Western Cape Government

Western Cape Education Department
Directorate: Curriculum FET

MARINE SCIENCES

Grade 12
REVISION BOOKLET
TERM 1

This revision program is designed to assist you with the revision of topics covered in Grade 11 (examinable in Grade 12) and Term 1.

The revision program will contain the following content:

<u>Grade 11</u>

- Chemical composition of sea water
- Shores – Rocky and sandy
- Phylum Echinodermata
- Archaeological evidence of early human relationships with the sea and seafood

<u>Grade 12 Term 1</u>

- Scientific inquiry (covered in all topics)
- SA Shorelines
- Diving Sciences and water gas laws
- Marine Protected Areas
- Marine ecotourism
- Estuaries
- Kelp Forests
- Commercial use of marine algae
- Chordata – Urochordata

TOPIC: Chemical Composition of sea water

Fill in the missing term in each block

Term	Definition
	An atom that has gained one or more electrons and has a negative electric charge
	The smallest units of ordinary matter that give the elements their distinct properties
	The smallest unit of matter comprised of a nucleus at the center, containing protons and neutrons, and electrons that orbit the nucleus
	An atom that has lost one or more electrons and has a positive electric charge
	Chemical bonds between two non-metal atoms that share valence electrons
	An atom's tendency to attract the shared electrons of a covalent bond to itself
	Subatomic particles that orbit the nucleus of an atom and have a negative electric charge
	Made up of two or more atoms of the same kind, held together by chemical bonds and cannot be broken down into simpler substances
	A force of attraction that results in the covalently bond between a hydrogen (H) atom and an electronegative atom, such as nitrogen (N), oxygen (O) or fluorine (F)
	An electrically charged atom or a group of atoms that results in an unbalanced electrical charge because it has either lost or gained one or more electrons
	Linkages that hold metal atoms and non-metal atoms together owing to the electrostatic attraction between oppositely charged ions, i.e. the positive and negative charges of the metal and non-metal ions

	The simplest unit of a chemical substance, made up of two or more atoms that are chemically bonded together
	Electrically neutral subatomic particles found in the nucleus of an atom
	Molecules formed either due to having covalent bonds where electrons are equally shared, or, in the example of CO_2 (O=C=O) where C=O double bond is polar covalent but points in exactly the opposite direction to the other C=O double bond, thus the two dipoles cancel each other out and the molecule as a whole is non-polar
	The positively charged central region of an atom, composed of protons and neutrons
	In the shell atomic model the number of electrons in this shell determines the reactivity or the ability of an atom to form chemical bonds (The shell atomic model is a simplified description of the structure of atoms. The first shell is closest to the nucleus; the others extend outward from the nucleus and overlap one another (ref Britannica))
	A covalent bond between two atoms where one end of the molecule is slightly positive and the other end of the molecule is slightly negative, i.e. the distribution of electrons between the covalently bonded atoms is not even
	A covalent bond where the distribution of electrons between the covalently bonded atoms is not even
	Having a type of chemical bond where a pair of electrons is unequally shared between two atoms
	Positively charged subatomic particles found in the nucleus of an atom
	The concentration of dissolved salt in a given volume of water, expressed in grams of salt per 1000 g (1kg) of water (parts per thousand, ‰)
	A liquid substance that is capable of dissolving most chemicals

	The property of water that allows it to dissolve more materials than any other liquid
	Electrons in the outermost shell of atoms that enter into the formation of chemical bonds

Question 1

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A-D) next to the question numbers (1.1 to 1.5) in the ANSWER BOOK, e.g. 1.6 D.

1.1 Which ONE of the following ions, constitute 86% of sea water?

A. Mg^{+} and Cl^{-}
B. Ca^{2+} and SO_4^{2-}
C. Na^{+} and Cl^{-}
D. K^{+} and SO_4^{2-}

1.2 Which ONE of the following is NOT a cation?

A. Magnesium ion
B. Chloride ion
C. Calcium ion
D. Potassium ion

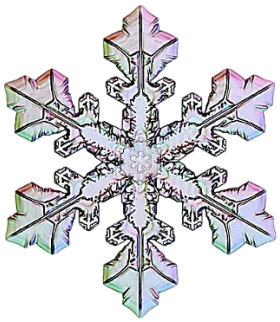
1.3 All the ions are extracted from a container of salt water and weighed. The combined mass of all the ions is 200g.
What is the mass of all the sodium and chloride ions?

A. 86 g
B. 99,36 g
C. 172 g
D. 198,72 g

1.4 Covalent bonds…

A. form between more than one atom.
B. form between two hydrogen atoms.
C. shares electrons.
D. All of the above.

1.5 There are various bonds which causes the crystalline structure of ice below.



[Source: https://www.mpg.de/6362003/water-ice-crystal]

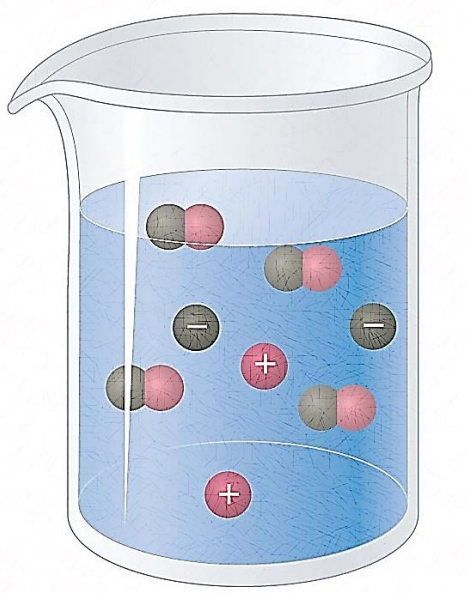
Which bond does **NOT** lead to the formation of the structure above?

A. Covalent
B. Polar covalent
C. Hydrogen
D. Ionic

(5x2)
(10)

Question 2

Water is said to be a universal solvent as indicated by the diagram below.



[Source: https://wou.edu/chemistry/courses/online-chemistry-textbooks/3890-2/ch104-chapter-7-solutions/]

2.1 Make a neatly labelled sketch of a water molecule. (4)
2.2 Discuss the molecular structure of a water molecule. (6)
2.3 Describe the effects of water on ionic bonds by describing how NaCℓ dissociates in water. (5)
2.4 Explain why oils cannot dissolve in water. (4)
[19]

Topic: 56.2 Shores – Rocky & Sandy

Fill in the missing term in each block

Term	Definition
	A low shore eulittoral zone characterised by dome-shaped argenvillei limpets
	A middle shore eulittoral zone, characterised by the presence of balanoid barnacles
	Specific forms of behaviour exhibited by animals to increase their chances of survival
	A low shore eulittoral zone characterised by pear-shaped cochlear limpets
	Another term referring to the intertidal zone
	Refers to marine animals which are able to survive in a wide range of salinities
	The region just below the spring low-tide mark
	The region between the spring low- and high-tide marks
	A high-shore eulittoral zone, characterised by small winkles
	The almost microscopic heterotrophs in soil or sediment ecosystems, often referred to as decomposers
	A food chain involving almost microscopic organisms, living in soil or sediment, which ultimately release nutrients for producers in larger food chains
	The dynamic zone where land and sea meet
	The specific line to which the sea reaches on the shore at any given moment
	The moon appears to be growing smaller
	The moon appears to be growing larger

Question 1

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A-D) next to the question numbers (1.1 to 1.8) in the ANSWER BOOK, e.g. 1.9 D.

1.1 The lower eulittoral zone on a rocky shore will be exposed at ...

A. spring low tide.
B. neap high tide.
C. spring high tide.
D. neap low tide.

1.2 Pill bugs and sand lice are found in abundance in the upper zone of sandy beaches of the ...

A. entire South African coast.
B. West and South Coasts of South Africa.
C. East Coast of South Africa only.
D. West Coast of South Africa only.

1.3 The area between the spring low tide and neap low tide marks that is only exposed for a few low tide cycles:

A. Middle shore
B. Intermediate shore
C. Upper shore
D. Lower shore

1.4 The factor that is NOT an abiotic factor of a rocky shore:

A. Desiccation
B. Wave action
C. Predation
D. Light intensity

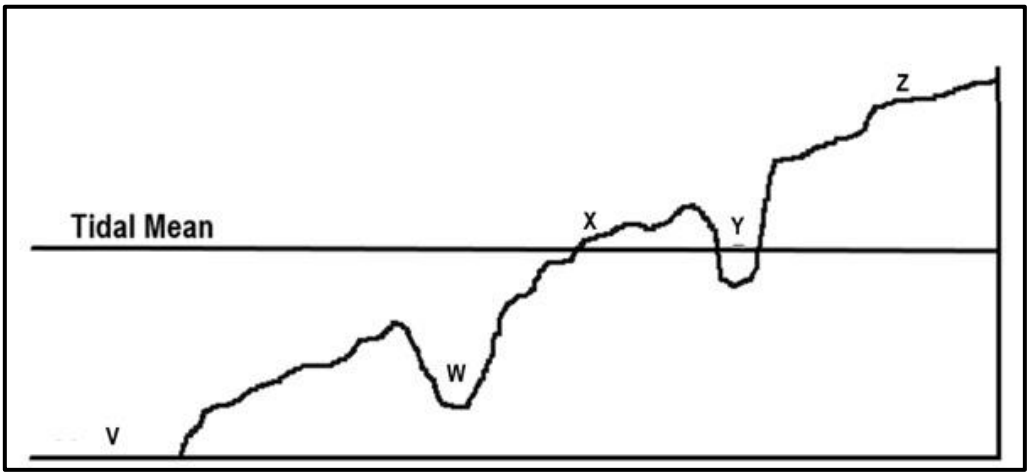
1.5 Which of the following is NOT a characteristic of a typical rocky shore?

A. They have a rocky substrate
B. Gullies are associate with rocky shores
C. Largely covered by small pebbles
D. Rock pools are eroded areas of rock

1.6 The middle eulittoral zone that is characterised by barnacles, limpets and encrusting algae is called the …

A. Littorina zone.
B. Cochlear zone.
C. Balanoid zone.
D. Oyster belt zone.

Use the diagram below to answer QUESTION 1.1.7 and 1.1.8



1.7 The list below refers to zones **V** to **Z**.

i) **V** has large amounts of sea squirts
ii) **W** and **Y** will have exactly the same organisms living in them
iii) **Z** is referred to as the Littorina zone
iv) **X** is associated with large amounts of barnacles
v) **V** is part of the shoreline
vi) **W** represents a gully

Select the options only containing correct answers

A. i, ii, iii, vi
B. ii, iii, iv
C. ii, iv, v, vi
D. i, ii, iv

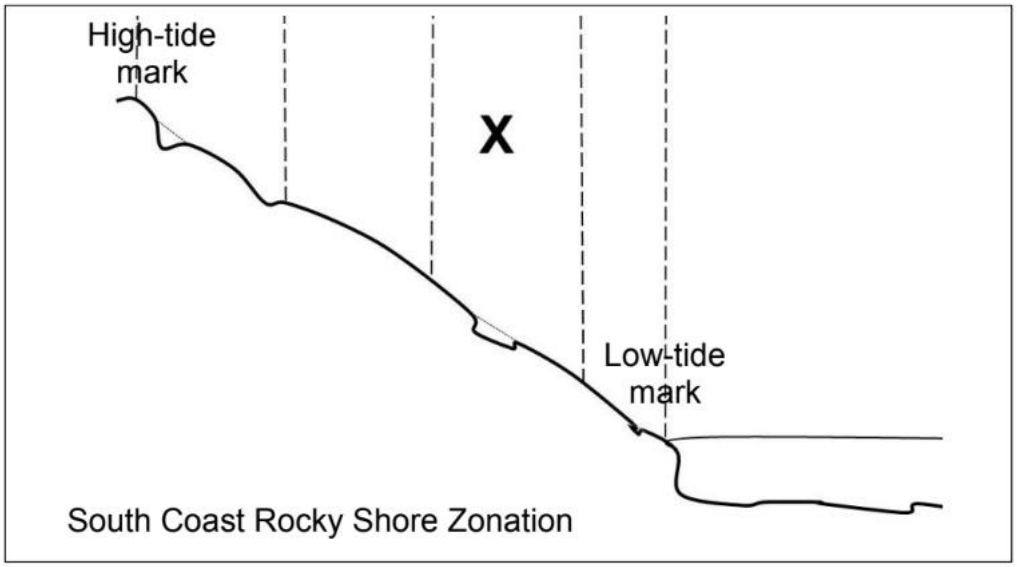
1.8 The area between Y and Z will have no algae and is found along warmer water. Select the INCORRECT statement

A. This area is known as the East Coast
B. Large amounts of small winkles will be found in this area
C. This area will have large amounts of limpets
D. Oysters are often associated with the above area

(8x2)
(16)

Question 2

Study the diagram below and answer the questions that follow.



2.1	Define the term intertidal zone.	(2)
2.2	Name area **X** AND mention ONE organism normally found there.	(2)
2.3	List TWO molluscs that could be found in area X if this rock shore was in Durban.	(2)
2.4	List THREE abiotic factors that affect organisms at the high-tide mark but NOT at the low-tide mark under normal conditions.	(3)
2.5	In your opinion would organisms living at the low-tide mark survive at the high-tide mark. Motivate your answer.	(2)
		(11)

Question 3

A group of scientists did a study to determine the effect of exposure time on the mass of two mollusc species found on a rocky shore.

The scientists used the following method:

- Collected 15 individuals of each species and placed them into three groups of 5 (Groups 1, 2 and 3)
- Recorded the average initial mass for each individual
- Placed each group of 5 into a desiccator (apparatus which dries them out)
- Left each group in the desiccator for different lengths of time (Group 1 for 2 hours, Group 2 for 4 hours and Group 3 for 6 hours)
- Recorded the final mass for each group
- Recorded the average percentage change in mass for each group

They recorded the results of the study as shown in the table below.

Effect of exposure time on the average percentage weight loss in two mollusc species

EXPOSURE TIME (HOURS)	AVERAGE PERCENTAGE (%) CHANGE IN MASS	
	SPECIES A	SPECIES B
2	12	3
4	24	6
6	45	15

3.1 Identify the…
(a) independent variable. (1)
(b) dependent variable. (1)
3.2 Give a suitable hypothesis for this investigation. (2)
3.3 Draw a bar graph to illustrate the data for both species as provided in the table above. (8)
3.4 Using the data provided, identify the species that would likely be found in the:
(a) Middle eulittoral zone (1)
(b) Lower eulittoral zone (1)
3.5 Explain your answers to QUESTION 3.4(a) and (b) above. (4)
(18)

Topic: 57. Echinoderms

<u>Fill in the missing term in each block</u>

Term	Definition
	The surface of an echinoderm opposite the oral surface
	The grooves on the arms of echinoderms from which tube feet extend
	The first body opening that forms in the early stages of embryo development
	A stage in embryonic development when the embryo is a hollow sphere
	Water-filled compartments around the stomachs of Brittle stars which open to the outside
	Tissue beneath the skin of some echinoderms enabling them to extensively alter the flexibility of their skin
	The small, jointed legs with which Feather stars hold onto their substrate and Barnacles filter feed

	Phagocytic cells in the coeloms of echinoderms, responsible for engulfing excretory products and preventing infection
	Animal phyla in which the blastopore becomes the anus
	Asieve-like plate which allows seawater to enter the water-vascular system of echinoderms
	An early stage of embryonic development when the embryo is a small solid collection of cells
	The surface of an echinoderm on which the mouth is found
	Small bones in some animals or the flat bony plates forming the skeleton of echinoderms
	Small extensions of the water-vascular system of echinoderms, outside the skin, enabling a surface for the exchange of gases and other chemicals
	A range of tiny protective nippers extending from the skin of some echinoderms
	Can engulf small particles and foreign cells into itself
	Sideward extensions from the arms of feather stars
	Echinoderm tube feet which have become modified to perform functions other than locomotion and adhesion
	Animal phyla in which the blastopore becomes the mouth
	Tubes extending from the stomach of an echinoderm and into the arms, assisting in the digestion and distribution of food
	Feathery branches extending into the coelom from the rectum of Sea cucumbers which draw in sea water to aid gaseous exchange
	The skeleton of an echinoid echinoderm like a Sea urchin

	Tubular extensions of the echinoderm water-vascular system, which normally have suckers on the ends and enable them to anchor themselves, as well as move around
	A system of water-filled compartments and muscular sacs which control the tube feet of echinoderms and assist internal transport of chemical substances

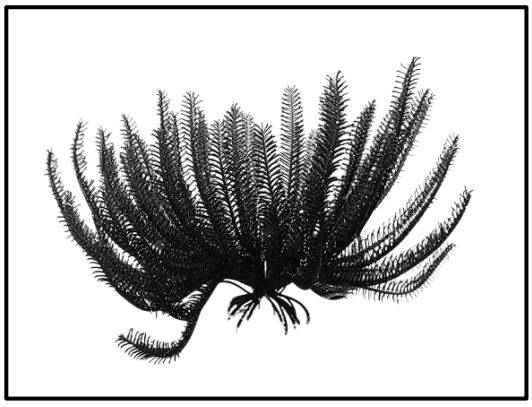
Question 1

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A-D) next to the question numbers (1.1 to 1.8) in the ANSWER BOOK, e.g. 1.9 D.

1.1 The exoskeleton in sea urchins is called …

A. a carapace.
B. a test.
C. an ossicle.
D. pedicellariae.

1.2 The animal in the illustration below is an echinoderm.



[Source: https://www.thefossilforum.com/]

To which Echinoderm class does the animal in the diagram above belong?

A. Asteroidea
B. Ophiuroidea
C. Crinoidea
D. Holothuroidea

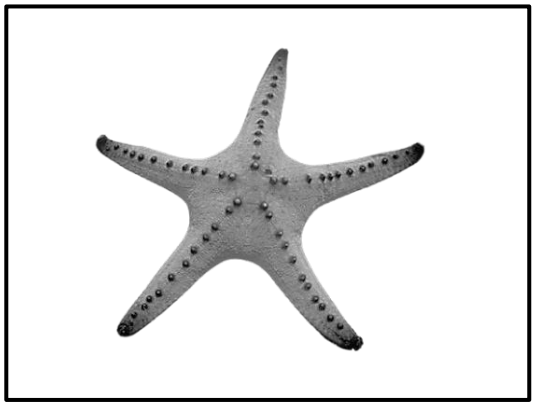
1.3 The class to which sea urchins belongs to:

A. Ophiuroidea
B. Crinoidea
C. Holothuroidea
D. Echinoidea

1.4 The Echinoderm class that does not use tube feet for locomotion:

A. Ophiuroidea
B. Crinoidea
C. Holothuroidea
D. Echinoidea

1.5 The illustration below represents a sea star.



[Source: https://tidechaser.blogspot.com/2012/03/]

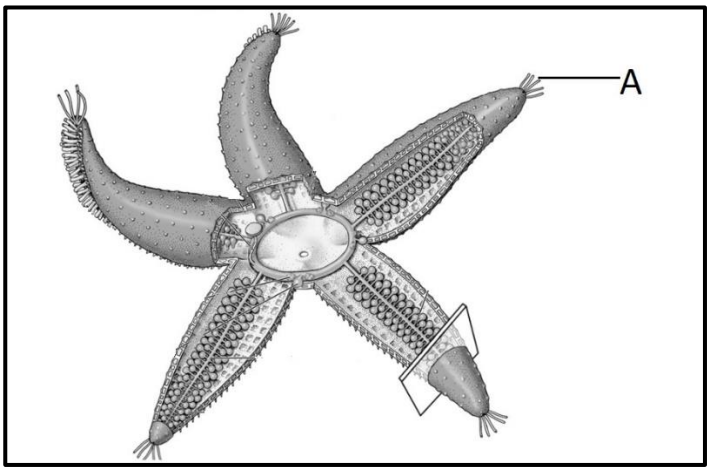
To which Echinoderm class does the sea star belong belong?

A. Asteroidea
B. Ophiuroidea
C. Crinoidea
D. Holothuroidea

1.6 Which structure does NOT form part of the excretion of echinoderms?

A. Pedicellariae
B. Papulae
C. Water-vascular system
D. Coelomocytes

1.7 Study the illustration of a sea star below.

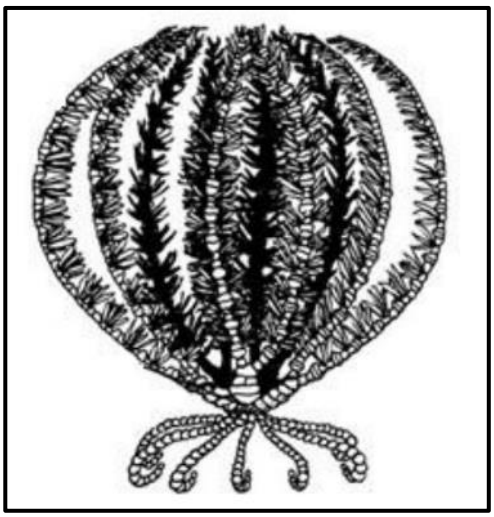


[Source: https://faculty.weber.edu/rokazaki/Zoology1120/FinalChapter22Echinodermata.pdf]

The system that assists in the movement of label A.

A. Water-vascular system
B. Nervous system
C. Digestive system
D. Open circulatory system

1.8 The image below represents an adult specimen of an echinoderm class.

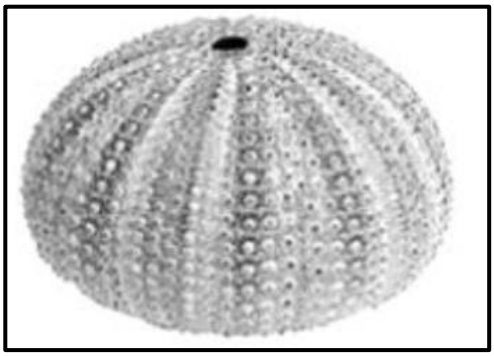


[Source: https://respirationsystem.weebly.com/uploads]

Which of the following is CORRECT for this adult organism?

	CLASS	**MOTILITY**
A.	Crinoidea	Can swim
B.	Ophiuroidea	Benthic
C.	Crinoidea	Only planktonic
D.	Ophiuroidea	Can swim

1.9 The structure represented below is referred to as a/an ...



[Source: https://www.deepseanews.com]

A. shell.
B. test.
C. endoskeleton.
D. basket.

1.10 Brittle stars …

A. have a central disc covered with rigid, brittle skin.
B. are mostly filter feeders.
C. mainly move around by actively swimming through the water.
D. have a through gut with a mouth and an anus.

1.11 Consider the following characteristics and complete the statement below.

i) Arrangement of jaws and teeth is called an Aristotle's lantern
ii) bilateral symmetry
iii) Through-gut
iv) Broad ossicles
v) Internal fertilisation

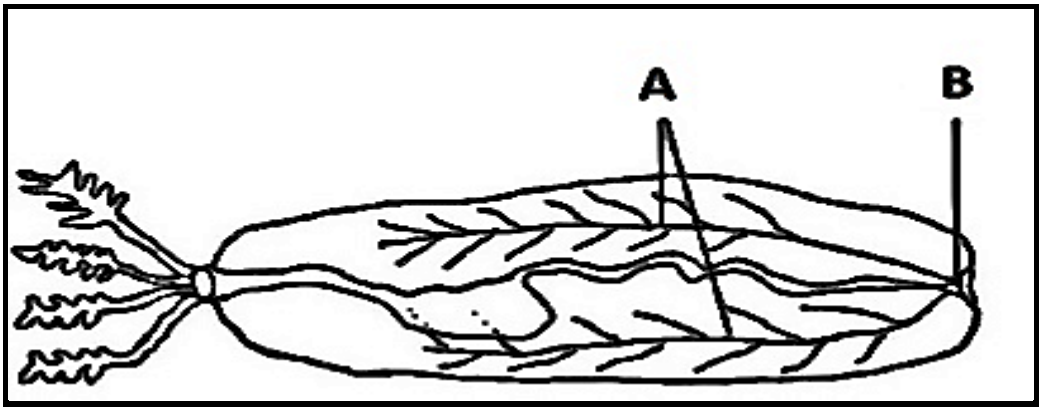
Which option includes features of Echinoderms ONLY?

A. i, iii and v
B. I, ii and iv
C. ii, iii and v
D. i, iii and iv

(11x2)
(24)

Question 2

The diagram below represents a class of echinoderm.



[Source: https://respiratorysystemsbiology02.weebly.com/echinodermata.html]

2.1 Identify the class of echinoderm represented in the diagram above. (1)

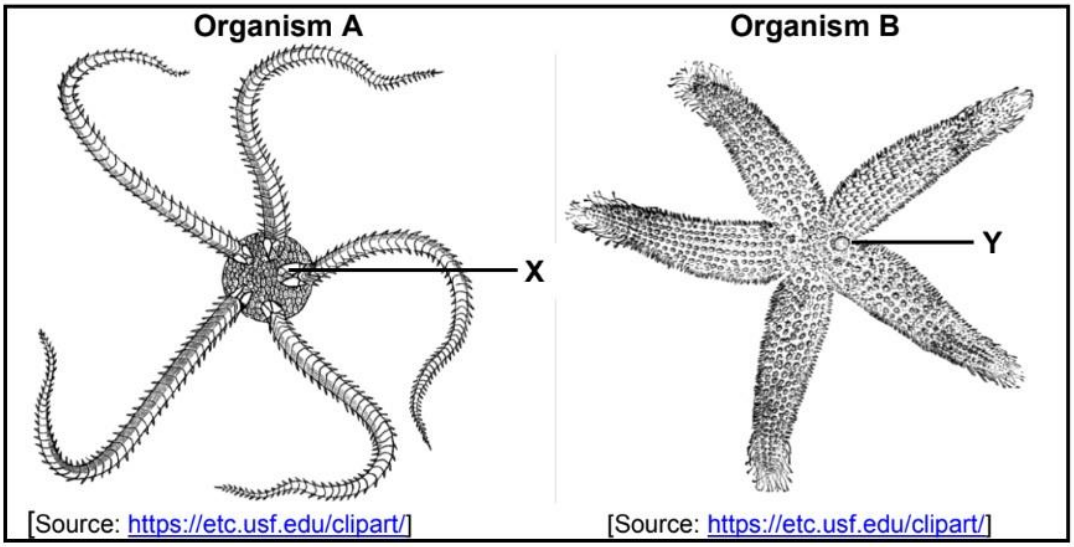
2.2 Provide labels for structures **A** and **B**. (2)

2.3 Describe how the structures mentioned in QUESTION 2.3.2 contributes to gaseous exchange. (3)

(6)

Question 3

Study the diagrams below and answer questions that follow.



[Source: https://etc.usf.edu/clipart/] [Source: https://etc.usf.edu/clipart/]

3.1 Label **X** are slit openings located on the oral side of the organism. Describe ONE function of label **X**. (3)

3.2 Label **Y** is sometimes mistaken as the organism's anus. Name AND explain the function of label **Y**. (3)

3.3 Compare the movement between organism A and organism B, by referring to their structural adaptations. (2)

3.4 Identify the surface shown in organism…

(a) **B**. (1)

(b) **A**. (1)

(9)

Topic: 58. Archaeological evidence of early human relationships with the sea and seafood

Question 1 (includes Overfishing)

Use the infographic below to answer the questions that follow.
Studying early coastal human populations in South Africa.

Background

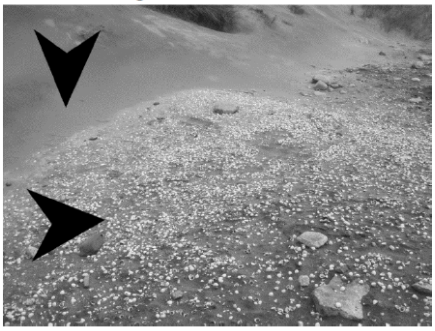
Archaeologists have been studying the ancient dump sites of early coastal dwelling populations. They focused mainly on the diet of these populations. After excavating a site, a researcher noted that the limpet shells in older parts of the dump site were larger than shells found in the younger parts (including living specimens of the same species). Carbon dating was used to determine the age of the shells found at the dumpsite and the sizes of shells were recorded in intervals of 10 000 years.

Table showing the average limpet shell radius found in the ancient dump sites over years.

Time in years	Size in millimetres (mm)
0 – 10 000	250
10 001 – 20 000	273
20 001 – 30 000	301
> 30 000	325

Excavation area of ancient dump site

(arrows indicating the direction of excavation)



Excavation process

The dump sites were excavated layer by layer. From the top outer layers to the deeper inner layers

Conclusion

The early coastal dwelling populations were referred to as the first sustainable harvesters. The data shows a different story. Excavations and research of these dumpsites continues.

1.1 Provide a scientific term for the 'ancient dumpsites' mentioned in the text. (1)

1.2 Motivate, in your opinion, if these dumpsites should be excavated. (2)

1.3 Discuss why the average shell radius of the limpets decreased over the 30 000-year period. (2)

1.4 Besides harvesting limpets from rocky shores, how else did early coastal dwelling populations gather food from the ocean? (3)

1.5 **It is believed that the early coastal dwelling populations overfished the coastal environment.**

(a) Discuss your opinion on the above statement. (2)

(b) Mention THREE ways in which modern humans are overfishing the coastal region. (3)

(c) Discuss FIVE key decisions for restoring fish stocks to sustainable levels. (5x2) (10)

(23)

Question 2

The coastline of South Africa has very interesting rock formations. Some of these, such as fish traps found between Gansbaai and Gouritz River, were made by early man in South Africa. The fish traps in the photo on the left below are from Stilbaai. Other rocky features have formed naturally over thousands of years through erosive forces. Look at these photographs to answer the questions that follow.

Man-made rock formations



[Source: https://frankiekayfotos.wordpress.com/2014/09/24]

Natural rock formations



[Source: https://www.alevelgeography.com/landforms-of-erosion/]

2.1 Explain how fish were trapped using these fish traps shown in the photo above? (5)

2.2 At another site close to Stilbaai, engraved ochre has been found.
Give the name of this archaeological site. (1)

(6)

Topic: 61. SA Shoreline

Fill in the missing term in each block

Term	Definition
	Subregions of the Afrotropical realmcontaining plant and animal speciesfound in the mountains of Africa and the southern Arabian Peninsula
	A broad shallow part of the southern African continental shelf, extending 250 km south of Cape Agulhas before falling steeply to the abyssal plain
	The region where the cold water of the Atlantic Ocean meets the warm water of the Indian Ocean
	Diamonds that have been removed from the primary Kimberlite source by natural erosive action over millions of years and eventually deposited in a new environment such as a riverbed, ocean floor or shoreline

	A genus of sea snails, marine gastropod molluscs in the family Nassariidae, the Nassa mud snails or dog whelks
	Plough snails found in the middle shore of sandy beaches
	Poorly sorted sedimentary rock
	Typically dark-coloured shale that is carbon-rich owing to the high vegetation content of the original sediments
	A gemstone formed of red silicate mineral
	Metamorphic rocks with a banded or foliated structure, typically coarse-grained and consisting mainly of feldspar, quartz, and mica
	A depressed geological structure bordered by a fault along one side, unlike a full-Graben, where a depressed block of land is bordered by parallel faults
	Rock composed of a metamorphic (altered) host material that is streaked or veined with granite rock; the name means “mixed rock”
	Flora that can withstand salt spray, growing in loose sand, its roots hold the coastline together
	The shape and form of something
	In geography the shape and structure of coastal systems or subsystems
	Convention on wetlands of international importance, especially waterfowl habitat
	An oxide mineral used as a source of titanium dioxide pigment, for use in plastics, paper products, paints, sunscreen, and even food colouring
	Fine-grained sedimentary rock formed from mud that is a mix of flakes of clay minerals and tiny particles of other minerals, especially quartz and calcite
	When magma moves upward in the Earth by breaking off and engulfing blocks of overlying rocks

	A fragment of foreign rock trapped within a host rock and having a different composition from the host rock
	A mineral widely used in the foundry industry mainly for casting and refractory applications

Question 1

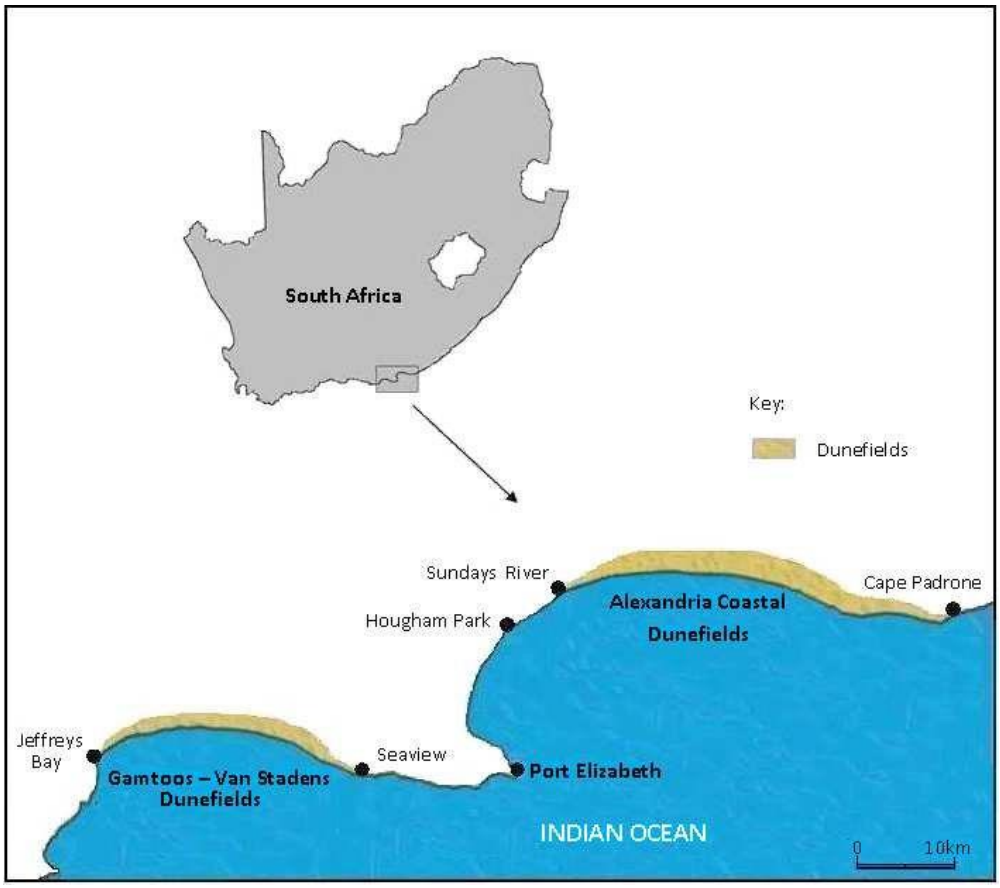
Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none**, next to the question number (1.1 to 1.10) e.g. 1.11 A only.

	Column I		**Column II**
1.1	Mossel Bay (South Coast)	**A**	Kosi Bay fish traps
		B	Pinnacle point
1.2	Blombos Cave	**A**	Artefacts dated to 77 000 years ago
		B	Engraved ochre
1.3	Knysna Heads	**A**	East Coast
		B	South Coast
1.4	North West Coast	**A**	Breede River
		B	Olifants River
1.5	KZN South Coast	**A**	Makatini clay thicket
		B	Sand forest
1.6	East Coast	**A**	Fish river
		B	Orange river
1.7	KZN North Coast	**A**	Oyster bay
		B	Kosi Bay
1.8	Petrified forest at Mzamba	**A**	East Coast
		B	KZN North Coast
1.9	Berg river	**A**	SW Coast
		B	NW coast
1.10	Tsitsikamma National Park	**A**	KZN South Coast
		B	KZN North Coast

(10x2)
(20)

Question 2

Below is a map indicating the location of the Alexandria Dune field east of Gqeberha



[Source: https://www.researchgate.net/]

2.1 Along which coastal region is the Alexandria Dune field located? (1)

2.2 Give the Köppen-Geiger classification for the Alexandria Dune field, which is found to the south of this coastal region? (1)

2.3 Name TWO places where Stone Age artefacts can be found in this coastal region. (2)

2.4 List the vegetation types that would typically be found dunes like the Alexandria Dune field in this coastal region. (5)

(9)

Topic 64: Diving Science Water and gas laws

Fill in the missing term in each block

Term	Definition
	The force exerted against a surface by the weight of the air above and surrounding the surface, due to gravity

	The capacity of a solid item to float on a fluid by displacing a volume of that fluid that is equal in weight to that item
	The tendency of an object to float in a fluid
	The measurement of the quantity or amount of material an object contains, causing it to have weight in a gravitational field
	An action of force applied against a surface and expressed in force per unit area
	The force with which an object is attracted towards the centre of Earth or celestial body by gravitation
	The force which is equal to the product of the mass and the gravitational constant
	A sensation of floating experienced when no external objects or contact forces are exerting a push or pull upon one's body
	In a parcel of air in which the temperature is kept constant, the gas volume decreases as the air pressure increases, and vice versa
	A painful condition when dissolved nitrogen in the blood stream bubbles out of solution due to rapid decompression, typically when a scuba diver ascends too quickly after diving at depth
	When the partial pressure of nitrogen becomes so high that it causes an effect similar to being intoxicated with alcohol. The deeper and faster the descent of the diver, the greater the effect
	When divers hold their breath on their ascent, forcing air into the veins of the lung which travels to the brain, causing a stroke
	In a parcel of air in which the temperature is kept constant, the gas volume decreases as the air pressure increases, and vice versa
	The pressure in a rigid container will change proportionally with absolute Kelvin temperature
	In a container holding different gases, the total pressure exerted on the sides of the container will be equal to the partial pressures of the individual gases

	The higher the pressure surrounding a body (e.g. a human body), the more gas is absorbed into the tissue of that body
	At a constant pressure and temperature, the volume of any gas is proportional to the number of gas molecules present. If the number of gas molecules increases, then the volume that the gas occupies also increases

Question 1

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A-D) next to the question numbers (1.1 to 1.4) in the ANSWER BOOK, e.g. 1.5 D.

Questions 1.1 and 1.2 are based on the following scenario

A diver at the surface descends to a depth of 15m in the water column, whilst holding a balloon with a volume of 10 litres.

1.1 Which gas law will apply to the volume of the gases in the balloon as the diver descends?

A. Charles' law
B. Guy Lussac's law
C. Boyle's law
D. Henry's law

1.2 What will the volume of balloon be at 15m in depth?

A. 3 litres
B. 4 litres
C. 5 litres
D. 6,6 litres

1.3 A diver at 30m below the surface inflates a balloon with 4 litres of air. What is the volume of the balloon as it reaches the surface?

A. 16 litres
B. 15 litres
C. 12 litres
D. 11 litres

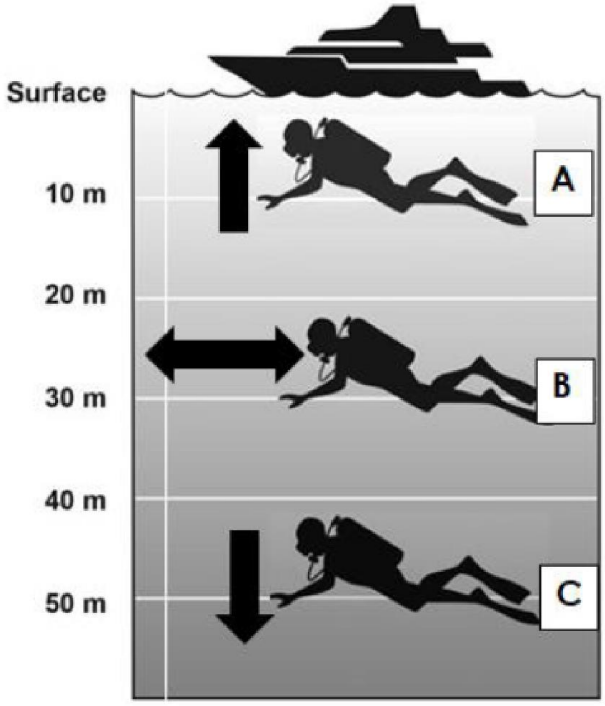
1.4 A dive cylinder on a boat was filled to 220 bars at 06:00 when the temperature was 11°C. It was then left on the boat until 15:00 where the pressure in the cylinder reached 240 bars. The temperature at 15:00 would then be ...

A. 12,0 °C.
B. 12,6 °C.
C. 36,8 °C.
D. 27,6 °C.

(4x2)
(8)

Question 2

The diagram below represents three types of buoyancy.



2.1 Provide the LETTER and NAME of the type of buoyancy that represents…

(a) buoyancy of cartilaginous skeletons in sharks. (2)

(b) when the immersed object is lighter than the fluid displaced. (2)

(c) when the immersed object is heavier than the fluid displaced. (2)

2.2 Name the apparatus that scuba divers use to control their buoyancy? (1)

2.3 Explain why you should not hold your breath while ascending. (3)

(10)

Question 3

Read the text based on a hypothetical scenario in the source below and answer the questions that follow.

On an island in the Indian Ocean, women dive for seafood which is a source of income. They have the ability to hold their breath for 8 minutes while diving.These women dive to depths of 30 metres where they inflate balloons which carry their harvest to the surface.

During training of the younger members of the village, some of the enthusiastic younger divers show signs of mild intoxication, as if they had consumed alcohol.

3.1 (a) Identify the medical condition that the young divers may be suffering from. (1)

(b) Describe the circumstances which lead to this medical condition. (3)

3.2 The balloon is filled to a volume of 2 litres at a depth of 16 metres and rises to the surface.

(a) Calculate the volume of the balloon at the surface. Assume that the temperature is constant. Show ALL calculations. (4)

(b) Explain why the balloon rises to the surface. (2)

(10)

Topic: 62. Marine Protected Areas

Fill in the missing term in each block

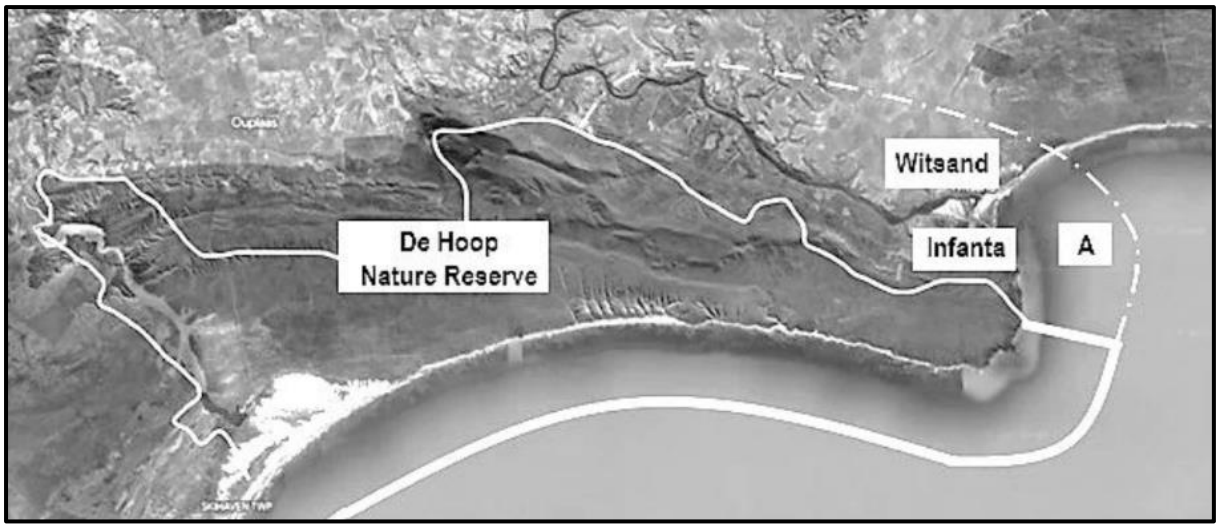
Term	Definition
	The provision of natural produce in a neighbouring area
	The regions of Earth occupied by living organisms
	An area made up of terrestrial, marine and coastal ecosystems that promote the conservation of nature and allows human use of the ecosystem in a sustainable way
	Biogeographic regions where there are high levels of diversity and where there is a significant level of threat to the biodiversity
	An area where the distribution of plants and animals have shared or similar characteristics through the region
	An area around the perimeter or the edge of a protected area. In this area there are restrictions on human activity to support the protection within the protected area
	The ability of an ecosystem to support and maintain the ecological processes as well as a diverse community of organisms
	The capacity of ecosystems to respond to pressures or disturbances by holding up against the damage and recovering rapidly from the human impacts
	Benefits to a habitat provided by nature and healthy ecosystems, such as provision of nutrients and good water quality
	The ability of an ecosystem to return to ecological equilibrium after a temporary human impact without undergoing large changes to its characteristics over time
	Tourism directed toward threatened, natural environments, intended to support conservation efforts and observe wildlife in that region

	The ecological state of only being found in a specific area
	The ecological state of being limited to a specific area
	A fishery fully used to a point that it needs to be left alone to recover at all
	Analysis performed using a software tool designed to help decision makers find good solutions for conservation planning problems. The goal is to maximise conservation while minimising cost to human endeavour.
	Areas of the oceans aimed at conserving environmental, social and cultural urpose
	No extractive activity is allowed in the area (set aside by the government)
	a group of items or people that closely matches the characteristics of its population as a whole
	A calculated reflection of the population from which it is drawn
	The population size of an individual species of any form of sea life regarded as food by humans, prominently including fish and shellfish
	The total combined mass of fish in a fish stock that are old enough to spawn or able to reproduce; the measurement of this mass is done as an estimate, e.g. 50% of the biological mass of a species of fish in a unit area

Question 1

Read the case study and view the map below to answer the question that follows.

The map below is an area found along the south coast of South Africa. The area within the solid white border is referred to as De Hoop Nature Reserve. Location **A** (as shown by the dotted line on the map) is where the Breede River flows into the ocean. The residents of Infanta and Witsand live near the Breede River mouth. The local government intends to expand the De Hoop Nature Reserve into location **A**, including both areas as part of the marine protected area (MPA). This expansion means that the residents will live within the MPA.



[Adapted from https://earth.google.com]

1.1 Define and explain what MPAs are. (9)

1.2 Discuss how Pressey's checklist will be used as a participatory approach with the residents and marine users within location A, to motivate for the expansion of the MPA. (14)

1.3 Elaborate on how the local government will determine whether the MPA expansion project is successful or not. (8)

1.4 Discuss why location A should have been included as part of the original MPA. (6)

1.5 Expand on the potential impact of the MPA extension project on the economic functionality of the residents close to location A. (3)

(40)

Topic: 63. Marine Ecotourism

Fill in the missing term in each block

Term	Definition
	Destruction of the environment through pollution, or loss of ecosystems and habitat
	Responsible travel to natural areas in a way that conserves the environment, sustains the well-being of the local people, and involves interpretation and education of guests and staff
	Giving false or misleading information as to the environmental benefits of a product or service

	Experiences offered to tourists centred on wild or natural environments
	A form of tourism where overcrowding above the carrying capacity of a site results in overuse and damage of resources
	Activities in which people travel and spend time away from home in pursuit of recreation, pleasure and relaxation using services for the experience and for their leisure

Question 1

Read the case study and view the image below to answer the question that follows.

The picture below is of a beach close to a large coastal city. In the past, this area had pristine beaches, a great abundance of biodiversity, large amounts of algae and great fish species diversity. Tourists used the warm ocean water for swimming, snorkelling, recreational diving and sports fishing. Tourism activities increased in the area, up to a point where it started to influence the ecological balance negatively. Due to overtourism, the biodiversity has decreased drastically, and the environment has started to degrade.

The International Ecotourism Society (TIES) has recommended closure of the coastal area to the public for a set period of time. The goal of implementing the management strategy is to mitigate the long-term degradation of the area and prevent a relapse (prevent the environment from being damaged again).



[Source: https://www.easybeaching.com/growing-concern-of-beach-pollution]

1.1 Discuss the influence that overtourism has on this ecosystem. (7)

1.2 Elaborate on how the local government will know whether the closure resulted in successful rehabilitation of the ecosystem. (12)

1.3 Discuss SIX ways in which this area can be utilised sustainably after re-opening. (12)

1.4 Expand, in detail, on how ecotourism can be promoted to avoid a relapse of this ecosystem. (9)

1.5 In your opinion, will the rehabilitation strategy be a sustainable plan for the coastal area indicated in the image? (2)

(42)

Topic 65: Estuaries

Fill in the missing term in each block

Term	Definition
	River mouths and their associated banks and beds which are subject to the tidal ebb and flow of the sea water they discharge into
	A falling or outgoing tide
	A rising or incoming tide
	A food chain consisting of organisms small enough to live in the spaces between sand particles and feed on organic detritus

Topic 66: Kelp Forests

Fill in the missing term in each block

Term	Definition
	The infratidal zone, down to a depth of about 1–2 m.
	The infratidal zone, where smaller Sea bamboo (*Ecklonia maxima*) and large amounts of benthic algae can be found
	The infratidal zone, where water depths are less than 15 m.
	The infratidal zone, where dense stands of Sea bamboo grow, with Split fan kelp (*Laminaria pallida*) forming an understorey, along with seaweeds that are mainly of the red variety
	The infratidal zone, where water depths are more than 15 m.
	The infratidal zone, featuring mainly island-like stands of Split fan kelp, in between which are extensive sections of open reef.

Question 1

Read the article on kelp forests below and answer the questions that follow.

SECRET GIANT KELP FOREST OFF CAPE TOWN CATCHES GLOBAL ATTENTION

A giant forest along the South-west Coast of South Africa would have probably remained out of sight if it was not for the Netflix film My Octopus Teacher which, among other prizes, won the 2021 BAFTA Award for the Best Documentary. The film has also succeeded in drawing public attention to kelp forests around the world. In fact, activists of the Sea Change Project have renamed the kelp forest where the film was shot as The Great African Sea Forest to give it similar attention as the Great Barrier Reef.

[Adapted from https://seachangeproject.com/great-african-seaforest]

1.1 Other than the Southern Coast, where can kelp forests be found in South Africa? (1)

1.2 'The film has also succeeded in drawing public attention to kelp forests around the world.' Explain FOUR ecological significant roles of kelp forests that thepublic should be made aware of. (8)

(9)

Topic 67: Commercial Use of Marine Algae

Fill in the missing term in each block

Term	Definition
	A jelly-like substance extracted from red algae
	A gelling agent, thickener and a stabiliser in many water-based foodstuffs extracted from kelp (brown algae)
	The breeding, rearing, and harvesting of fish, shellfish, algae, and other organisms in all types of water environments
	The farming of freshwater or saltwater organisms in controlled or semi-controlled environments called holding systems
	The red-orange pigment contained in certain seaweeds, particularly Chlorophyta (green algae)
	The sulphur containing polysaccharide extracted from many red algae
	Substances which promote the growth of microorganisms
	The farming of marine organisms
	To do with the production of medicinal products

Topic 68: Chordata

Fill in the missing term in each block

Term	Definition
	Animal phyla in which the blastopore becomes the anus
	A rod of firm connective tissue supporting and possibly enclosing a dorsal nerve cord
	A group of animals having a notochord which is not divided into vertebral segments and in some organisms the notochord may only be present in the larval form
	A notochord divided into flexible segments of cartilage or bone
	The Subphylum of animals which have a vertebral column

ANSWERS

TOPIC: 45. Chemistry of sea water

Term	Definition
Anion	An atom that has gained one or more electrons and has a negative electric charge
Atoms	The smallest units of ordinary matter that give the elements their distinct properties
Atom	The smallest unit of matter comprised of a nucleus at the center, containing protons and neutrons, and electrons that orbit the nucleus
Cation	An atom that has lost one or more electrons and has a positive electric charge
Covalent bonds	Chemical bonds between two non-metal atoms that share valence electrons
Electronegativity	An atom's tendency to attract the shared electrons of a covalent bond to itself
Electrons	Subatomic particles that orbit the nucleus of an atom and have a negative electric charge
Elements	Made up of two or more atoms of the same kind, held together by chemical bonds and cannot be broken down into simpler substances

Hydrogen bond	A force of attraction that results in the covalently bond between a hydrogen (H) atom and an electronegative atom, such as nitrogen (N), oxygen (O) or fluorine (F)
Ion	An electrically charged atom or a group of atoms that results in an unbalanced electrical charge because it has either lost or gained one or more electrons
Ionic bonds	Linkages that hold metal atoms and non-metal atoms together owing to the electrostatic attraction between oppositely charged ions, i.e. the positive and negative charges of the metal and non-metal ions
Molecule	The simplest unit of a chemical substance, made up of two or more atoms that are chemically bonded together
Neutrons	Electrically neutral subatomic particles found in the nucleus of an atom
Non-polar molecules	Molecules formed either due to having covalent bonds where electrons are equally shared, or, in the example of CO_2 (O=C=O) where C=O double bond is polar covalent but points in exactly the opposite direction to the other C=O double bond, thus the two dipoles cancel each other out and the molecule as a whole is non-polar
Nucleus	The positively charged central region of an atom, composed of protons and neutrons
Outer shell	In the shell atomic model the number of electrons in this shell determines the reactivity or the ability of an atom to form chemical bonds (The shell atomic model is a simplified description of the structure of atoms. The first shell is closest to the nucleus; the others extend outward from the nucleus and overlap one another (ref Britannica))
Polar bond	A covalent bond between two atoms where one end of the molecule is slightly positive and the other end of the molecule is slightly negative, i.e. the distribution of electrons between the covalently bonded atoms is not even
Polar bond	A covalent bond where the distribution of electrons between the covalently bonded atoms is not even
Polar nature	Having a type of chemical bond where a pair of electrons is unequally shared between two atoms

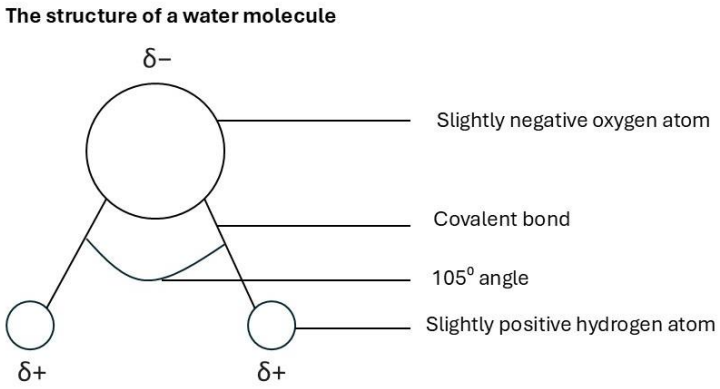
Protons	Positively charged subatomic particles found in the nucleus of an atom
Salinity	The concentration of dissolved salt in a given volume of water, expressed in grams of salt per 1000 g (1kg) of water (parts per thousand, ‰)
Universal solvent	A liquid substance that is capable of dissolving most chemicals
Universal solvent	The property of water that allows it to dissolve more materials than any other liquid
Valence electrons	Electrons in the outermost shell of atoms that enter into the formation of chemical bonds

Question 1

1.1 C ✓✓
1.2 B ✓✓
1.3 C ✓✓
1.4 B ✓✓
1.5 D ✓✓ (5x2)
(10)

Question 2

2.1



MARKING GUIDELINES		
CRITERIA	**ELABORATION**	**MARK ALLOCATION**
Correct drawing **(D)**	One oxygen atom and two hydrogen atoms. The molecule has a bent shape.	1
Suitable heading **(H)**	Descriptive heading	½
Drawing technique (**T**)	• Drawing in pencil • Drawing neat solid lines (not more than 45-55% shading - marker's discretion)	½ ½
Labels (**L**)	Mark any 3	3 x ½

(4)

2.2
- A water molecule is composed of two hydrogen atoms and one oxygen atom. ✓
- The atoms are covalently bonded ✓ / hydrogen atoms shares its electrons with oxygen
- Forms a dipole ✓ / polar molecule / bipolar
- with the oxygen side being slightly / partially negative and hydrogen side being slightly positive. ✓
- Resulting in a bent (-shaped) molecule ✓
- Hydrogen and oxygen bond at an angle of 105° ✓ (6)

2.3
- Water is a polar molecule ✓
- When NaCl is introduced to water, it dissociates into positive Na+ cations ✓
- and negative Cℓ- anions ✓
- as the ionic bonds between Na+ and Cℓ- are weakened by the polarity of water ✓
- The ions are attracted to the water molecule ✓ (5)

2.4
- The molecules in oils are non-polar ✓
- meaning they are neither positive or negative ✓
- They therefore cannot attract water molecules ✓
- We call this characteristic hydrophobic ✓ (4)

(19)

Topic: 56. Shores – Rocky and Sandy

Term	**Definition**
Argenvillei zone	A low shore eulittoral zone characterised by dome-shaped argenvillei limpets
Balanoid zone	A middle shore eulittoral zone, characterised by the presence of balanoid barnacles
Behavioural adaptations	Specific forms of behaviour exhibited by animals to increase their chances of survival
Cochlear zone	A low shore eulittoral zone characterised by pear-shaped cochlear limpets
Eulittoral	Another term referring to the intertidal zone
Euryhaline	Refers to marine animals which are able to survive in a wide range of salinities
Infratidal zone	The region just below the spring low-tide mark
Intertidal zone	The region between the spring low- and high-tide marks
Littorina zone	A high-shore eulittoral zone, characterised by small winkles

Meiofauna	The almost microscopic heterotrophs in soil or sediment ecosystems, often referred to as decomposers
Meiofaunal food chain	A food chain involving almost microscopic organisms, living in soil or sediment, which ultimately release nutrients for producers in larger food chains
Shore	The dynamic zone where land and sea meet
Shoreline	The specific line to which the sea reaches on the shore at any given moment
Wanes (moon)	The moon appears to be growing smaller
Waxes (moon)	The moon appears to be growing larger

Question 1

1.1 A ✓✓
1.2 B ✓✓
1.3 D ✓✓
1.4 C ✓✓
1.5 C ✓✓
1.6 C ✓✓
1.7 D ✓✓
1.8 C ✓✓ (8x2)
(16)

Question 2

2.1 - The area between the high- and low tide mark ✓✓ (2)

2.2 **ZONE**
- Middel – eulittoral zone ✓ / Lower-Balanoid zone

ORGANISM
- Limpets / Mussels /algae ✓ (2)

2.3 - Barnacles ✓
- Limpets ✓ (2)

2.4 - Desiccation✓
- Light Intensity ✓
- Temperature ✓ (3)

2.5 **IF NO**
- They would not be adapted to living at higher temperatures / light intensity / increased desiccation

IF YES
- They are not exposed to water for some part of the day and are thus adapted to the same conditions

1 mark if Opinion and Motivation correlates 1 mark for motivation (Any logical relevant substantiating answer, marker discretion for insightful thinking) (2)

(11)

Question 3

3.1 (a) Exposure time (hours) ✓
(b) Average percentage (%) change in mass ✓ (2)

3.2 - The longer the exposure time, the greater the average percentage change in mass (for both species)

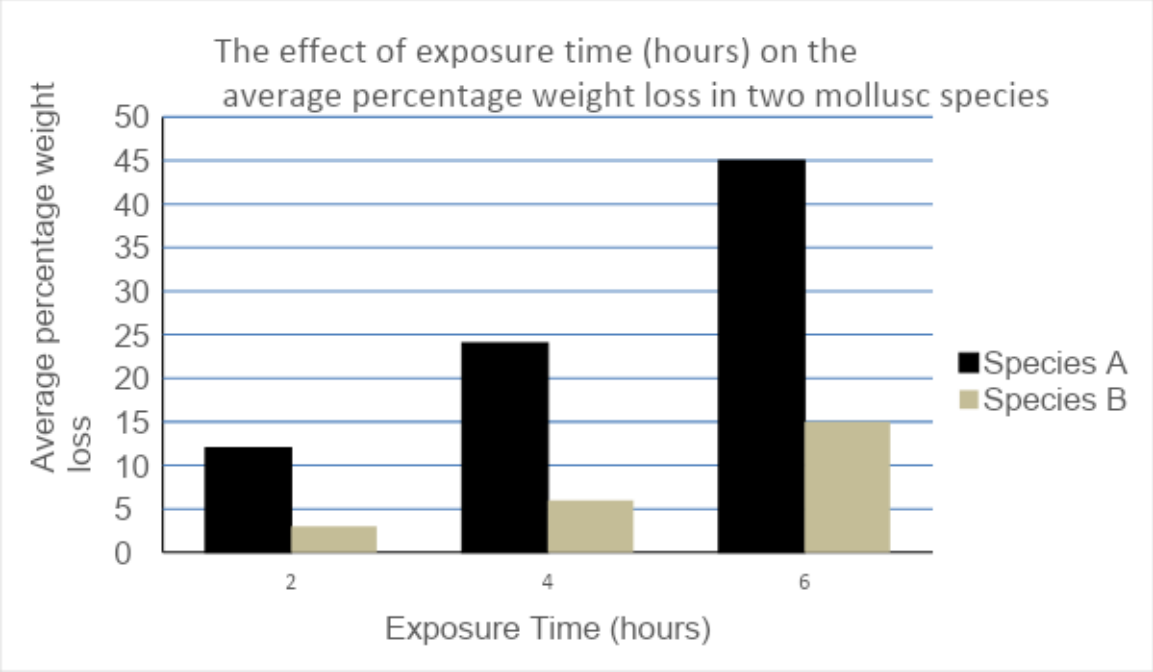
OR

- The shorter the exposure time, the lower the average percentage change in mass (for both species)

Both variables (Temperature AND growth rate) **present** ✓
Direction of prediction ✓ (2)

3.3

MARKING GUIDELINES	
CRITERIA	**MARK ALLOCATION**
Descriptive heading (**H**)	½
Heading includes both variables (Exposure time and Average percentage (%) change in mass) (**V**)	½
Type of graph: Bar graph (**T**)	½
Independent variable (**I**) (X-axis: Time)	½
Dependent variable (**D**) (Y-axis: Average percentage (%) change in mass)	½
Label for X-axis (**XL**)	½
Label for Y-axis (**YL**)	½
Unit of measurement of X-axis (**XM**)	½
Unit of measurement of Y-axis (**YM**)	½
Formatting of bars: Bars width equal (**BW**) Bars spaces equal (**BS**)	 ½ ½
Appropriate scale on Y-axis (**YS**)	½
Plotting (**P**)	Any 4 x ½



-

(8)

3.4 (a) (Species) B ✓ (1)
(b) (Species) A ✓ (1)

3.5
- The middle eulittoral zone is more exposed ✓
- Than the lower eulittoral zone ✓
- As species B experienced the lowest average percentage change in mass ✓
- It shows that species B is best suited/adapted to the middle eulittoral zone ✓ (4)

(18)

Topic: 57. Echinoderms

Term	**Definition**
Aboral surface	The surface of an echinoderm opposite the oral surface
Ambulacral groove	The grooves on the arms of echinoderms from which tube feet extend
Blastopore	The first body opening that forms in the early stages of embryo development
Blastula	A stage in embryonic development when the embryo is a hollow sphere

Bursae	Water-filled compartments around the stomachs of Brittle stars which open to the outside
Catch-connective tissue	Tissue beneath the skin of some echinoderms enabling them to extensively alter the flexibility of their skin
Cirri	The small, jointed legs with which Feather stars hold onto their substrate and Barnacles filter feed
Coelomocytes	Phagocytic cells in the coeloms of echinoderms, responsible for engulfing excretory products and preventing infection
Deuterostome	Animal phyla in which the blastopore becomes the anus
Madreporite	Asieve-like plate which allows seawater to enter the water-vascular system of echinoderms
Morula	An early stage of embryonic development when the embryo is a small solid collection of cells
Oral surface	The surface of an echinoderm on which the mouth is found
Ossicles	Small bones in some animals or the flat bony plates forming the skeleton of echinoderms
Papulae	Small extensions of the water-vascular system of echinoderms, outside the skin, enabling a surface for the exchange of gases and other chemicals
Pedicellariae	A range of tiny protective nippers extending from the skin of some echinoderms
Phagocytic	Can engulf small particles and foreign cells into itself
Pinnules	Sideward extensions from the arms of feather stars
Podia	Echinoderm tube feet which have become modified to perform functions other than locomotion and adhesion

Protostome	Animal phyla in which the blastopore becomes the mouth
Pyloric caecae	Tubes extending from the stomach of an echinoderm and into the arms, assisting in the digestion and distribution of food
Respiratory tree	Feathery branches extending into the coelom from the rectum of Sea cucumbers which draw in sea water to aid gaseous exchange
Test	The skeleton of an echinoid echinoderm like a Sea urchin
Tube feet	Tubular extensions of the echinoderm water-vascular system, which normally have suckers on the ends and enable them to anchor themselves, as well as move around
Water-vascular system	A system of water-filled compartments and muscular sacs which control the tube feet of echinoderms and assist internal transport of chemical substances

Question 1

1.1 B ✓✓
1.2 C ✓✓
1.3 D ✓✓
1.4 D ✓✓
1.5 A ✓✓
1.6 A ✓✓
1.7 A ✓✓
1.8 A ✓✓
1.9 B ✓✓
1.10 B ✓✓
1.11 D ✓✓ (11x2)
(24)

Question 2

2.1 - Holothuroidea ✓ (1)

2.2 A - respiratory tress ✓
B- cloaca / anus ✓ (2)

2.3 - Seawater can be drawn through the anus ✓
- and circulated through the respiratory trees ✓
- to provide an extensive gaseous exchange surface inside the coelom ✓ (3)

(6)

Question 3

3.1
- Bursae ✓*
- provides a large surface area through which gaseous exchange ✓ can take place
- keep the eggs inside where they are fertilised and develop ✓ into small adults, before crawling out to fend for themselves. (3)

3.2
- Madreporite ✓*
- allows water to be fed into the water-vascular system ✓
- which then equalises the pressure ✓ within the body in relation to the outside. (3)

3.3 **Organism A**
- Dragging themselves along with their very flexible arms ✓
- It is possible that the tube feet help by sticking to the substrate ✓

Any 1

Organism B
- Glides effectively over any surface, using multiple rows of these tube feet ✓/ muscular sucker (2)

3.4 (a) Aboral ✓ surface (1)

(b) Oral ✓ surface (1)

(9)

Topic: 58. Archaeological evidence of early human relationships with the sea and seafood

Question 1 (includes Overfishing)

1.1
- Middens ✓ (1)

1.2 **IF YES**

- It helps us understand how these ancient civilisations lived. ✓
- It is an important part of South African heritage and should be protected / documented. ✓

IF NO

- These sites might be deemed as sacred by some individuals and should be left undisturbed. ✓
- There are so many sites along our coast and not all of them should be excavated. ✓

Open ended question
One mark if answer and reason correlates.
One mark for reason
Accept any other logical relevant answer. (2)

1.3
- As the people harvested the largest limpets. ✓
- The gene pool for large limpets became smaller. ✓

OR

- Due to lower levels of calcium carbonate (aragonite) being available ✓
- limpet shell size decreased. ✓

(mark any other logical relevant answer) (2)

(cause and effect)

1.4
- Used fish stone traps along with the tides to capture fish ✓
- Used reed traps to in shallow estuaries ✓
- Would eat food washed out on the beach (scavenge) ✓ (3)

1.5 (a) **IF YES**
- The middens indicate that as consumption/harvesting continued the limpet shells decreased. ✓
- A permanent change was made in the limpet populations due to these harvesters. ✓

IF NO
- These people did not fish on a commercial scale and were seen as hunter gatherers. ✓
- There is not enough evidence to prove that the decrease in shell size is due to the harvesting of the limpets. ✓ (2)

(b)
- Hand lines used by fishers. ✓
- Unregulated harvesting of species. ✓
- Illegal harvesting / poaching. ✓

(Accept any other logical relevant reasoning applied to coastal area) (3)

(c)
- The biology and life cycle of that species ✓*
- e.g., should be studied to know when and where to harvest the species. ✓

- The population size ✓*
- e.g., species with larger populations should be considered above low number species. ✓

- Their lengths ✓*
- e.g., catching larger individuals might mean they are not sexually mature yet and will not be able to reproduce. ✓

- The ages ✓*
- e.g., if juvenile fish are caught the population will not show growth as older reproducing individuals are not replaced. ✓

- The spawner biomass that can replenish the volumes of fish already removed✓*
- e.g., Protecting the reproducing species can result in the populations gradually increasing. ✓

(1 mark for decision✓* and 1 mark for discussion✓)

(5x2) (10)

(23)

Question 2

2.1
- During spring high tide ✓
- The seabed at the trap slopes gently upward ✓
- Fish swam over the stone wall into the area (while foraging) ✓
- When the tide subsides, water drained between the stones ✓
- Larger fish get trapped on dry rocks on the shore side of the wall ✓

(5)

2.2 Blombos cave ✓ (1)

(6)

Topic: 61. SA Shoreline

Term	Definition
Afromontane	Subregions of the Afrotropical realm containing plant and animal species found in the mountains of Africa and the southern Arabian Peninsula
Agulhas Bank	A broad shallow part of the southern African continental shelf, extending 250 km south of Cape Agulhas before falling steeply to the abyssal plain
Agulhas Bank	The region where the cold water of the Atlantic Ocean meets the warm water of the Indian Ocean
Alluvial diamonds	Diamonds that have been removed from the primary Kimberlite source by natural erosive action over millions of years and eventually deposited in a new environment such as a riverbed, ocean floor or shoreline
Bullia	A genus of sea snails, marine gastropod molluscs in the family Nassariidae, the Nassa mud snails or dog whelks
Bullia	Plough snails found in the middle shore of sandy beaches
Dwyka tillite	Poorly sorted sedimentary rock
Ecca shales	Typically dark-coloured shale that is carbon-rich owing to the high vegetation content of the original sediments
Garnet	A gemstone formed of red silicate mineral
Gneisses	Metamorphic rocks with a banded or foliated structure, typically coarse-grained and consisting mainly of feldspar, quartz, and mica

Half-Graben	A depressed geological structure bordered by a fault along one side, unlike a full-Graben, where a depressed block of land is bordered by parallel faults
Migmatite	Rock composed of a metamorphic (altered) host material that is streaked or veined with granite rock; the name means “mixed rock”
Littoral strand vegetation	Flora that can withstand salt spray, growing in loose sand, its roots hold the coastline together
Morphology	The shape and form of something
Morphology	In geography the shape and structure of coastal systems or subsystems
Ramsar Convention	Convention on wetlands of international importance, especially waterfowl habitat
Rutile	An oxide mineral used as a source of titanium dioxide pigment, for use in plastics, paper products, paints, sunscreen, and even food colouring
Shales	Fine-grained sedimentary rock formed from mud that is a mix of flakes of clay minerals and tiny particles of other minerals, especially quartz and calcite
Stoping	When magma moves upward in the Earth by breaking off and engulfing blocks of overlying rocks
Xenolith	A fragment of foreign rock trapped within a host rock and having a different composition from the host rock
Zircon	A mineral widely used in the foundry industry mainly for casting and refractory applications

Question 1

1.1 B only ✓✓
1.2 Both A and B ✓✓
1.3 B only ✓✓
1.4 None ✓✓
1.5 Both A and B ✓✓
1.6 A only ✓✓
1.7 B only ✓✓
1.8 A only ✓✓
1.9 A only ✓✓
1.10 None ✓✓

(10x2)
(20)

Question 2

2.1 East Coast ✓ (1)

2.2 Cfb ✓ (1)

2.3
- The mouth of the Great Fish River ✓
- Melkhoutboom Cave ✓ (2)

2.4
- Dense subtropical thicket
- Evergreen Afromontane forest in the river valleys
- Fynbos
- Aloe
- Grassland interspersed with coastal thicket (5)

(9)

Topic 64: Diving Science Water and gas laws

Term	Definition
Atmospheric pressure	The force exerted against a surface by the weight of the air above and surrounding the surface, due to gravity
Buoyancy	The capacity of a solid item to float on a fluid by displacing a volume of that fluid that is equal in weight to that item
Buoyancy	The tendency of an object to float in a fluid
Mass	The measurement of the quantity or amount of material an object contains, causing it to have weight in a gravitational field
Pressure	An action of force applied against a surface and expressed in force per unit area
Weight	The force with which an object is attracted towards the centre of Earth or celestial body by gravitation
Weight	The force which is equal to the product of the mass and the gravitational constant
Weightlessness	A sensation of floating experienced when no external objects or contact forces are exerting a push or pull upon one's body
Boyle's Law	In a parcel of air in which the temperature is kept constant, the gas volume decreases as the air pressure increases, and vice versa

The bends	A painful condition when dissolved nitrogen in the blood stream bubbles out of solution due to rapid decompression, typically when a scuba diver ascends too quickly after diving at depth
Nitrogen Narcosis	When the partial pressure of nitrogen becomes so high that it causes an effect similar to being intoxicated with alcohol. The deeper and faster the descent of the diver, the greater the effect
Air embolism	When divers hold their breath on their ascent, forcing air into the veins of the lung which travels to the brain, causing a stroke
Boyle's Law	In a parcel of air in which the temperature is kept constant, the gas volume decreases as the air pressure increases, and vice versa
Gay Lussac's Law	The pressure in a rigid container will change proportionally with absolute Kelvin temperature
Dalton's law	In a container holding different gases, the total pressure exerted on the sides of the container will be equal to the partial pressures of the individual gases
Henry's Law	The higher the pressure surrounding a body (e.g. a human body), the more gas is absorbed into the tissue of that body
Avogadro's Law	At a constant pressure and temperature, the volume of any gas is proportional to the number of gas molecules present. If the number of gas molecules increases, then the volume that the gas occupies also increases

Question 1

1.1 A ✓✓
1.2 B ✓✓
1.3 A ✓✓
1.4 C ✓✓ (4x2)
(8)

Question 2

2.1 (a) B ✓ – Neutrally ✓ buoyant (2)

(b) A ✓ – Positively ✓ buoyant (2)

(c) C ✓ – Negatively ✓ buoyant (2)

2.2 Buoyancy control device ✓ / BCD (1)

2.3
- As you ascend the volume of the air expands ✓
- as Volume increase as pressure decreases. ✓
- The expanding air may result in an air embolism✓ (3)

(10)

Question 3

3.1 (a) Nitrogen narcosis ✓ (1)

(b)
- They descended too deep and too fast ✓
- resulting in the partial pressure of nitrogen becoming very high ✓
- The diver will show signs of euphoria ✓ (3)

3.2 (a) P1 = 1,6 + 1 = 2,6 bar P2 = 1 bar

V1 = 2 litres V2 = X litres

$P_1V_1 = P_2V_2$ **OR** $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$V_2 = \frac{P_1V_1}{P_2}$

1 mark ✓ – correct formula OR rearranging formula)

$V_2 = \frac{(2,6)(2)}{1}$ ✓

= 5,20 ✓ litres✓ (4)

(b)
- The air is less dense than water ✓
- making the balloon positively buoyant ✓ (2)

(10)

Topic: 62. Marine Protected Areas

Term	Definition
Adjacent yield	The provision of natural produce in a neighbouring area
Biosphere	The regions of Earth occupied by living organisms
Biosphere reserve	An area made up of terrestrial, marine and coastal ecosystems that promote the conservation of nature and allows human use of the ecosystem in a sustainable way
Biological hotspots	Biogeographic regions where there are high levels of diversity and where there is a significant level of threat to the biodiversity
Biogeographic region	An area where the distribution of plants and animals have shared or similar characteristics through the region

Buffer OR Transitional protection zone	An area around the perimeter or the edge of a protected area. In this area there are restrictions on human activity to support the protection within the protected area
Ecological integrity	The ability of an ecosystem to support and maintain the ecological processes as well as a diverse community of organisms
Ecosystem resilience	The capacity of ecosystems to respond to pressures or disturbances by holding up against the damage and recovering rapidly from the human impacts
Ecosystem services	Benefits to a habitat provided by nature and healthy ecosystems, such as provision of nutrients and good water quality
Ecosystem stability	The ability of an ecosystem to return to ecological equilibrium after a temporary human impact without undergoing large changes to its characteristics over time
Ecotourism	Tourism directed toward threatened, natural environments, intended to support conservation efforts and observe wildlife in that region
Endemism	The ecological state of only being found in a specific area
Endemism	The ecological state of being limited to a specific area
Exploited fish species	A fishery fully used to a point that it needs to be left alone to recover at all
Marxan Analysis	Analysis performed using a software tool designed to help decision makers find good solutions for conservation planning problems. The goal is to maximise conservation while minimising cost to human endeavour.
Marine Protected Areas	Areas of the oceans aimed at conserving environmental, social and cultural urpose
No-take	No extractive activity is allowed in the area (set aside by the government)
Representative sample	a group of items or people that closely matches the characteristics of its population as a whole
Representative sample	A calculated reflection of the population from which it is drawn

Seafood stocks	The population size of an individual species of any form of sea life regarded as food by humans, prominently including fish and shellfish
Spawner biomass	The total combined mass of fish in a fish stock that are old enough to spawn or able to reproduce; the measurement of this mass is done as an estimate, e.g. 50% of the biological mass of a species of fish in a unit area

Question 1

1.1
- Is an area of the ocean that is given greater protection than surrounding areas, ✓
- Such as biosphere reserves ✓ / fishery reserve / harvest refuge / marine reserve / marine park / marine sanctuary / no take marine reserve (give one example)
- It is a clearly defined geographical space, ✓
- recognised, dedicated, and managed through legal ✓ / effective means
- to achieve the conservation of nature ✓/ cultural values.
- They restrict human exploitation ✓ / overuse / misuse.
- It protects the environment and the organisms living within it. ✓
- Promoting ecological stability, ✓
- rehabilitation and restoration. ✓ (9)

1.2
- Identify stakeholders and inform them of the conservation initiative ✓ / idea (e.g. Cape Nature / Resident Conservation Society researching the area).
- Set goals for the (conservation) system ✓
- Inform stakeholders of the state of the plants, animals / species in the area. ✓
- Discuss how the residents could (potentially) benefit from the expansion, with the stakeholders ✓
- Discuss the (potential) pros and cons of the expansion with users (fishers, tourists, divers, game rangers, conservation officials, scientists etc.) ✓
- Data on the features to be represented (and protected such as fish counts) are compiled and evaluated.✓
- Conservation goals are translated into quantitative targets ✓ / goals, benefits and objectives are communicated to all parties involved (via WhatsApp groups and signage boards).
- Contribution of existing reserves to meeting targets is determined ✓ (like at Stilbaai)
- Algorithms / irreplaceability analyses are used to show how this area will meet conservation goals. ✓
- Conservation action is implemented ✓ / Residents are made aware of final outcomes of the planning process
- An adaptive management approach ✓ / such as closing easy access roads / improved awareness / campaigning

- based on constant monitoring of the conservation system is followed ✓ / residents can be involved in local management of monitoring of the conservation system

Checklist should be more or less in order (at least 4 steps) ✓*

Applying Pressey's list to INFANTA / WITSAND / BREEDE RIVER MOUTH ✓* (14)

(12 + **2 compulsory ✓*** marks)

1.3
- The vulnerability status of the habitat ✓ / organisms is decreasing.
- Biodiversity abundance is increasing. ✓
- Spawner biomass increases. ✓
- Adjacent yield is more abundant ✓ / spill-over effect.
- Successful research can be conducted in the area.✓
- Monitoring if actual steps are occurring ✓ (not just on paper).
- The human impact on the area is decreasing. ✓
- Environmental Education is taking place in the area ✓ / greater awareness of the conservation status of the area.
- Expression of satisfaction from stakeholders ✓

(Any logical relevant substantiating answer, marker discretion for insightful thinking) (8)

1.4
- This area is an estuary, ✓
- which is a breeding ground, ✓
- a nursery / feeding ground for marine species ✓
- Often rich in nutrients (from upstream) ✓
- Estuaries are seen as biodiversity hotspots ✓
- More sustainable tourism practices ✓

(Any logical relevant substantiating answer, marker discretion for insightful thinking) (6)

1.5 **1 mark if trend and reasoning correspond.**
2 marks for expansion
Positive
- Ecotourism will increase. ✓
- There will be more income for conservation ✓ / research / awareness programmes.
- Opportunities within the MPA can lead to economic stability for the residents ✓
- Researchers / universities might conduct studies in the area. ✓
- Government / private investment in the area might increase. ✓
- There will be a greater buy-in of stakeholders. ✓

OR

Negative
- The local people will not be able to live off the land as they used to. ✓
- Jobs based on nature tourism might be lost. ✓
- People might move away from the area, leading to a decrease in population. ✓
- New legislations might limit the activities the local people do in the area ✓ (less entrepreneurial freedom).

(Any logical relevant substantiating answer, marker discretion for insightful thinking) (3)

(40)

Topic: 63. Marine Ecotourism

Term	Definition
Degradation	Destruction of the environment through pollution, or loss of ecosystems and habitat
Ecotourism	Responsible travel to natural areas in a way that conserves the environment, sustains the well-being of the local people, and involves interpretation and education of guests and staff
Greenwashing	Giving false or misleading information as to the environmental benefits of a product or service
Nature-based tourism	Experiences offered to tourists centred on wild or natural environments
Over-tourism	A form of tourism where overcrowding above the carrying capacity of a site results in overuse and damage of resources
Tourism	Activities in which people travel and spend time away from home in pursuit of recreation, pleasure and relaxation using services for the experience and for their leisure

Question 1

1.1
- Tourists are using the area for their pleasure, leading to unintentional damage to the environment. ✓
- The site's carrying capacity is reached✓/ overcrowding.
- Increased waste / litter / sewage ✓ (must indicate type of pollution)
- Organisms in the area might be chased away/ trampled upon.
- Sound pollution increases. ✓
- To prevent overharvesting ✓ of resources e.g. too much fishing
- Boating activities place anchor buoys ✓ which drag along the seafloor
- Habitat / breeding site destruction ✓

(Any logical relevant substantiating answer, marker discretion for insightful thinking) (7)

1.2
- Monitor that litter decreases. ✓
- Measure plant growth increasing. ✓
- Algae populations becoming more abundant.✓
- Fish populations size increase. ✓
- (Fish) biodiversity increases. ✓
- Catch yield of fishers increases. ✓
- Bird life returning. ✓
- Animals will use the area as a nesting ✓ / breeding ground.
- Rare / endemic species population increases ✓ / vulnerability levels of organisms improve.

- Ecosystem starts to stabilise. ✓
- Water chemistry returns to normal.✓
- Decrease in water pollutants.✓

(Any logical relevant substantiating answer, marker discretion for insightful thinking)

(12)

1.3

- Research ✓
- e.g. Universities can use the area as a real world case study for their students ✓ / An area to compare with other study sites.

- Monitoring ✓ / Observing
- e.g. population size, fish stock, pollutant levels. ✓

- Ecotourism ✓
- e.g. Tourism activities that promote a stable, functioning area. ✓

- Low-impact recreation ✓
- e.g. Have individuals (tourists) using the area in a reasonable manner that does not degrade the environment. ✓

- Education ✓of visitors / Create awareness
- e.g. This area can be used for school excursions that will promote education ✓ / This area can be used as a training ground for students / Placing sign boards in the area

- Exploitation ✓
- e.g. Once the area has stabilised, sustainable harvesting of the area. ✓

(Any logical description of the term, marker discretion for insightful thinking)
(Mark ANY 6 uses and their description)

(12)

1.4

- Prevent overtourism by regulating the amount of people entering the area ✓ / by charging an entrance fee
- Impact assessments can be conducted on a regular basis ✓
- to monitor: the stability of the area ✓ / waste / ecosystem / plants / animals / geology
- Allocate funds to maintain the stable environment. ✓
- Plan for each tourist season in advance to ensure that infrastructure and services can cope with the number of tourists. ✓ / Plan to manage the carrying capacity of the area
- Educate the communities on the fragile nature of the area. ✓
- Employ guides that are properly trained ✓ / briefed / educated / prepared.
- Guides implement and apply ecotourism principles to minimise impact ✓
- Audit tourist operators' practices to assess their environmental impact. ✓
- Interact with the area in an environmentally conscious manner. ✓
- Activities promoting ecological balance is rewarded ✓ / implemented.
- Boards ✓/ signage promoting ecotourism can be erected.
- Law enforcement can impose fines for people who do not act in line. ✓

- Ecotourism income is used to enhance the local community and its infrastructure ✓ (health clinic, transport, education).
- Ecotourism can provide increased employment opportunities ✓
- and increased income ✓ for the local community
- The local traditions ✓
- and local crafts ✓ need to be considered when planning

(Any logical relevant substantiating answer, marker discretion for insightful thinking)

Any 9 (9)

1.5 **If "YES"**

- By following the formulated plan, the area can be rehabilitated.
- Less human interaction with the beach resulting in less litter, chemicals, pollutants.

If "NO"

- The area is too close to large developments for rehabilitation to occur.
- The area is so popular that people will keep flocking to it.

(Any logical relevant substantiating answer, marker discretion for insightful thinking)

1 mark if Opinion and motivation correlates
1 mark for motivation (2)

(42)

Topic 65: Estuaries

Fill in the missing term in each block

Term	Definition
Estuaries	River mouths and their associated banks and beds which are subject to the tidal ebb and flow of the sea water they discharge into
Tidal ebb	A falling or outgoing tide
Tidal flow	A rising or incoming tide
Meiofaunal food chain	A food chain consisting of organisms small enough to live in the spaces between sand particles and feed on organic detritus

Topic 66: Kelp Forests

Term	Definition
Inshore zone	The infratidal zone, down to a depth of about 1–2 m.
Inshore zone	The infratidal zone, where smaller Sea bamboo (*Ecklonia maxima*) and large amounts of benthic algae can be found
Intermediate zone	The infratidal zone, where water depths are less than 15 m.

Intermediate zone	The infratidal zone, where dense stands of Sea bamboo grow, with Split fan kelp (*Laminaria pallida*) forming an understorey, along with seaweeds that are mainly of the red variety
Offshore zone	The infratidal zone, where water depths are more than 15 m.
Offshore zone	The infratidal zone, featuring mainly island-like stands of Split fan kelp, in between which are extensive sections of open reef.

Question 1

1.1 West coast ✓ (1)

1.2
- Kelp holdfasts provide a haven for invertebrates ✓ such as filter feeders
- promoting increased biodiversity ✓

- Kelp also reduces the effect of wave action ✓
- providing calm inshore environments in which animals can thrive ✓

- Kelp particles, decomposition bacteria and phytoplankton blooms ✓
- are capitalised on by herbivores and filter feeders ✓

- Carnivores and omnivores feed ✓ on the filter feeders
- which thrive in kelp forests ✓

(Mark statement and reason. Mark first 4 only) (8)

(9)

Topic 67: Commercial Use of Marine Algae

Term	Definition
Agar	A jelly-like substance extracted from red algae
Algin / Alginate / Alginic acid	A gelling agent, thickener and a stabiliser in many water-based foodstuffs extracted from kelp (brown algae)
Aquaculture	The breeding, rearing, and harvesting of fish, shellfish, algae, and other organisms in all types of water environments
Aquaculture	The farming of freshwater or saltwater organisms in controlled or semi-controlled environments called holding systems

Beta-carotene	The red-orange pigment contained in certain seaweeds, particularly Chlorophyta (green algae)
Carrageenan	The sulphur containing polysaccharide extracted from many red algae
Culture media	Substances which promote the growth of microorganisms
Mariculture	The farming of marine organisms
Pharmaceutical	To do with the production of medicinal products

Topic 68: Chordata

Term	**Definition**
Deuterostomes	Animal phyla in which the blastopore becomes the anus
Notochord	A rod of firm connective tissue supporting and possibly enclosing a dorsal nerve cord
Protochordates	A group of animals having a notochord which is not divided into vertebral segments and in some organisms the notochord may only be present in the larval form
Vertebral column	A notochord divided into flexible segments of cartilage or bone
Vertebrata / Vertebrates	The Subphylum of animals which have a vertebral column