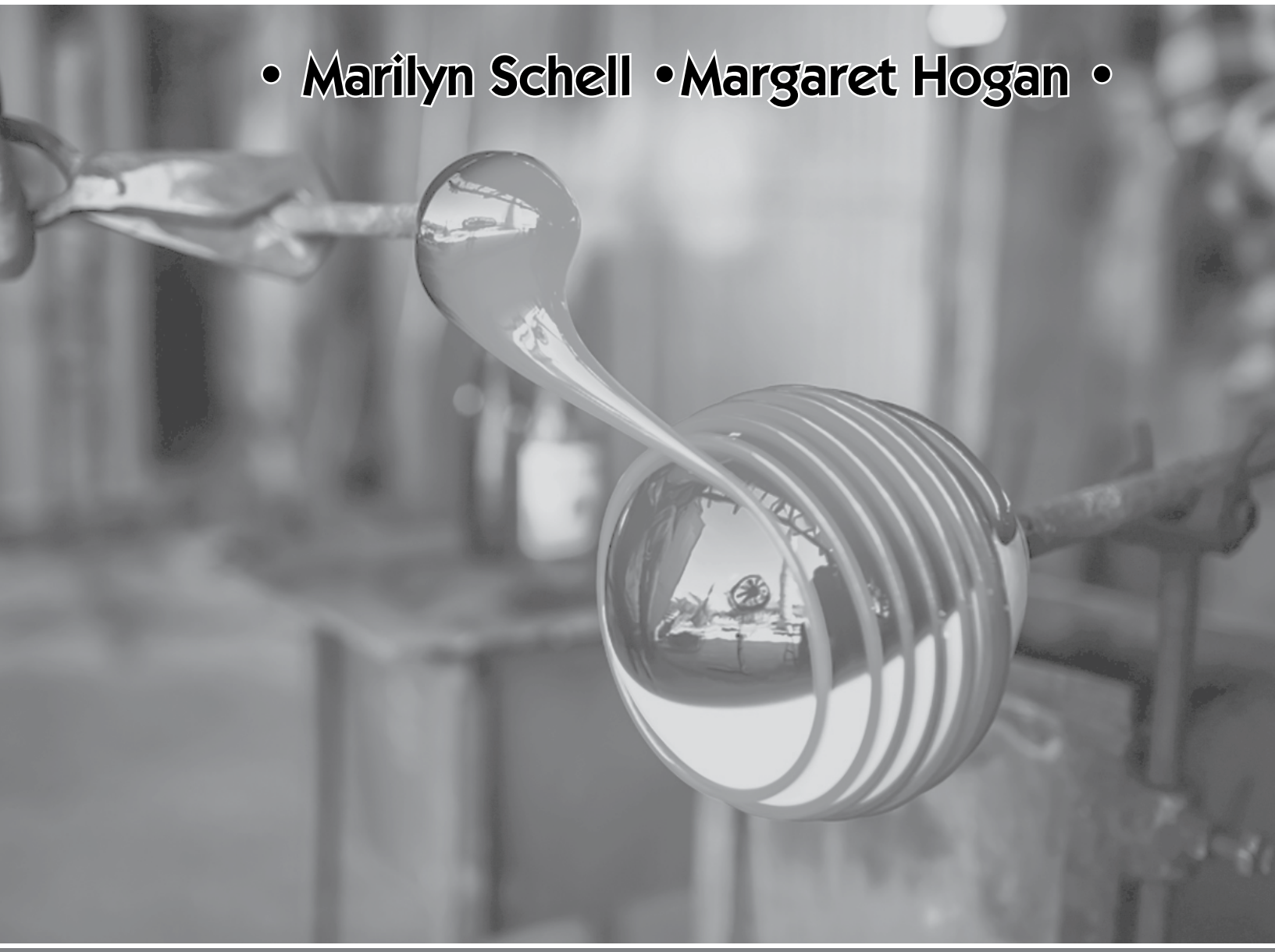
DOT POINT

VCE CHEMISTRY UNITS 1 AND 2



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Contents

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Words to Watch

account, account for State reasons for, report on, give an account of, narrate a series of events or transactions.

analyse Interpret data to reach conclusions.

annotate Add brief notes to a diagram or graph.

apply Put to use in a particular situation.

assess Make a judgement about the value of something.

calculate Find a numerical answer.

clarify Make clear or plain.

classify Arrange into classes, groups or categories.

comment Give a judgement based on a given statement or result of a calculation.

compare Estimate, measure or note how things are similar or different.

construct Represent or develop in graphical form.

contrast Show how things are different or opposite.

create Originate or bring into existence.

deduce Reach a conclusion from given information.

define Give the precise meaning of a word, phrase or physical quantity.

demonstrate Show by example.

derive Manipulate a mathematical relationship(s) to give a new equation or relationship.

describe Give a detailed account.

design Produce a plan, simulation or model.

determine Find the only possible answer.

discuss Talk or write about a topic, taking into account different issues or ideas.

distinguish Give differences between two or more different items.

draw Represent by means of pencil lines.

estimate Find an approximate value for an unknown quantity.

evaluate Assess the implications and limitations.

examine Inquire into.

explain Make something clear or easy to understand.

extract Choose relevant and/or appropriate details.

extrapolate Infer from what is known.

hypothesise Suggest an explanation for a group of facts or phenomena.

identify Recognise and name.

interpret Draw meaning from.

investigate Plan, inquire into and draw conclusions about.

justify Support an argument or conclusion.

label Add labels to a diagram.

list Give a sequence of names or other brief answers.

measure Find a value for a quantity.

outline Give a brief account or summary.

plan Use strategies to develop a series of steps or processes.

predict Give an expected result.

propose Put forward a plan or suggestion for consideration or action.

recall Present remembered ideas, facts or experiences.

relate Tell or report about happenings, events or circumstances.

represent Use words, images or symbols to convey meaning.

select Choose in preference to another or others.

sequence Arrange in order.

show Give the steps in a calculation or derivation.

sketch Make a quick, rough drawing of something.

solve Work out the answer to a problem.

state Give a specific name, value or other brief answer.

suggest Put forward an idea for consideration.

summarise Give a brief statement of the main points.

synthesise Combine various elements to make a whole.

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What the book includes

This book provides questions and answers for each dot point in the Victorian Certificate of Education Study Design for each core topic in the Year 11 Chemistry syllabus:

Unit 1 How Can the Diversity of Materials Be Explained?

- Area of Study 1 How Can Knowledge of Elements Explain the Properties of Matter?
- Area of Study 2 How Can the Versatility of Non-Metals Be Explained?

Unit 2 What Makes Water Such a Unique Chemical?

- Area of Study 1 How Do Substances Interact With Water?
- Area of Study 2 How Are Substances in Water Measured and Analysed?

Format of the book

The book has been formatted in the following way:

1.1 Subtopic from syllabus.

1.1.1 Assessment statement from syllabus.

1.1.1.1 First question for this assessment statement.

1.1.1.2 Second question for this assessment statement.

The number of lines provided for each answer gives an indication of how many marks the question might be worth in an examination. As a rough rule, every two lines of answer might be worth 1 mark.

How to use the book

Completing all questions will provide you with a summary of all the work you need to know from the syllabus. You may have done work in addition to this with your teacher as extension work. Obviously this is not covered, but you may need to know this additional work for your school exams.

When working through the questions, write the answers you have to look up in a different colour to those you know without having to research the work. This will provide you with a quick reference for work needing further revision.

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Unit 1

How Can the Diversity of Materials Be Explained?

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DOT POINT

AREA OF STUDY 1

How Can Knowledge of Elements Explain the Properties of Matter?

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1.1 Elements and the periodic table.

1.1.1 The relative and absolute sizes of particles that are visible and invisible to the unaided eye: small and giant molecules and lattices; atoms and subatomic particles; nanoparticles and nanostructures.

1.1.1.1 All matter is made of particles. List the following particles in order of size, starting from the largest.

Hydrogen ion, molecule of carbon dioxide, atom of oxygen, water molecule, nanoparticle, bacterium, a virus.

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1.1.1.2 Complete the table to show conversion of units.

1 km = ... m	1 picometre (pm) = ... m
1 m = ... microns (μ)	1 micron (μ) = ... m
1 m = ... nanometres (nm)	1 nanometre (nm) = ... m

1.1.1.3 Matter can occur in three states depending on the energy levels of the particles.

(a) Name these states. .....

(b) If the energy level is increased for example, by heating a substance, what change does this bring about in the particles?

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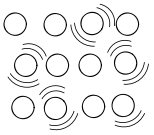
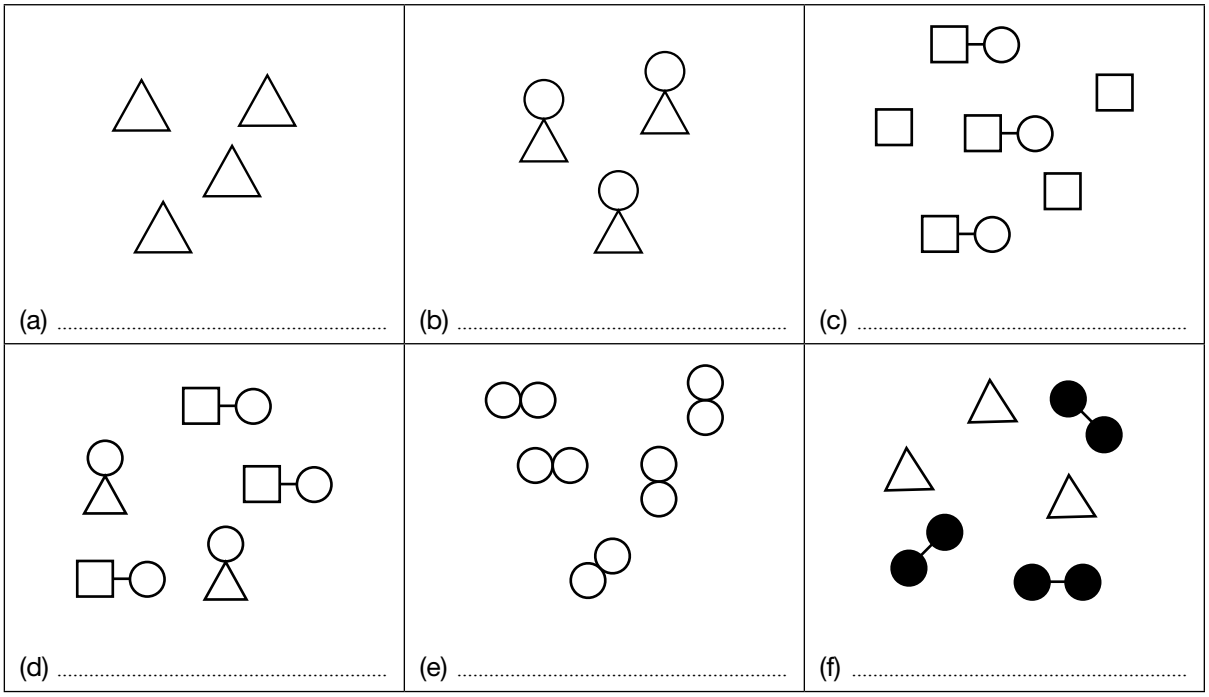
1.1.1.4 Complete the table below to summarise the properties of the three states of matter.

Property	Solid	Liquid	Gas
Arrangement of particles.		Particles are close together and moving more freely.	
Diagram.			
Shape.			Depends on container.
Volume (space occupied).	Definite volume.		
Ability to be compressed (be pushed into a smaller volume).			Can be compressed.
Ability to diffuse (spread through another substance).	Cannot diffuse.		
Kinetic energy of particles.			

1.1.1.5 Identify each of the following diagrams as representing an element, mixture or compound.



(a) ..... (b) ..... (c) .....

(d) ..... (e) ..... (f) .....

1.1.1.6 Polymers are giant molecules called macromolecules. Explain why they do not have a definite molecular size.

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1.1.1.7 What is meant by a lattice structure? .....

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1.1.1.8

(a) Describe the structure of a nanotube such as the one shown in the diagram**.**

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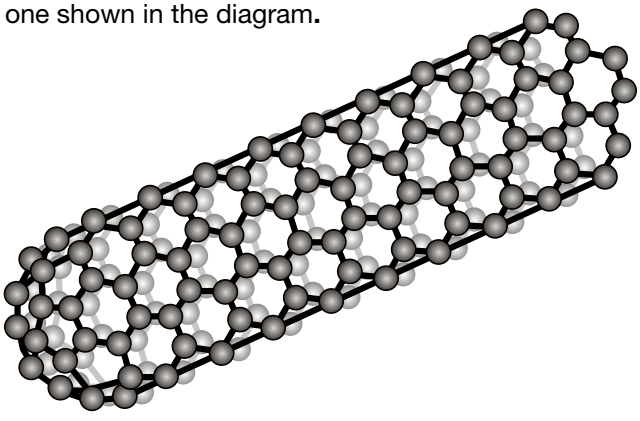

(b) Outline five properties of the nanostructure described as a nanotube.

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Answer Questions 1.1.1.9 to 1.1.12 by selecting the most correct alternative.

1.1.1.9 Which is at nanoscale?

(A) An atom of gold.
(B) Raindrops.
(C) The head of a pin.
(D) DNA.

1.1.1.10 One way silver metal differs from silver nanoparticles is:

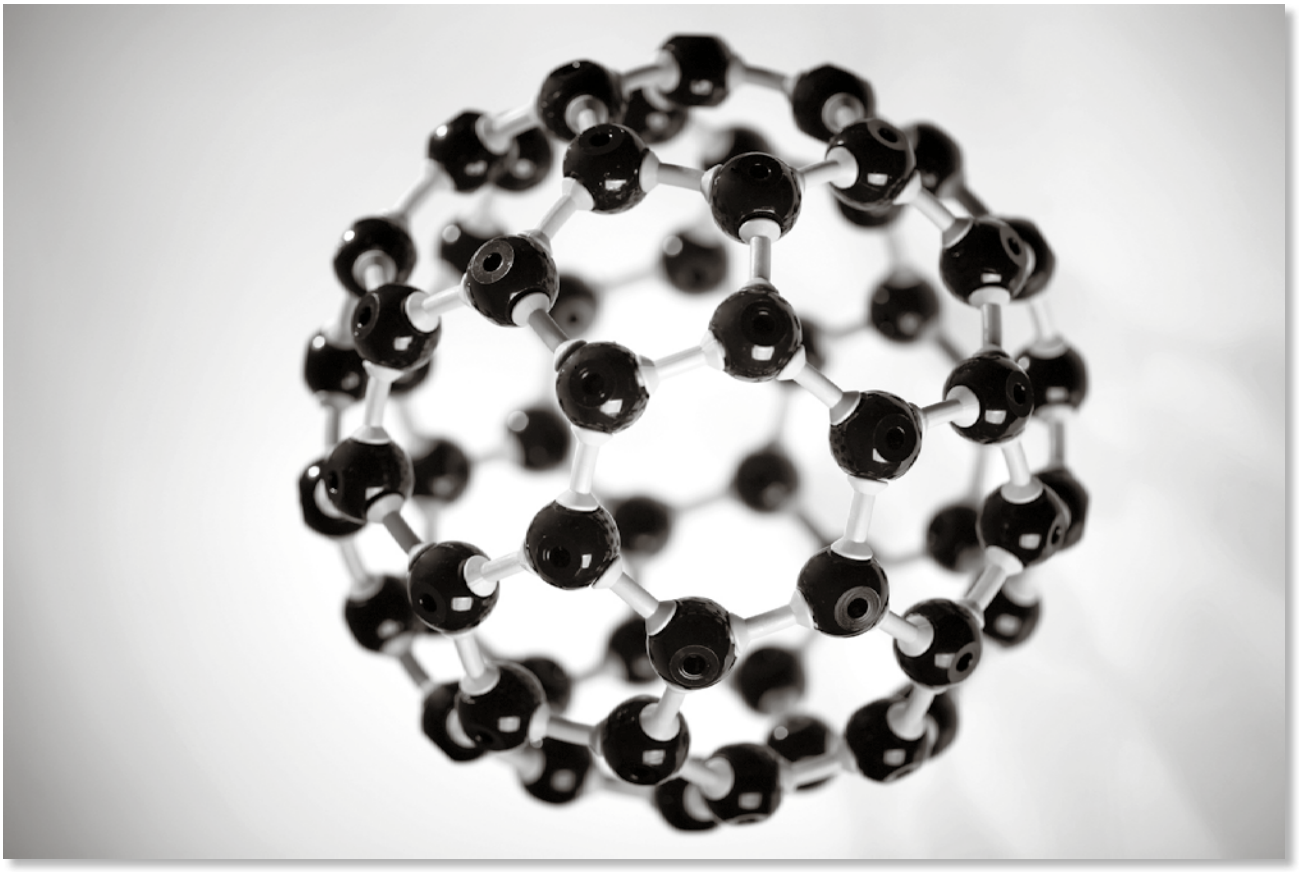
(A) Nanoparticles are bigger.
(B) Only nanoparticles are soluble.
(C) Silver nanoparticles cannot be used as catalysts.
(D) Silver nanoparticles cannot harm people or the environment because they are so tiny.

1.1.1.11 A nanotube is composed of:

(A) A mixture of elements arranged in a tubular shape.
(B) A compound containing carbon which is very small.
(C) A cylinder shaped structure made of hexagonal rings of carbon atoms.
(D) Isotopes of carbon atoms arranged like a tube which is about 1.3 nm long.

1.1.1.12 The scanning tunnelling microscope produces images of very small objects such as atoms by using a stream of electrons rather than light. Visible light cannot be used to study objects as small as atoms because:

(A) The diameter of atoms is less than the wavelength of visible light.
(B) Light bounces off the surfaces of electrons in atoms.
(C) Electrons can be absorbed into the atoms making them visible.
(D) Atoms are too tiny for us to see, we can only study them by using models.



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1.1.2 The definition of an element with reference to atomic number; mass number; isotopic forms of an element using appropriate notation.

1.1.2.1 Everything is made up of atoms.

(a) Define an atom.

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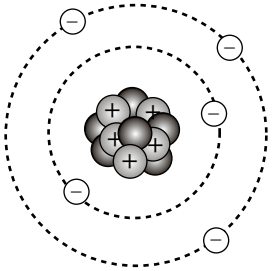
(b) The diagram shows the structure of an atom. Add a key to the diagram to identify the three types of particles in the atom.



1.1.2.2 Complete the following table to show the particles present in atoms.

Particle	Where found	Symbol	Relative charge	Relative mass
Proton	Nucleus of atom		+1	1
Neutron				
Electron		e^-		

1.1.2.3 Compare the mass number (*A*) and the atomic number (*Z*) of an element. Include an example in your answer.

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1.1.2.4 Complete the following table to show the particles in the atoms of some elements.

Name of element	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons
Hydrogen			1	0	
Beryllium	4	9			
	10	20			
	13			14	
			80	121	

1.1.2.5 Use the periodic table and atomic numbers provided to identify the names and symbols for each of the following elements.

Atomic number	Name of element	Symbol
5		
7		
19		
92		

1.1.2.6 Identify which two of the species in the table (X, Y, G and H) are both the same element.

	Number of neutrons	Number of protons	Number of electrons
X	13	12	12
Y	13	13	13
G	12	12	12
H	12	11	11

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1.1.2.7

(a) Explain what is meant by isotopes. .....

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(b) Predict whether isotopes of an element would have the same physical and chemical properties.

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1.1.2.8 Complete the following table of isotopes. The first one has been done for you.

	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons
Copper-63	29	63	29	34	29
Copper-65					
Lead-204					
Lead-206					
Lead 208					
Uranium-235					
Uranium-238					
Hydrogen-1					
Hydrogen-2					
Hydrogen-3					

1.1.2.9 The table details the particles in four atoms.

Identify which two of these atoms could be isotopes. Explain your choice.

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Atoms	Number of protons	Number of neutrons	Number of electrons
P	27	34	27
Q	29	36	29
R	25	36	36
S	29	34	29

1.1.2.10 A radioisotope is an isotope that has an unstable nucleus. It decays spontaneously, emitting alpha, beta and/or gamma radiation. Complete the table to compare these types of radiation.

Factor	Alpha (α) radiation	Beta (β) radiation	Gamma (γ) radiation
Structure		Particles	
Consist of	Helium nucleus (2 protons and 2 neutrons)		
Charge			Nil
Ionising ability		Fair	
Penetration	Poor (2 to 10 cm in air)		Very good (several cm of lead)
Deflection in electric field		Towards positive plate	

1.1.2.11 Radioisotopes decay in exponential fashion.

The graph illustrates the decay of a radioisotope.

(a) What is the half-life of the element?

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(b) What percentage of the original sample of the element will remain after 3 years?

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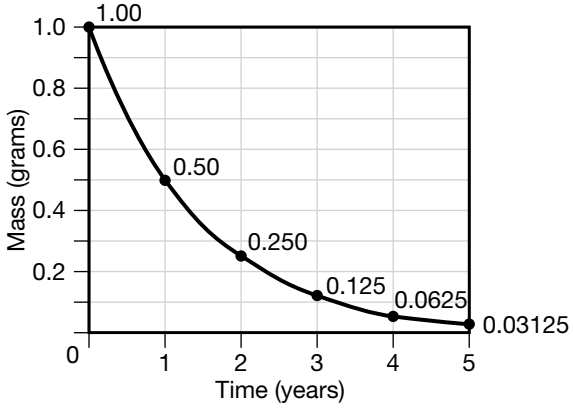

1.1.2.12 Isotopes of the same element must have the same number of:

(A) Protons. (B) Neutrons.

(C) Electrons. (D) Protons and neutrons.

1.1.2.13 A neutral atom of $^{37}_{17}$ would have:

(A) 37 protons, 37 neutrons and 37 electrons. (B) 17 protons, 37 neutrons and 17 electrons.

(C) 17 protons, 20 neutrons and 37 electrons. (D) 17 protons, 20 neutrons amd 17 electrons.

1.1.2.14 An atom of phosphorus has an atomic number of 15 and a mass number of 31. How many neutrons are present?

(A) 15 (B) 16 (C) 31 (D) None of the above.

1.1.3 Spectral evidence for the Bohr model and for its refinement as the Schrödinger model; electronic configurations of elements 1 to 36 using the Schrödinger model of the atom, including s, p, d, and f notations (with copper and chromium exceptions).

1.1.3.1 A number of scientists have contributed to our present day model of the atom. Describe the models of atomic structure put forward by each of the following scientists.

(a) John Dalton. .....

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.....

(b) JJ Thomson. .....

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(c) Ernest Rutherford. .....

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(d) Niels Bohr. .....

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1.1.3.2 C-12, C-13 and C-14 represent isotopes of carbon.

(a) What do the numbers tell you? .....

(b) Rewrite formulas for these three isotopes using an alternative notation. .....

1.1.3.3 Complete the following table to show arrangement of electrons for the first 20 elements of the periodic table according to Bohr's atomic model. Use a 2-D diagram to model the electron arrangement for atoms of these elements.

Name of element and symbol	Electron configuration	Diagram model
Hydrogen H		
Helium He		

Name of element and symbol	Electron configuration	Diagram model
Lithium		
..... Be		
Boron		
Carbon		
Nitrogen		

Name of element and symbol	Electron configuration	Diagram model
Oxygen		
Fluorine		
..... Ne		
Sodium		
..... Mg		

Name of element and symbol	Electron configuration	Diagram model
Aluminium		
Silicon		
Phosphorus		
..... S		
..... Cl		

Name of element and symbol	Electron configuration	Diagram model
..... Ar		
Potassium		
..... Ca		

1.1.3.4 A spectrum refers to any property that can vary.

(a) Use an example to explain what is meant by a continuous spectrum. .....

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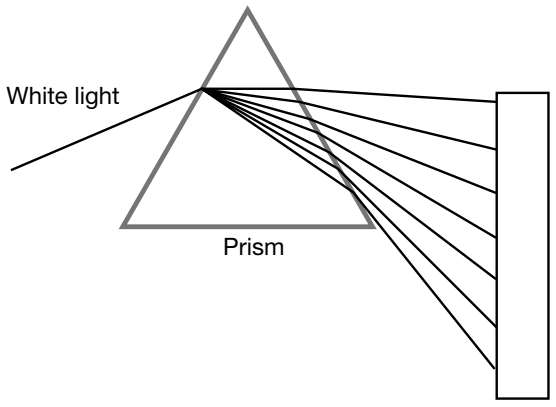
(b) A prism can split white light into all the colours of the rainbow, forming a continuous spectrum. On the diagram label the visible colours of light in the spectrum shown.



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Answers

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Unit 1 How Can the Diversity of Materials Be Explained?

1.1.1.1 Bacterium, virus, nanoparticle, molecule of carbon dioxide, water molecule, atom of oxygen, hydrogen ion.

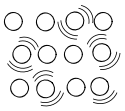
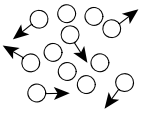
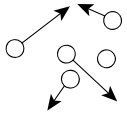
1.1.1.2

1 km = 1000 m	1 picometre (pm) = 10^{-12} m
1 m = 1 000 000 (10^6) microns (μ)	1 micron (μ) = 10^{-6} m
1 m = 10^9 nanometres (nm)	1 nanometre (nm) = 10^{-9} m

1.1.1.3 (a) Solid, liquid, gas.

(b) They move faster.

1.1.1.4

Property	Solid	Liquid	Gas
Arrangement of particles	Particles are close together and vibrating in fixed positions.	Particles are close together and moving more freely.	Particles are far apart and moving very freely.
Diagram			
Shape	Definite shape.	Takes the shape of the container.	Depends on container.
Volume	Definite volume.	Definite volume.	Fills all available space.
Ability to be compressed	Cannot be compressed.	Cannot be compressed.	Can be compressed.
Ability to diffuse	Cannot diffuse.	Can diffuse.	Can diffuse.
Kinetic energy of particles	Least.	More than solids, less than liquids.	Greatest kinetic energy.

1.1.1.5 (a) Element.

(b) Compound.

(c) Mixture (of element and compound).

(d) Mixture (of two compounds).

(e) Element.

(f) Mixture (of two elements).

1.1.1.6 Polymers are made of long chains of smaller molecules joined together, the chains varying in length and branching. Chains can vary in length and extent of branching.

1.1.1.7 A lattice is a giant array of atoms joined together in three dimensions. Lattices can be large enough to be visible as crystals, e.g. diamond.

1.1.1.8 (a) A nanotube is a cylinder made of hexagonal rings of carbon atoms, like a sheet of graphite coiled into a cylinder but without any seams. The nanotube is closed at one end by pentagonal rings of carbon atoms. The walls may be only one cell thick or many cells thick with concentric nanotubes made of cylinders inside cylinders. Their average diameter is 1.2 to 1.4 nm and they are much longer than they are thick – up to 28 million times longer.

(b) Various. Properties of nanotubes include:

- High tensile strength – the strongest and stiffest materials known. They are harder than diamond and stronger than steel, especially concentric tubes or bundles of tubes.
- Inner tubes can slide inside outer tubes with minimal friction.
- Some are good conductors of electricity, others are semiconductors.
- Can act as efficient catalysts.
- A wide range of materials can be inserted into the tubes including metals, metal oxides and small proteins.
- They can enter cells, accumulate in cytoplasm and may cause the death of cells.
- They are toxic if inhaled and may cause mesothelioma (a form of cancer of the lungs).

1.1.1.9 D

1.1.1.10 B

1.1.1.11 C

1.1.1.12 A