manufacturers give the ingredients of the material? Use safety data to learn about the compounds contained in your food and medicines.	An activity that classifies a range of materials and combines all these properties could be useful to revise the content	The introduction of the topic was moved to grade 9 and is **only revised in grade 10** Learners are encouraged to look at food additives and preservatives. This should be contrasted with indigenous ways of food preservation.
0.25 hour	Mixtures: heterogeneous and homogeneous.	• Revise the properties of a mixture: • Revise the properties of a heterogeneous mixture. • Revise the	• Make mixtures of sand and water, potassium dichromate and water, iodine and ethanol, iodine and water. Which mixtures are heterogeneous and which mixtures are homogeneous? • Let learners make their own homogeneous and heterogeneous mixtures and motivate or defend their choices.		

		properties of a homogeneous mixture. • Give examples of heterogeneous and homogeneous mixtures.			

Time	Topics Grade 10	Content, Concepts & Skills	Practical Activities	Resource Material	Guidelines for Teachers
0.25 Hour	Pure substances: elements and compounds.	• Revise the microscopic and symbolic representations for elements, compounds and mixtures. • Revise the definition of an element. • Revise the definition of a compound. • Revise the definition of pure substances • Revise the classification of substances as pure, as compounds or as elements. • Devise criteria for purity. Use melting point and boiling points as evidence of purity. Use chromatography as evidence of purity.	• Decide which of the following substances are pure substances: water, tea, salt water, copper, brass, air, oxygen. • Use molecular models to build pure substances, elements and compounds (motivate your answer). **Activity:** • Do experiment with paper chromatography to show that water soluble ink-pens or "Smarties" are not pure colours, but are mixtures of colours.	Use the periodic table to identify the elements. Test tubes, glass beaker, filter paper and water soluble ink-pens.	
0.25 hour	Names and formulae of substances.	• Revise the names of compounds using the names of the elements from which they are made. • Revise the cat ion and anion table • Revise the writing of names when given the formulae. • Revise the writing of formulae when given the names. • Revise the meaning of the name endings like –ide, -ite and –ate • Understand the meaning of prefixes di-, tri- etc.	**Activity:** • Why do we have scientific language? • Identify the elements that make up a compound on the food labels collected by the learners. • Compare the scientific names with traditional names for compounds known by learners.		Indicate the relationship between names and chemical formulae and chemical bonding to learners. Pay attention to the names of covalent compounds and the names of ionic compounds.
0.25 hour	Metals, metalloids and non-metals.	• Revise the classification of substances as metals using their properties • Identify the metals, their position on the periodic table and their number in comparison to the number of non-metals • Revise the classification of non-metals using their properties • Identify the non-metals and their position on the periodic table • Describe metalloids as having mainly non-metallic properties	• Identify the metals, non-metals and metalloids on the periodic table. • Test copper, lead, aluminium, zinc, iron, sulphur, carbon, iodine, graphite and silicon to determine whether they have metallic, metalloid or non-metallic character. How are these elements used in industry?		Metalloid is the more scientific name for semi-metal. Give preference to the use of the name metalloids, but do not penalize learners for the use of the name semi-metals.

		• Revise the classification of metalloids by their characteristic property of increasing conductivity with increasing temperature (the reverse of metals) e.g. silicon and graphite. • Identify the metalloids and their position on the periodic table			
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
0.25 hours	Electrical conductors, semiconductors and insulators.	• Revise the classification of materials as: electrical conductors, semiconductors and insulators • Give examples of electrical conductors, semiconductors and insulators • Identify the substances and the 'appliances or objects', that are in common daily use in homes and offices, that are specifically chosen because of their electrical properties (conductors, insulators and semi-conductors)	• Test the following substance to classify them as conductors, semiconductors or insulators: glass, wood, graphite, copper, zinc, aluminium and materials of your own choice.		
0.25 hours	Thermal conductors and insulators	• Revise how to test and classify materials as: thermal conductors and insulators • Give examples of materials that are thermal conductors and insulators	• Test the following substance to classify them as heat conductors, or insulators: glass, wood, graphite, copper, zinc, aluminium and materials of your own choice.		
0.25 hours	Magnetic and nonmagnetic materials.	• Revise how to test and classify materials as magnetic and non-magnetic. • Give examples of materials that are magnetic and non-magnetic. • Give examples of the use we make of magnets in daily life (in speakers, in telephones, electric motors, as compasses, ..)	• Test the following substance to classify them as magnetic, or nonmagnetic: glass, wood, graphite, copper, zinc, aluminium, iron nail and materials of your own choice.		
2 HOURS	**States of Matter and the Kinetic Molecular Theory**	Physical state is only one of the ways of classifying matter. The Kinetic-molecular theory and intermolecular forces are the basis for solid, liquid, gas and solution phenomena.			Revision of matter and states of matter is the bigger picture.

1 hour	Three states of matter	• Verify the particulate nature of matter by investigating diffusion and Brownian motion. • List and characterize the three states of matter • Define freezing point, melting point and boiling point. • Identify the physical state of a substance at a specific temperature, given the melting point and the boiling point of the substance • Define melting, evaporation, freezing, sublimation and condensation as changes in state • Demonstrate these changes of state.	**<u>Prescribed experiment for formal assessment</u>** • Start with ice in a glass beaker and use a thermometer to read the temperature every 10 seconds when you determine the heating curve of water. Do the same with the cooling curve of water starting at the boiling point. Give your results on a graph.	**Materials:** Burner, glass beaker, ice water and a thermometer.	An activity that classifies a variety of compounds and combines all these properties, including KMT, could be useful to revise the content.
1 hour	Kinetic Molecular Theory	• Describe a solid, a liquid, and a gas according to the Kinetic Molecular Theory in terms of particles of matter.			

Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
4 HOURS	**<u>The Atom: basic building block of all matter</u>** **(Atomic structure)**	All matter is made up of atoms. Everything around you, including your own body, your hair, your organs and even the air you breathe is made up of atoms. Atomic theory is the foundation for understanding the interactions and changes in matter. The periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure. Everything in the world is made up of different combinations of atoms from the elements on the periodic table.			Visualization is very important in Chemistry to demystify the subject and make it easier to understand.
0.5 hour	Models of the atom.	Given a list of key discoveries (or hypotheses) match these to the description of the atom that followed the discovery. Be able to do this for the period starting with the Greek suggestion that atoms constituted matter, through the electrical experiments of the 19^{th} century, to the discovery of radioactivity, Rutherford's gold foil experiment and the Bohr model.	**Activity:** (1) Make a list of key discoveries about atomic structure. Do this as a library assignment. Look at work from JJ Thomson, Ernest Rutherford, Marie Curie, JC Maxwell, Max Planck, Albert Einstein, Niels Bohr, Lucretius, LV De Broglie, CJ Davisson, LH Germer, Chadwick, Werner Heisenberg, Max Born, Erwin Schrödinger, John Dalton, Empedocles, Leucippus, Democritus,		<u>Note to the teacher</u>: This type of activity (1) should be used to introduce or practice report writing and/or presentation skills. This topic could also be used as a cooperative learning activity. You don't need information on all the names mentioned: you can

		• Identify five major contributions to the current atomic model used today. • What is the purpose of a model of the atomic structure?	Epicurus, Zosimos, Maria the Jewess, Geber, Rhazes, Robert Boyle, Henry Cavendish, A Lavoisier, H Becquerel State the key discovery in ONE sentence and match the discovery to the influence on the description of the atom. (2) The class can make a flow chart on the discoveries or construct a time line to display the discoveries.		choose the names of the scientists you want information on. Make a list of key discoveries and discoverers (this is NOT for rote learning in exams. This is an activity and **NOT FOR EXAM PURPOSES**, but just for literature study as an activity. It gives learners a real life experience of the construction of knowledge over time.)
0.5 hour	Atomic mass and diameter.	• Give a rough estimate of the mass and diameter of an atom • Show that the atom is mainly an empty space with the nucleus occupying a very small space in any atom (explain the α-particle scattering experiment). • Describe and use the concept of relative atomic mass	**Activity:** (1) Note the correct use of scientific notation and the meaning of the values obtained when giving atomic mass or atomic radius. (2) Use analogies to show how small the nucleus is compared to the atom.		Simulate the α-particle scattering experiment with a nucleus of marbles (glued together) and BB gun pellets as electrons and shoot with marbles as α-particles.
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
1 hour	Structure of the atom: protons, neutrons, electrons.	• Given a **periodic table** or suitable data Define the atomic number of an element and give its value. Give the number of protons present in an atom of an element Give the number of electrons present in a neutral atom Show that by removing electrons from an atom the neutrality of the atom is changed Determine charge after removing electrons from the atom. Calculate the number of neutrons present Calculate the mass number for an isotope of an element	**Activities:** (1) Use the PT to make a Science puzzle to clarify and strengthen concepts (2) Describe the structure of the atom in terms of protons, neutrons and electrons. Make a drawing to show your interpretation of the structure of an atom.	PT must have values with at least one decimal point.	**Note:** The Periodic Table has been introduced superficially in grade 9 and can be used as such in atomic structure. Deeper study on the PT is done in term 2.
1 hour	Isotope	• Explain the term isotope	**Activities:**		

		• Calculate the relative atomic mass of naturally occurring elements from the percentage of each isotope in a sample of the naturally occurring element and the relative atomic mass of each of the isotopes. • Represent atoms (nuclides) using the notation $^{A}_{Z}E$.	(1) Identify isotopes among elements with relevant information (2) Perform calculations related to isotopic masses and relative atomic masses		Do simple calculations to improve learners understanding of the concept isotopes. Z = atomic number and A = mass number
1 hour	Electron configuration.	• Give electronic arrangement of atoms (up to Z=20) according to the orbital box diagrams (notation, (↑↓)) and the spectroscopic electron configuration notation ($1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$, $4s^2$) (sometimes called Aufbau principle) • Describe atomic orbitals and the shapes of the s-orbitals and the p-orbitals. • Sate Hund's rule and Pauli's Exclusion Principle.	**Activities:** (1) Understand and deduce the electronic arrangement of atoms. (2) Represent the electronic arrangements of atoms using electron diagrams. **<u>Recommended experiment for informal assessment</u>** (3) Flame tests to identify some metal cations and metals.	**Materials** Watch glass, burner, propette, methanol, bamboo sticks, metal salts to be tested including NaCl, $CuCl_2$, $CaCl_2$, KCl and metals copper powder, magnesium, zinc powder, iron powder etc.	Energy is seen as the energy of the electron in ground state and excited state. The Aufbau principle (building-up principle) is the principle that the orbital that fills first is the orbital with the lowest energy. In atoms the order for filling of orbitals is 1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p……electronic structure. (Aufbau is German for building-up.)

Time	Topics Grade 10	Content, Concepts & Skills	Practical Activities	Resource Material	Guidelines for Teachers
4 HOURS	**<u>Periodic Table</u>**	The periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure. Student should develop an understanding about the importance of the periodic table in Chemistry. Knowledge and concepts about periodic trends of physical properties of some elements are required.		The atomic properties of an element are related to its electronic configuration and hence to its position on the periodic table.	
2 HOURS	The position of the elements in the periodic table related to their electronic arrangements	• Understand that elements in the PT are arranged in order of ascending atomic number • Appreciate the PT as a systematic way to arrange elements • Define the group number and the period number of an element in the PT • Relate the position of an element in the PT to its electronic structure and vice versa • Understand periodicity by looking at the following properties from the elements Li to Ar: density, melting points and boiling points, atomic radius, periodicity in formulae of halides, periodicity in formulae of oxides, and ionization energy. • What is the influence of periodicity on electron-affinity and electronegativity? • Define atomic radius, ionization energy, electron-affinity and electronegativity	**Activities:** (1) Use the PT to make a Science puzzle to clarify and strengthen concepts **(2)** Searching for and presenting information on elements and the development of the PT **(3)** Pack your own PT and discover the missing elements. The concepts you are investigating are periodicity, predicting properties, groups, and periods. Get paint colour samples from a hardware store. Use an empty PT grid to pack your colour chips according to the following rules: Basic colour represents chemical properties; the shade of the paint chip represents atomic mass; similar intensities of shade are in the same period. Sequence metals to non metals according to the colours of the visible spectrum from red to violet. Remove a few paint chips and pack the periodic table again. Can you describe the properties of the missing chip (elements)?	**Information for Periodic Table activity:** On you colour cards for the PT you can also add information like density, melting point, boiling point, heat conductivity, physical appearance, reaction with oxygen, reaction with water, etc.	How the periodic table is organized is not as important as what information can be derived from the PT. Information like bonding, valency, orbitals, electronic structure. This section is crucial as it provides the basis for conceptual understanding of bonding. Teachers should ensure that learners understand the structure of the PT and not only know how to use it. Enough time must be spent on this NB!!
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
2 HOURS	Similarities in chemical properties among elements in Groups 1, 2, 17 and 18	• Relate the electronic arrangements to the chemical properties of group 1, 2, 17 and 18 elements. • Describe the differences in			

		reactivity of group 1, 2 and 17 elements, • Predict chemical properties of unfamiliar elements in groups 1, 2, 17 and 18 of the PT. • Indicate where metals are to be found on the periodic table. • Indicate where nonmetals are to be found on the periodic table. • Indicate where transition metals are to be found on the periodic table.			
4 HOURS	**<u>Chemical bonding</u>**	Interactions between matter generate substances with new physical and chemical properties.			
4 HOURS	Covalent bonding, ionic bonding and metallic bonding	• Draw Lewis dot diagrams of elements. • **Covalent bonding**: sharing of electrons in the formation of covalent bond single, double and triple bonds. electron diagrams of simple covalent molecules, names and formulae of covalent compounds • **Ionic bonding:** transfer of electrons in the formation of ionic bonding, cations and anions electron diagrams of simple ionic compounds ionic structure as illustrated by sodium chloride • **Metallic bonding** Sharing a delocalized electron cloud among positive nuclei in the metal. • Revise the cation and the anion table done in grade 9. • Revise the names of	**Activities:** (1) Describe and draw the formation of a covalent bond (2) Describe, using electron diagrams, the formation of single, double and triple bonds. (3) Write the names and formulae of covalent compounds in terms of the elements present and the ratio of their atoms (4) Describe, using electron diagrams, the formation of ions and ionic bonds (5) Draw the electron diagrams of cations and anions (6) Predict the ions formed by atoms of metals and non-metals by using information in the PT. (7) Name ionic compounds based on the component ions (8) Describe the structure of an ionic crystal (9) Describe the simple model of metallic bonding	Ionic crystal lattices can be made with polystyrene balls and skewer sticks and displayed in the classroom	You need to have an explanation of chemical bonding before you describe molecular substances and ionic substances. Ensure that the correct terminology is used here, e.g. ionic substances do not form *molecules* **Electron diagrams refer to Lewis dot diagrams for elements.** **Under Chemical Bonding here <u>only the definitions</u> of covalent bonding, ionic bonding and metallic bonding are done.** On page 25 the applications or the effect of this kind of bonding is done. Given 4 hours, but 2 hours would also be enough

		compounds. • Revise relative molecular mass for covalent molecules. • Revise relative formula mass for ionic compounds.			

GRADE 10 PHYSICS *(WAVES, SOUND & LIGHT)* TERM 1					
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
4 HOURS	**Transverse pulses on a string or spring**				
2 HOURS	Pulse, amplitude	• Define a pulse • Define a transverse pulse • Amplitude • Define amplitude as maximum disturbance of a particle from its rest (equilibrium) position • Know that for a transverse pulse the particles of the medium move at right angles to the direction of propagation of the pulse.	Practical Demonstration: Let learners observe the motion of a single pulse travelling along a long, soft spring or a heavy rope.	**Materials:** Slinky spring, rope	Sometimes learners are taught about waves without ever learning about pulses. A pulse is a single disturbance. It has an amplitude and pulse length, but no frequency, since it only happens once.
2 HOURS	Superposition of Pulses	• Explain that superposition is the addition of the amplitudes of two pulses that occupy the same space at the same time • Define constructive interference • Define destructive interference • Explain (using diagrams) how two pulses that reach the same point in the same medium superpose constructively and destructively and then continue in the original direction of motion • Apply the principle of superposition to pulses	**Recommended experiment for informal assessment:** Use a ripple tank to demonstrate constructive and destructive interference of two pulses.	**Materials:** Ripple tank apparatus.	

Time	Topics Grade 10	Content, Concepts & Skills	Practical Activities	Resource Material	Guidelines for Teachers
2 HOURS	**Transverse waves**				
2 HOURS	Wavelength, frequency, amplitude, period, wave speed;	• Define a transverse wave as a succession of transverse pulses. • Define wavelength, frequency, period, crest and trough of a wave. • Explain the wave concepts: in phase and out of phase. • Identify the wavelength, amplitude, crests, troughs, points in phase and points out of phase on a drawing of a transverse wave. • Know the relationship between frequency and period, i.e. f = 1/T and T = 1/f. • Define wave speed as the product of the frequency and wavelength of a wave: $v = f\lambda$ • Use the speed equation, $v = f\lambda$, to solve problems involving waves.			For a wave the distance travelled in one period is one wavelength, and frequency is 1/period.
4 HOURS	**Longitudinal waves:**				
1 HOUR	On a spring	• Generate a longitudinal wave in a spring • Draw a diagram to represent a longitudinal wave in a spring, showing the direction of motion of the wave relative to the direction in which the particles move	**Practical Demonstration:** Generate a longitudinal wave in a spring.	**Materials:** Slinky spring	

Time	Topics Grade 10	Content, Concepts & Skills	Practical Activities	Resource Material	Guidelines for Teachers
2 HOURS	Wavelength, frequency, amplitude, period, wave speed.	• Define the wavelength and amplitude of a longitudinal wave • Define compression and rarefaction • Define the period and frequency of a longitudinal wave and the relationship between the two quantities. $f=\frac{1}{T}$ • Use the equation for wave speed, $v = f\lambda$ to solve problems involving longitudinal waves.			
1 HOUR	Sound waves	• Explain that sound waves are created by vibrations in a medium in the direction of propagation. The vibrations cause a regular variation in pressure in the medium. • Describe a sound wave as a longitudinal wave • Explain the relationship between wave speed and the properties of the medium in which the wave travels (gas, liquid or solid)	**Practical Demonstration:** How to make sound using a vuvuzela. **Practical Activity (Project):** Making a string (or wire) telephone	**Materials:** Vuvuzela **Materials:** Two 340ml drink cans, 2 nails, string or copper wire (not too thick)	Learners should understand that sounds waves are pressure waves. For this reason, the more closely spaced the molecules of the medium, the faster the wave travels. That is why sound travels faster in water than in air and faster in steel than in water.
2 HOURS	**Sound**				
1 HOUR	Pitch, loudness, quality (tone)	• Relate the pitch of a sound to the frequency of a sound wave • Relate the loudness of a sound to both the amplitude of a sound wave and the sensitivity of the human ear	**Practical Activity:** 1. Compare the sounds made by blowing on different vuvuzelas of different sizes. 2. Compare the sounds made by blowing on a vuvuzela versus the sounds produced by a flute. 3. Use a function generator to produce sounds of different	**For 1 and 2:** Vuvuzelas of different sizes, flutes Or Tuning forks Or Vuvuzelas, flutes, microphone,	The human ear is more sensitive to some frequencies than to others. Loudness thus depends on both the amplitude of a sound wave and its frequency (whether it lies in a region where the ear is more or less sensitive).

			frequencies and amplitudes and use the oscilloscope to display the different characteristics of the sounds that are produced.	oscilloscope, loudspeaker, cables. **For 3:** Oscilloscope, function generator, loud- speaker, cables.	
TIME	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
1 HOUR	Ultrasound	• Describe sound with frequencies higher than 20 kHz as ultrasound, up to about 100 kHz. • Explain how an image can be created using ultrasound based on the fact that when a wave encounters a boundary between two media, part of the wave is reflected, part is absorbed and part is transmitted. • Describe some of the medical benefits and uses of ultrasound, e.g. safety, diagnosis, treatment, pregnancy			When an ultrasound wave travels inside an object comprising different materials such as the human body, each time it encounters a boundary, e.g. between bone and muscle, or muscle and fat, part of the wave is reflected and part of it is transmitted. The reflected rays are detected and used to construct an image of the object.
4 HOURS	**Electromagnetic Radiation**				
0.5 HOUR	Dual (particle/wave) nature of EM radiation	• Explain that some aspects of the behaviour of EM radiation can best be explained using a wave model and some aspects can best be explained using a particle model.			This is also known as the wave-particle duality.
1 HOUR	Nature of EM radiation	• Describe the source of electromagnetic waves as an accelerating charge • Use words and diagrams to explain how an EM wave propagates when an electric field oscillating in one plane produces a magnetic field oscillating in a plane at right angles to it, which produces an oscillating electric field, and so on. • State that these mutually regenerating			Mention that unlike sound waves, EM waves do not need a medium to travel through.

		fields travel through space at a constant speed of $3x10^8$m/s, represented by c. Application exercises on cognitive levels 1 to 3. Refer Physical Sciences Assessment Taxonomy (Appendix 1 in this document).			
TIME	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
1 HOUR	EM spectrum	• Given a list of different types of EM radiation, arrange them in order of frequency or wavelength. • Given the wavelength of EM waves, calculate the frequency and vice versa, using the equation: $c = f\lambda$ • Give an example of the use of each type of EM radiation, i.e. gamma rays, X-rays, ultraviolet light, visible light, infrared, microwave and radio and TV waves. • Indicate the penetrating ability of the different kinds of EM radiation and relate it to energy of the radiation. • Describe the dangers of gamma rays, X-rays and the damaging effect of ultra-violet radiation on skin • Discuss radiation from cell-phones			
1 HOUR	Nature of EM as particle – energy of a photon related to frequency and Wavelength	• Define a photon • Calculate the energy of a photon using $E = hf = \frac{hc}{\lambda}$ Where h = 6.63 $x10^{-34}$ J.s is Planck's constant, c=$3x10^8$ $m.s^{-1}$ is the speed of light in a vacuum and λ is the wavelength.			

		Application exercises on cognitive levels 1 to 3. Refer Physical Sciences Assessment Taxonomy (Appendix 1 in this document).			
0.5 HOUR	**INDIGENOUS KNOWLEDGE SYSTEMS**				
0.5 HOUR	Detection of waves associated with natural disasters	• **Indigenous knowledge systems (IKS)** Discuss qualitatively animal behavior related to natural disasters across at most two different cultural groups and within current scientific studies.			**IKS** Discuss legends and folklores about animal behaviour related to natural disasters using any one of the following: earthquakes, tsunamis or floods.

ASSESSMENT TERM 1	**TERM 1:Recommended Formal Assessment** [1] Experiment (Chemistry): Heating and cooling curve of water. [2] Control Test

GRADE 10 CHEMISTRY *(MATTER AND MATERIALS)* TERM 2					
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
8 HOURS	<u>**Particles substances are made of**</u>	Matter is described as anything that has mass and occupies space. All matter is made up of atoms. Atoms can combine to form compounds: molecular compounds (molecules) or ionic compounds (salts) or metals (copper or iron or …)			Describe matter from the concepts: atoms, elements, compounds, chemical reactions.
8 HOURS	Atoms and compounds. • Molecules (molecular substances) are due to covalent bonding. • Ionic substances are due to ionic bonding. (The APPLICATIONS or EFFECT of the different types of chemical bonding are emphasized here.)	• Describe atoms as the very small particles of which all substances are made. • State that the only substances found in atomic form are the noble gases at ambient conditions. • Describe a COMPOUND as a group of two or more atoms that are attracted to each other by relatively strong forces or bonds. The atoms are combined in definite proportions. • When atoms **share electrons** they are bonded covalently and the resulting collection of atoms are called a molecule. As a general rule molecular substances are almost always composed of nonmetallic elements. • When the **electrons of atoms are transferred** from one atom to another atom to form positive and negative ions, the ions bond with ionic bonds and the resulting solid is called an ionic substance (or salt or ionic compound). As a general rule ionic substances are usually composed of both metallic elements (usually forming positive ions) and nonmetallic elements (usually forming negative ions) • When metal atoms lose their outer electrons to form a lattice of regularly spaced positive ions and the outer electrons form a delocalized "pool" of electrons that surround the positive ions, the atoms are bonded by metallic bonding and the resulting collection of atoms is called a metal.	**Experiment:** (1) Elements and compounds investigated by doing experiments. (2) The electrolysis of water (sodium sulphate added) to give products. Identify the elements and the compounds. **Demonstration:** (1) Use "Jelly Tots" and tooth picks or play dough to make visual presentations of atoms, molecules, compounds, elements, (2) Use atomic model kits to demonstrate chemical bonding in elements and compounds. Visual representations, preferably 3D, is	**Materials:** (For exp.1) Cal–C-Vita tablets, water, glass beaker, candle, limewater, zinc metal and hydrochloric acid, blue copper (II) sulphate, test tubes and burner. <u>Class activity</u>: different groups can investigate different crystal shapes, building models for each shape and presenting or displaying it in the classroom. This could include covalent molecular and network structures	DON'T explain concepts from atoms to molecules, this leads to misconceptions! Both molecules and ionic substances are COMPOUNDS, respectively due to DIFFERENT chemical bonding! **Remember** these concepts are very abstract to learners. The more visual you can make the concepts, even by using models, the more logical the concepts will become to the learners. Description of molecules and ionic substances make it important to do this section after the concept of chemical bonding. The terms simple molecules and giant molecules are confusing (sugar being anything but a simple

		• Give **examples of molecules** based on the above description e.g. Covalent molecular structures consist of separate molecules: oxygen, water, petrol, CO_2, S_8, C_{60} (buckminsterfullerene or buckyballs) … Covalent network structures consist of giant repeating lattices of covalently bonded atoms: diamond, graphite, SiO_2, some boron compounds • Give **examples of ionic substances** (solids, salts, ionic compounds) based on the above description e.g. A sodium chloride crystal, potassium permanganate crystal, … • Give **examples of metals** based on the above description e.g. a metal crystal like a piece of copper, or zinc, or iron, • Recognize molecules from models (space filling, ball and stick, …) • Draw diagrams to represent molecules using circles to represent atoms • Represent molecules using Molecular formula for covalent molecular structures, e.g. O_2, H_2O, C_8H_{18}, $C_{12}H_{22}O_{11}$, Empirical formulae for covalent network structures, e.g. C as diamond, graphite and SiO_2 as quartz, glass or sand. • Give the formula of a molecule from a diagram of the molecule and vice versa	important here to ensure conceptual understanding of the formation of the different types of compounds		molecule if water is seen as a simple molecule!) The terms **covalent molecular structures** and **covalent network structures** can be used instead. .

<table>
<tr><th colspan="6">GRADE 10 CHEMISTRY (CHEMICAL CHANGE) TERM 2</th></tr>
<tr><th>Time</th><th>Topics Grade 10</th><th>Content, Concepts & Skills</th><th>Practical Activities</th><th>Resource material</th><th>Guidelines for Teachers</th></tr>
<tr><td>4 HOURS</td><td><u>Physical and Chemical Change</u></td><td colspan="2">The properties of matter determine how matter interacts with energy.</td><td></td><td>A <u>chemical change</u> is a change that involves the transformation of one or more substances into one or more different substances.</td></tr>
<tr><td>3 HOURS</td><td>Separation of particles in physical change and chemical change.</td><td>• Describe that the rearrangement of molecules occurs during physical changes e.g. describe
– molecules as separated when water evaporates to form water vapour
– disordering of water molecules when ice melts due to breaking of intermolecular forces
– energy change (as small) in relation to chemical changes
– mass, numbers of atoms and molecules as being conserved during these physical changes
• Describe examples of a chemical change that could include
– the decomposition of hydrogen peroxide to form water and oxygen; and
– the synthesis reaction that occurs when hydrogen burns in oxygen to form water. (Why do we consider these reactions to be chemical changes?)
Describe
– the energy involved in these chemical changes as much larger than those of the physical change i.e. hydrogen is used as a rocket fuel.</td><td>Practical Demonstration:
(1) Show macroscopically what happens when ice is heated in a glass beaker to liquid and further to gas.
(2) Show with small plastic pellets or marbles the arrangement of the particles in ice, in water and in water vapour
(3) Separation reactions like distillation, filtration and paper-chromatography can be used to indicate physical change.
(4) Mix iron and sulphur and separate with a magnet.
(5) Heat iron and sulphur with a burner and test the new substance that formed to see whether the product is a new substance (result of a chemical reaction)

Practical experiments:
(1) Add H_2O_2 to manganese dioxide (catalyst) and collect the oxygen by the downwards displacement of water in the</td><td>Materials:

Burner, glass beaker, ice.
Marbles of plastic pellets

Materials:
MnO_2, hydrogen peroxide, test tubes, gas delivery tube, stopper and water bowl. Zinc, hydrochloric acid and stopper for hydrogen combustion.</td><td>Explain the process of physical change by means of the kinetic molecular theory.

The use of models to demonstrate is crucial in this section. This helps learners to ‘see’ into the microscopic world of matter.

Explain the energy transformations carefully.</td></tr>
</table>

		– mass and atoms are conserved during these chemical changes but the number of molecules is not. Show this with diagrams of the particles	test tube. Is this a physical change or a chemical change? (Explain) (2) Use apparatus for hydrogen combustion to burn hydrogen in oxygen. Is this a physical change or a chemical change? (Explain)		
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
1 HOUR	Conservation of atoms and mass.	• Illustrate the **conservation of atoms** and **non-conservation of molecules** during chemical reactions using models of reactant molecules (coloured marbles stuck to each other with 'prestik' will suffice) • Draw diagrams representing molecules at a sub-microscopic level to show how particles rearrange in chemical reactions and atoms are conserved	**<u>Recommended experiment for informal assessment</u>** (1) Prove the law of Conservation of matter by (1) reacting lead(II) nitrate with sodium iodide, and (2) reacting sodium hydroxide with hydrochloric acid and (3) reacting Cal-C-Vita tablet with water.	**Materials:** Test tubes, glass beaker, lead(II) nitrate, sodium iodide, sodium hydroxide, hydrochloric acid, bromothymol blue, 1 Cal-C-Vita tablet, a plastic bag, rubber band and mass meter.	Marbles and prestik or Jelly Tots and tooth picks can be used to indicate Conservation of Mass in chemical reaction equations. All schools may not have mass meters, but the experiment can still be done without the direct comparison of mass of reactants and products
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
	Law of constant composition	• State the law of constant proportions • Explain that **the ratio** in a particular compound **is fixed** as represented by its chemical formula	**Experiment:** (1) Experiment with the ratio in which elements combine.	**Materials:** 10 Test tubes, glass beaker, 2 propettes, glass beaker, silver nitrate, sodium chloride, lead(II) nitrate, sodium iodide, iron(III) chloride, sodium hydroxide, mass meter.	A propette is a graduated medicine dropper with which to transfer liquids from one container to another.
4 HOURS	**<u>Representing chemical change</u>**	Balanced chemical equations represent chemical change and concur with the Law of Conservation of Matter. Balanced chemical equations are fundamentally important for understanding the quantitative basis of chemistry. Always start with a balanced chemical reaction equation before carrying out a quantitative study of the chemical reaction.			

4 HOURS	Balanced chemical equations	• Represent chemical changes using reaction equations i.e. translate word equations into chemical equations with formulae with subscripts to represent phases (s), (ℓ), (g) and (aq) • Balance reaction equations by − using models of reactant molecules (coloured marbles stuck to each other with 'prestik' will suffice) and rearranging the 'atoms' to form the products while conserving atoms − representing molecules at a sub-microscopic level using coloured circles and simply rearranging the pictures to form the product molecules while conserving atoms'. − by inspection using reaction equations • Interpret balanced reaction equations in terms of − conservation of atoms − conservation of mass (use relative atomic masses)	**Experiment:** (1) Amount of product is related to amount of reactant according to balanced equation (sodium hydrogen carbonate and dilute sulphuric acid). Conservation of matter.	**Materials:** Glass beaker, propette, 2 test tubes, 2 propettes, water bowl, filter paper, measuring cylinder (10 ml), long gas delivery tube, stopper for gas production, syringe, sodium hydrogen carbonate, dilute sulphuric acid, mass meter.	

GRADE 10 PHYSICS *(ELECTRICITY & MAGNETISM)* TERM 2					
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
2 OURS	**<u>Magnetism</u>**				
0.5 HOUR	Magnetic field of permanent magnets	• Explain that a magnetic field is a region in space where another magnet or ferromagnetic material will experience a force (non-contact)			Electrons moving inside any object have magnetic fields associated with them. In most materials these fields point in all directions, so the net field is zero. In some materials (ferromagnetic) there are domains, which are regions where these magnetic fields line up. In permanent magnets, many domains are lined up, so there is a net magnetic field.
1 HOUR	Poles of permanent magnets, attraction and repulsion, magnetic field lines.	• Describe a magnet as an object that has a pair of opposite poles, called north and south. Even if the object is cut into tiny pieces, each piece will still have both a N and a S pole. • Apply the fact that like magnetic poles repel and opposite poles attract to predict the behaviour of magnets when they are brought close together • Show the shape of the magnetic field around a bar magnet and a pair of bar magnets placed close together, e.g. using iron filings or compasses. Sketch magnetic field lines to show the shape, size and direction of the magnetic field of different arrangements of bar magnets	**Recommended practical activity for informal assessment:** Pattern and direction of the magnetic field around a bar magnet.	**Materials:** Sheet of A4 paper, a bar magnet, iron filings **Materials:** Sheet of A4 paper, a bar magnet, several small compasses	Magnetic fields are different from gravitational and electric fields because they are not associated with a single particle like a mass or a charge. It is never possible to find just a north pole or just a south pole in nature i.e. a magnetic monopole does not exist. At the microscopic level, magnetic fields are a product of the movement of charges. Field lines are a way of representing fields. The more closely spaced the field lines are at a point the greater the field at that point. Arrows drawn on the field lines indicate the direction of the field. A magnetic field points from the north to the south pole. Field lines never cross and can be drawn in all three dimensions. For simplicity, only two dimensions are usually shown in drawings
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**

0.5 HOUR	Earth's magnetic field, compass	• Explain how a compass indicates the direction of a magnetic field. • Compare the magnetic field of the Earth to the magnetic field of a bar magnet using words and diagrams • Explain the difference between the geographical North pole and the magnetic North pole of the Earth. • Give examples of phenomena that are affected by Earth's magnetic field e.g. Aurora Borealis (Northern Lights), magnetic storms. • Discuss qualitatively how the earth's magnetic field provides protection from solar winds.			The geographic North and South Poles are the northernmost and southernmost points respectively of the Earth's axis of rotation.
4 HOURS	**<u>Electrostatics</u>**				
0.5 HOUR	Two kinds of charge	• Know that all materials contain positive charges (protons) and negative charges (electrons). • Know that an object that has an equal number of electrons and protons is neutral (no net charge) • Know that positively charged objects are electron deficient and negatively charged objects have an excess of electrons • Describe how objects (insulators) can be charged by contact (or rubbing) – tribo-electric charging			It is reasonable to call the two types of charge "positive" and "negative" because when they are added the net charge is zero (i.e. neutral). Be sure that learners know that all objects contain both positive and negative charges, but we only say an object is charged when it has extra positive charges (electron deficient) or negative charges (excess of electrons).
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**

0.5 HOUR	Force exerted by charges on each other (descriptive) Attraction between charged and uncharged objects (polarisation)	• Recall that like charges repel and opposite charges attract • Explain how charged objects can attract uncharged insulators because of the movement of polarized molecules in insulators	**Practical Demonstration:** Rubbing a balloon against dry hair. Bring a charged balloon, rubbed against dry hair, near a stream of smooth flowing water (laminar flow).	**Materials:** , plastic pen, small pieces of paper, stream of smooth flowing water	In materials that comprise polarised molecules, these molecules may rotate when brought near to a charged object, so that one side of the object is more positive and the other side more negative, even though the object as a whole remains neutral.
1 HOUR	Charge conservation	• State the principle of conservation of charge as: *The net charge of an isolated system remains constant during any physical process*. e.g. two charges making contact and then separating. • Apply the principle of conservation of charge • Know that when two objects having charges Q_1 and Q_2 make contact, each will have the same final charge: $Q = \frac{Q_1 + Q_2}{2}$, after separation **NOTE:** This equation is only true of identically sized conductors on insulating stands.			
1 HOUR	Charge quantization	• State the principle of charge quantization • Apply the principle of charge quantization			Every charge in the universe consists of integer multiples of the electron charge. $Q=nq_e$, where $q_e= 1.6 \times 10^{-19}$ C and n is an integer.

Time	Topics Grade 10	Content, Concepts & Skills	Practical Activities	Resource Material	Guidelines for Teachers
8 HOURS	**<u>Electric circuits</u>**				
1 HOUR	emf, Potential difference (pd)	• Know that the voltage measured across the terminals of a battery when no current is flowing through the battery is called the emf. • Know that the voltage measured across the terminals of a battery when current is flowing through the battery is called potential difference (pd). • Know that emf and pd are measure in volts (V)	**Practical Demonstrations:** Set up a circuit to measure the emf and potential difference and get learners to try to account for the discrepancy.	**Materials:** Light bulbs, resistors, batteries, switches, connecting leads, ammeters, voltmeters	If possible, give learners the opportunity to connect meters in circuits. If the meters have more than one scale, always connect to the largest scale first so that the meter will not be damaged by having to measure values that exceed its limits.
1 HOUR	Current	• Define current, I, as the rate of flow of charge. It is measured in ampere (A), which is the same as coulomb per second • Calculate the current flowing using the equation $$I = \frac{Q}{\Delta t}$$ • Indicate the direction of the current in circuit diagrams (conventional)			The direction of current in a circuit is from the positive end of the battery, through the circuit and back to the negative end of the battery. In the past, this was called conventional current to distinguish it from electron flow. However, it is sufficient to call it the direction of the current and just mention that this is by convention. A very common misconception many learners have is that a battery produces the same amount of current no matter what is connected to it. While the voltage produced by a battery is constant, the amount of current supplied depends on what is in the circuit.
1 HOUR	Measurement of voltage (pd) and current	• Draw a diagram to show how to correctly connect an ammeter to measure the current through a given circuit element • Draw a diagram to show how to correctly connect a voltmeter to measure the voltage across a given circuit element	**Practical Demonstrations:** Set up a circuit to measure the current flowing through a resistor or light bulb and also to measure the potential difference across a light bulb or resistor.	**Materials:** Light bulbs, resistors, batteries, switches, connecting leads, ammeters, voltmeters	Make sure that learners know that the positive side of the meter needs to be connected closest to the positive side of the battery. An ammeter must be connected in series with the circuit element of interest; a voltmeter must be connected in parallel with the circuit element of interest.

TIME	Topics Grade 10	Content, Concepts & Skills	Practical Activities	Resource Material	Guidelines for Teachers
1 HOUR	Resistance	• Define resistance • Explain that resistance is the opposition to the flow of electric current. • Define the unit of resistance; one ohm (Ω) is one volt per ampere. • Give a microscopic description of resistance in terms of electrons moving through a conductor colliding with the particles of which the conductor (metal) is made and transferring kinetic energy. • Explain why a battery in a circuit goes flat eventually by referring to the energy transformations that take place in the battery and the resistors in a circuit			One of the important effects of a resistor is that it converts electrical energy into other forms of energy, such as heat and light. A battery goes flat when all its chemical potential energy has been converted into other forms of energy.
2 HOURS	Resistors in series	• Know that current is constant through each resistor in series circuit. • Know that series circuits are called voltage dividers because the total potential difference is equal to the sum of the potential differences across all the individual components. • Calculate the equivalent (total) resistance of resistors connected in series using: $R_s = R_1 + R_2 + ...$	**Prescribed experiment:** (Part 1 and part 2) **Part 1** Set up a circuit to show that series circuits are voltage dividers, while current remains constant.	**Materials:** Light bulbs, resistors, batteries, switches, connecting leads, ammeters, voltmeters	When resistors are connected in series, they act as obstacles to the flow of charge and so the current through the battery is reduced. The current in the battery is inversely proportional to the resistance.

Time	Topics Grade 10	Content, Concepts & Skills	Practical Activities	Resource Material	Guidelines for Teachers
2 HOURS	Resistors in parallel	• Know that voltage is constant across resistors connected in parallel. • Know that a parallel circuit is called a current divider because the total current in the circuit is equal to the sum of the branch currents. • Calculate the equivalent (total) resistance of resistors connected in parallel using: $\frac{1}{R_p}=\frac{1}{R_1}+\frac{1}{R_2}+...$ • Know that for <u>two resistors</u> connected in parallel, the total resistance can be calculated using: $R_p=\frac{product}{sum}=\frac{R_1R_2}{R_1+R_2}$	**Prescribed experiment: Part 2** Set up a circuit to show that parallel circuits are current dividers, while potential difference remains constant,	**Materials:** Light bulbs, resistors, batteries, switches, connecting leads, ammeters, voltmeters	When resistors are connected in parallel, they open up additional pathways. The current through the battery therefore increases according to the number of branches.

ASSESSMENT TERM 2	**<u>TERM 2:Recommended Formal Assessment</u>** [1] Experiment (Physics): Prescribed Physics experiments Part 1 and Part 2: Electric circuits with resistors in series and parallel measuring potential difference and current [2] Midyear Examinations

GRADE 10 CHEMISTRY *(CHEMICAL CHANGE)* TERM 3					
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
8 HOURS	**Reactions in aqueous solution**	Chemical reactions can be investigated and described through their stoichiometric, kinetic, equilibrium, and thermodynamic characteristics. Many reactions in chemistry and the reactions in living systems are carried out in aqueous solution. We shall study chemical reactions that occur in aqueous solutions where water is the solvent.			
2 HOURS	Ions in aqueous solution: their interaction and effects.	• Explain, using diagrams representing interactions at the sub-microscopic level, with reference to the polar nature of the water molecule how water is able to dissolve ions • Represent the dissolution process using balanced reaction equations using the abbreviations (s) and (aq) appropriately e.g. when salt is dissolved in water ions form according to the equation: $NaCl(s) \rightarrow Na^+(aq) + Cl^-(aq)$ • Define the process of dissolving (solid ionic crystals breaking up into ions in water). • Define the process of hydration where ions become surrounded with water molecules in water solution (don't go into intermolecular forces; just use the polarity of the water molecule and the charge of the ions).	**Practical work:** • Investigate different types of solutions (table salt in water, $KMnO_4$ in water, NaOH in water, KNO_3 in water) and write balanced equations for each • Investigate different types of reactions in aqueous medium and write balanced ionic equations for the different reaction types. **Activity:** (1) Explain what is meant by ion exchange reactions and use an experiment to illustrate the concept of ion-exchange reactions (Ion-exchange reactions are reactions where the positive ions exchange their respective negative ions due to a driving force like the formation of an insoluble salt in precipitation reactions; the formation of a gas in gas-forming reactions; the transfer of protons in an acid-base reaction.)	**Materials:**	**Note:** The chemistry of hard water can be used as an application of ions in aqueous solution. This topic can be investigated as a practical investigation: (not to be examined) • What is 'hard water'? Why is this a problem? Where in SA is hard water a problem and how is the problem addressed? (Explain the chemistry and how we deal with it). • What is acid rain - the chemistry and the impact on our lives/the environment? (as application for ions in aqueous solution) The use of single displacement reactions and double displacement reactions leads to misconceptions with redox reactions where displacement reactions take place due to electron transfer. "Displacement reactions" in ion-exchange reactions and displacement in redox reactions

Time	Topics Grade 10	Content, Concepts & Skills	Practical Activities	Resource Material	Guidelines for Teachers
					differ due to no change in oxidation numbers of elements (in ion-exchange reactions) and change in oxidation numbers of elements (in displacement reactions in redox reactions).
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
1 HOUR	Electrolytes and extent of ionization as measured by conductivity	• Describe a simple circuit to measure conductivity of solutions • Relate conductivity to – the **concentration of ions** in solution and this in turn to the **solubility** of particular substances, however – the type of substance, since some substances, like sugar, dissolve but this does not affect conductivity, conductivity will not always be a measure of solubility	**Activity:** Find in literature the different definitions of chemical change and physical change. Discuss the definitions and come to a conclusion about the most correct definition. **Experiment:** Dissolve respectively 500 mg sugar, sodium chloride, calcium chloride and ammonium chloride in 1 ml water. Measure the temperature each time. What does this tell you about the reaction taking place? Evaporate the water afterwards. What does this tell you about the reaction?		**As per agreement we shall define:** A physical property can be measured and observed without changing the composition or identity of a substance. Water differs from ice only in appearance, not in composition, so going from ice to water to water vapour and back, is a physical change. A chemical property of a substance involves a chemical change where the products of the reaction have completely different chemical and physical characteristics than the reactants. The composition of the reactant and the product differ from each other.
3 HOURS	Precipitation reactions.	• Write balanced reaction equations to describe precipitation of insoluble salts • Explain how to test for the presence of the following anions in solution: – Chloride – using silver nitrate and nitric acid – Bromide- using silver nitrate and nitric acid – Iodide -using silver nitrate and nitric acid – Sulphate – using barium nitrate and nitric acid	**Experiment:** 1. Do some qualitative analysis tests of cations and anions (e.g. chlorides, bromides, iodides, sulphates, carbonates). 2. Prepare a salt (e.g. $CuCO_3$) from its soluble reagents.		The emphasis should not be rote learning of the equations or tests, but how to write balanced equations accurately

		− Carbonate –using barium nitrate and acid (precipitate dissolves in nitric acid) • Identify an ion or ions in a solution from a description of the reactants mixed and the observations of the products			
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
2 HOURS	Other chemical reaction types. In water solution	• Ion exchange reactions − Precipitation reactions − Gas forming reaction − Acid-base reactions. • and redox reactions which are an electron transfer reaction. (Use the charge of the atom as an indication of electron transfer, no redox reaction terminology is required here.) Use the charge of the atom to demonstrate how losing or gaining electrons affect the overall charge of an atom.	**Recommended experiment for informal assessment** (1) Identify CHEMICAL REACTION TYPES experimentally: -precipitation -gas forming reactions -acid-base reactions -redox reactions. (2) What is the driving force of each reaction type? (The formation of an insoluble salt; the formation of a gas; the transfer of protons; the transfer of electrons) (3) Identify each reaction type in a group of miscellaneous chemical reactions.	**Materials:** Soluble salts to form precipitations, acids and bases, sodium carbonate and hydrochloric acid, silver nitrate and sodium bromide, sodium metal, manganese dioxide, burner, copper(II) sulphate and thin copper wire.	Include the basic reaction types here to make chemical reaction equations easier. for learners. This section is just an introduction and should be done superficially. Spend the time teaching concepts like ion formation well to lay the foundation for grade 11 work. Acids and bases, redox is done again in Grade 11 and further studies in Grade 12. Reaction types are done **to create awareness of the types** of reactions and to make it easier for learners to write balanced chemical equations.

GRADE 10 CHEMISTRY *(CHEMICAL CHANGE)* TERM 3					
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
8 HOURS	**<u>Quantitative aspects of chemical change:</u>**	Learners should recognise that owing to the small size of the atoms, molecules and ions, properties of these species are often compared on a mole basis and that the Avogadro constant is a number which chemists commonly use in the comparison of physical and chemical properties. Stoichiometry is the study of quantitative composition of chemical substances and the qualitative changes that take place during chemical reactions.			
1 HOUR	• Atomic mass and the MOLE CONCEPT;	• Describe the mole as the SI unit for amount of substance • Relate amount of substance to relative atomic mass • Describe the relationship between mole and Avogadro's number • Conceptualize the magnitude of Avogadro's number using appropriate analogies. • Write out Avogadro's number with all the zeros to get a better concept of the amount. • Define molar mass. • Describe the relationship between molar mass and relative molecular mass and relative formula mass • Calculate the molar mass of a substance given its formula.	**Practical activity:** 1 dozen = 12 eggs(e.g.) 1 gross = 144 eggs 1 million = 1000 000 eggs 1 mole = Avogadro's number = 6,022 x 10^{23} eggs Molar mass is the mass of one mole of any substance under discussion. Relative molecular mass is the mass of ONE MOLECULE (e.g. water H_2O) relative to the mass of carbon -12. Relative formula mass is the mass of ONE FORMULA UNIT (e.g. NaCl) of an ionic substance relative to the mass of carbon-12.		Refer back to atomic mass earlier in grade 10 Do the mole concept thoroughly. <u>Note to the teacher</u>: The term atomic *mass* should be used and not atomic *weight*. Avogadro's number = 602 200 000 000 000 000 000 000
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
2 HOURS	• Molecular and formula masses;	• Reason qualitatively and proportionally the relationship between number of moles, mass and molar mass • Calculate mass, molar mass and number of moles according to the relationship n= m/M • Determine the **empirical formula** for a given substance from percentage	**Experiment:** Do an experiment to remove the water of crystallization from copper(II) sulphate or cobalt(II) chloride and determine the number of moles of water removed from the crystals.		Refer back to Dalton's reasoning in the history of atomic theory in grade 10

		composition • Determine the number of moles of **water of crystallization** in salts like $AlCl_3.nH_2O$.			
2 HOURS	• Determining the composition of substances	• Determine **percent composition** of an element in a compound. • Define and determine concentration as moles per volume.	• Describe practical quantitative methods for determining chemical composition • Determine the percentage composition from the chemical formula of the substance	**Materials:** Glass beaker spatula, propette, water bowl, filter paper, mass meter, sodium hydrogen carbonate, dilute sulphuric acid. **Materials** Glass beaker, spatula, propette, burner, heating stand, mass meter, boiling stones, water, magnesium powder, vinegar.	
1 HOUR	Amount of substance (mole), molar volume of gases, concentration of solutions.	• Calculate the number of moles of a salt with given mass. • Definition of molar volume is stated as: 1 mole of gas occupies 22.4 dm^3 at 0^0C (273 K) and 1 atmosphere (101.3 kPa) • Calculate the molar concentration of a solution.			Link to gas laws in grade 11. Express as SI units
2 HOURS	Basic stoichiometric calculations	• Do calculations bases on concentration, mass, moles, molar mass and volume. • Determine the theoretical yield of a product in a chemical reaction, when you start with a known mass of reactant.			

GRADE 10 PHYSICS *(MECHANICS)* TERM 3					
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
4 HOURS	**Vectors and scalars**				
4 HOURS	Introduction to vectors & scalars.	• List physical quantities for example time, mass, weight, force, charge etc. • Define a vector and a scalar quantity. • Differentiate between vector and scalar quantities • Graphical representation of vector quantities. • Properties of vectors like equality of vectors, negative vectors, addition and subtraction of vectors using the force vector as an example. N.B. This is to be done in <u>one dimension only</u>. • Define resultant vector. • Find resultant vector graphically using the tail-to-head method as well as by calculation for a maximum of four force vectors.			
8 HOURS	**Motion in one dimension:**				
3 HOURS	Reference frame, position, displacement and distance.	• Describe the concept of a frame of reference • Explain that a frame of reference has an origin and a set of directions e.g. East and West or up and down. • Define one dimensional motion. • Define position relative to a reference point and understand that position can be positive or negative. • Define distance and know that distance is a scalar quantity. • Define displacement as a change in position. • Know that displacement is a vector quantity that points from initial to final position. • Know and illustrate the difference between displacement and distance • Calculate distance and displacement for one	**Practical Demonstration**: Use a long straight track, a curved track, a toy car and a meter rule to illustrate the concept of position, distance and displacement. Make cardboard arrows to represent vector quantities.	**Materials:** Long track, toy car, meter rule , cardboard, scissors, prestik, tape	Restrict problems and contexts to 1D only. Use the symbol x (or y) for position and Δx (or Δy) for displacement to emphasise that displacement is a change in position. Use D for distance. Also restrict problem solving to 1D only i.e. do not do examples or problems involving circular motion.

Time	Topics Grade 10	Content, Concepts & Skills	Practical Activities	Resource Material	Guidelines for Teachers
		dimensional motion			
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
5 HOURS	Average speed, average velocity, acceleration	• Define average speed as the distance travelled divided by the total time and know that average speed is a scalar quantity. • Define average velocity as the displacement (or change in position) divided by the time taken and know that average velocity is a vector quantity. • Calculate average speed and average velocity for one dimensional motion. • Convert between different units of speed and velocity, e.g. $m{\cdot}s^{-1}$, $km{\cdot}h^{-1}$. • Define average acceleration as the change in velocity divided by the time taken. • Differentiate between positive acceleration, negative acceleration and deceleration • Understand that acceleration provides no information about the direction of motion; it only indicates how the motion (velocity) changes.	**Experiment**: Measurement of velocity	**Materials:** Ticker timer and tape, power supply, trolley, inclined plane, retort stand, ruler. **Materials:** Ticker timer and tape, power supply, trolley, inclined plane, retort stand, ruler.	We are dealing only with motion that involves zero or constant acceleration. Do NOT include problems with changing acceleration. Mathematically velocity is defined as $v = \frac{\Delta x}{\Delta t}$ For uniformly accelerated motion in one dimension, average acceleration and instantaneous acceleration are one and the same and will be referred to as "acceleration" Note that the symbol separating compound units can be a multiplication dot or a full stop. Also $m.s^{-1}$, m/s and $m{\cdot}s^{-1}$ will be accepted. Note: Deceleration means that the object is slowing down, whilst negative acceleration implies that the object in speeding up in the opposite (negative) direction.
8 HOURS	**<u>Instantaneous speed and velocity and the equations of motion.</u>**				
2 HOURS	Instantaneous velocity, instantaneous speed,	• Define instantaneous velocity as the displacement (or change in position) divided by an infinitesimal (very small) time interval. • Know that instantaneous velocity is a vector quantity. • Define instantaneous speed as the magnitude of the instantaneous velocity.			Instantaneous velocity is the gradient (slope) of the tangent at a point on the x-t graph.
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
6 HOURS	Description of motion in words,	• Describe in words and distinguish between motion with uniform velocity and uniformly	**<u>Recommended experiment</u>**	**Materials:** Trolley, ticker tape	The emphasis should be on concept formation and testing

	diagrams, graphs and equations.	accelerated motion. • Describe the motion of an object given its position *vs* time, velocity *vs* time and acceleration *vs* time graph • Determine the velocity of an object from the gradient of the position *vs* time graph. • Know that the slope of a tangent to a position *vs*. time graph yields the instantaneous velocity at that particular time. • Determine the acceleration of an object from the gradient of the velocity vs time graph. • Determine the displacement of an object by finding the area under a velocity *vs* time graph. • Use the kinematics equations to solve problems involving motion in one dimension (horizontal only). $v_f = v_i + a\Delta t$ $\Delta x = v_i\Delta t + \frac{1}{2}a(\Delta t)^2$ $v_f^2 = v_i^2 + 2a\Delta x$ $\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ • Demonstrate an understanding of motion of a vehicle and safety issues, such as the relationship between speed and stopping distance	**<u>for informal assessment</u>** Roll a trolley down an inclined plane with a ticker tape attached to it and use the data to plot a position vs. time graph. **<u>Recommended project for formal assessment:</u>** Acceleration	apparatus, tape, ticker-timer, graph paper, ruler **Materials:** Trolley, ticker tape apparatus, tape, ticker-timer, graph paper, ruler	understanding. A description of the motion represented by a graph should include, where possible, an indication of whether the object is moving in the positive or negative direction, speeding up, slowing down, moving at a constant speed (uniform motion) or remaining at rest. The three graphs are very different representations of a motion. Learners need to reason both, from graphs to words and from words to graphs. For example, reference to using area under a velocity time curve need not be difficult and examples can be made concrete if calculating displacement is confined to adding up squares (the area of a square represents displacement; a car traveling at 20 m s^{-1} for 3 s travels 60 m. – the addition of three squares of dimensions 20 m·s^{-1} by 1 s). Note: The following kinematic equations are also acceptable.

					$v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$ $s = \left(\frac{v+u}{2}\right)t$ u ≡ initial velocity v ≡ final velocity a ≡ average acceleration s ≡ displacement t ≡ time interval Problem-solving strategies should be taught explicitly. Problem solutions should include a sketch of the physical situation, including an arrow to indicate which direction is chosen as positive. Physical understanding should be stressed above mathematical manipulations.

ASSESSMENT ***TERM 3***	**<u>TERM 3:Recommended Formal Assessment</u>** **[1] Recommended (Physics) project: Measuring the acceleration of an object.** **OR Recommended (Chemistry) project: Purification and quality of water.** **[2] Control test**

GRADE 10 PHYSICS *(MECHANICS)* TERM 4					
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
8 HOURS	**Energy:**				
1.5 HOURS	Gravitational potential Energy	• Define gravitational potential energy of an object as the energy it has because of its position in the field relative to some reference point. • Determine the gravitational potential energy of an object using $E_P = mgh$			Fundamentally, there are only two kinds of energy viz. potential and kinetic (excluding rest mass energy).
1.5 HOURS	Kinetic energy	• Define kinetic energy as the energy an object possess as a result of its motion • Determine the kinetic energy of an object using $E_K = \frac{1}{2}mv^2$			Introduce kinetic energy as the energy an object has because of its motion. The same notation used for kinetic and potential energy in Physics, will also be used for those concepts in Chemistry.
1 HOUR	Mechanical energy (E_M)	• Define mechanical energy as the sum of the gravitational potential and kinetic energy. Use equation: $E_M = E_K + E_P$			
4 HOURS	Conservation of mechanical energy (in the absence of dissipative forces).	• State the law of the conservation of energy • State that in the absence of air resistance, the mechanical energy of an object moving in the earth's gravitational field is constant (conserved) • Apply the principle of conservation of mechanical energy to various contexts viz. objects dropped or thrown vertically upwards, the motion of a pendulum bob, roller coasters and inclined plane problems. Use equation: $E_{K1} + E_{P1} = E_{K2} + E_{P2}$	**Practical Demonstration:** Conversion of Energy (qualitative)	**Materials:** A length of plastic pipe approx 20mm diameter, a marble, masking tape, measuring tape.	In conservation of energy problems, the path taken by the object can be ignored. The only relevant quantities are the object's velocity and height above the reference point.

GRADE 10 CHEMISTRY *(CHEMICAL SYSTEMS)* TERM 4					
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**
8 HOURS	**The hydrosphere**	The hydrosphere consists of the earth's water. It is found as liquid water (both surface and underground), ice (polar ice, icebergs, and ice in frozen soil layers called permafrost), and water vapour in the atmosphere.			The focus of this section should not be the chemical equations or any rote learning, but should encourage application, interpretation, and environmental impact.
8 HOURS	Its composition and interaction with other global systems.	• Identify the hydrosphere and give an overview of its interaction with the atmosphere, the lithosphere and the biosphere. Water moves through: air (atmosphere) rocks and soil (lithosphere) plants and animals (biosphere) dissolving and depositing, cooling and warming. • Explain how the building of dams affects the lives of the people and the ecology in the region.	**Activity:** Study the ecology of the dams built to provide water for communities. For this activity learners will have to rely on interviews with the people who have lived in the area under investigation for many years or rely on literature about their areas. • Study the ecology of rivers in your area • Study the ecology of the dams built to provide water for communities. Investigate how the building of dams has changed the ecology of rivers and the livelihood of people in the areas around them by applying the science you learnt this year. **Recommended experiment for informal assessment** Test water samples for	**Materials** Use TETRA-test strips to test for water (buy from pet shop for fish tanks). Silver nitrate, microscope or	The hydrosphere is not a global cycle.

			carbonates, chlorides, nitrates, nitrites, pH and look at water samples under the microscope. **<u>Recommended project for formal assessment.</u>** The purification and quality of water	magnifying glass, filter paper and funnel.	
Time	**Topics Grade 10**	**Content, Concepts & Skills**	**Practical Activities**	**Resource Material**	**Guidelines for Teachers**

ASSESSMENT ***TERM 4***	**<u>TERM 4:Recommended Formal Assessment</u>** **[1] Final Examinations**