METHODIST LADIES' COLLEGE

Methodist Ladies' College
Semester 1 Sample Examination

Question/Answer Booklet

MARINE AND MARITIME STUDIES
ATAR Year 12

Student Name: _____

Teacher Name: _____

Time allowed for this paper
Reading time before commencing work: ten minutes
Working time for paper: three hours

Materials required/recommended for this paper
To be provided by the supervisor
This Question/Answer Booklet
Multiple-choice Answer Sheet

To be provided by the candidate
Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters
Special items: non-programmable calculators approved for use in the WACE examinations

Important note to candidates
No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of total exam	Your mark
Section One: Multiple-choice	20	20	20	20	20	
Section Two: Short answer	6	6	90	90	50	
Section Three: Extended answer	4	2	70	50	30	
				Total	100	

Instructions to candidates

1. The rules for the conduct of ATAR course examinations are detailed in the Year 12 Information Handbook. Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

   Section One: Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through the square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answer. No marks will be given if more than one answer is completed for any question.

   Sections Two and Three: Write your answers in this Question/Answer Booklet.

3. You must be careful to confine your responses to the specific questions asked and to follow any instruction that are specific to a particular questions.

4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
   - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
   - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the questions that you are continuing to answer at the top of the page.

Section One: Multiple-choice **15% (20 marks)**

This section has **20** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 20 minutes.

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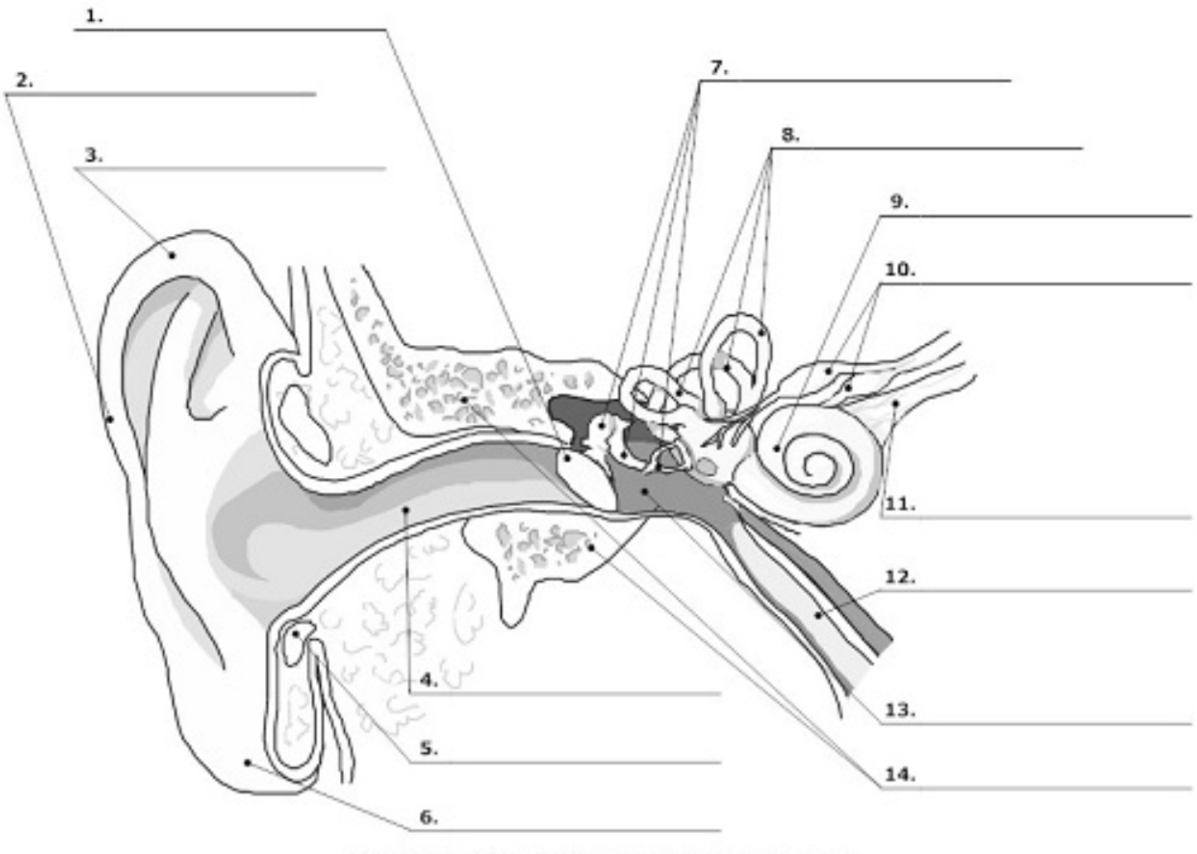
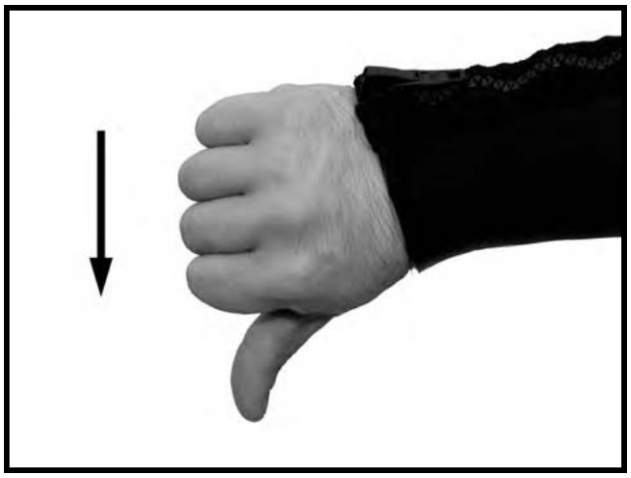
1. The image below shows a diagram of the human ear.



The part labelled '1' is called the:

a. Inner ear
b. Ear drum
c. Ear membrane
d. Stapes

2. What does the following hand signal indicate during a SCUBA/snorkel dive?



a. ‘going down’
b. ‘things are bad!’
c. ‘look underneath’
d. ‘my air supply is getting of low’

3. A snorkeller was found to have a volume of 60 L and a mass of 58 kg, when weighed in air on a set of bathroom scales. She gained one kilogram when she put on her wetsuit and displaced 64 L of seawater when submerged.

   Assuming the density of seawater is 1 kg/L, how much weight would she need to wear on her weight belt to make her neutrally buoyant?

a. 6kg
b. 5kg
c. 2kg
d. 1kg

4. Below are four statements.

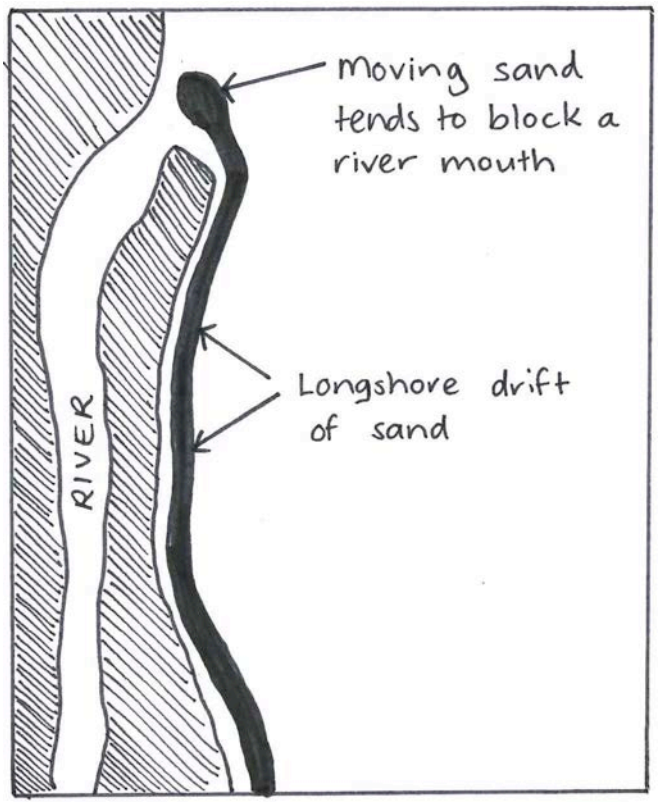
   I. The only early warning indicators of climate change available.
   II. Spatial and temporal patterns of biodiversity of the plankton are identified
   III. Serve as reference points for the general status of planktonic communities in a given area.
   IV. An important survey tool on the health of ocean systems.

   Which of the following options correctly list the benefits of Continuous Plankton Recorder surveys such as AusCPR?

a. I, II, III and IV
b. I and II only
c. III and IV only
d. II, III and IV

See next page

5. Consider the following diagram of a coastal river mouth.



The most effective coastal engineering structure that would solve the issue of sand blocking the river mouth is:

a. breakwater
b. training walls
c. sloping seawalls
d. groyne

6. The three major air spaces affected by pressure when you descend are:

a. Sinuses, lungs and stomach
b. Mask, ears and sinuses
c. Lungs, mask and ears
d. Ears, lungs and stomach

7. The reasons why the population size of an invasive marine pest species often grows rapidly when it is introduced into a new environment include which of the following?

I. The marine pest species is resistant to pesticides.
II. There is a large, underutilised food source in the new environment.
III. The marine pest species has few natural predators in the new environment.

a. II only
b. I and III only
c. II and III only
d. I, II, and III

See next page

8. Which of the following is by far the leading cause of water pollution?

    a. agriculture activities
    b. dredging for mineral sands
    c. effluent from factories
    d. sewage treatment plants

9. The food chain of a coastal ecosystem has a mean primary production of 100 000 tonnes carbon/year, a food chain efficiency of 10%, and a 3-link food chain of:

Algae → Small fish → Large fish → Top predator

    A reasonable prediction of top predator production for this ecosystem is:

    a. 1 tonne carbon/year
    b. 10 tonnes carbon/year
    c. 100 tonnes carbon/year
    d. 1000 tonnes carbon/year

10. The following excerpt is taken from a snorkelling manual and describes the steps taken to clear a snorkel.

    'The snorkel clear begins while you are still underwater. As you begin to surface, look straight up and exhale a small amount of air into the snorkel. As you ascend, the air will expand and remove the water. By the time you reach the surface, most if not all of the water will be cleared from the snorkel'.

    The procedure describe above is best known as the:

    a. Blast method
    b. Displacement method
    c. Snorkel clear method
    d. Underwater snorkel method

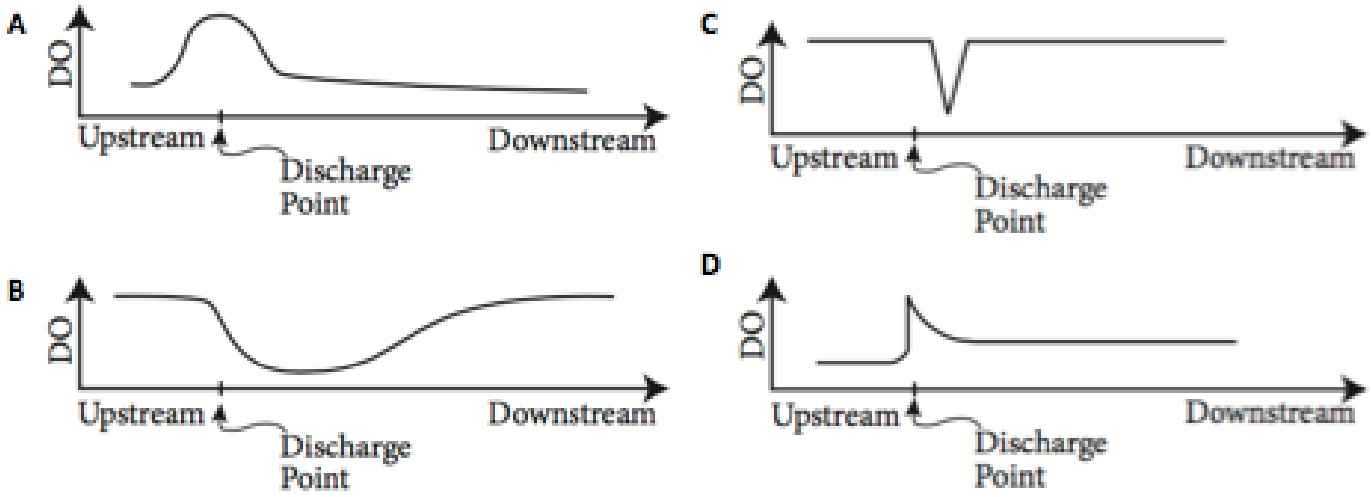
11. Which of the following are considered to be a source of 'expense' in the sand budget?

    a. onshore wind
    b. damming of rivers
    c. longshore drift (in)
    d. cliff erosion

See next page

12. A point source discharges organic waste into a stream.

    Which of the following graphs best depicts the expected pattern for dissolved oxygen (DO) in this stream as distance increases downstream from the discharge point?



    a. A
    b. B
    c. C
    d. D

13. The most abundant greenhouse gas in the earth's atmosphere is:

    a. carbon dioxide (CO_2)
    b. nitrous oxide (N_2O)
    c. water vapor (H_2O)
    d. methane (CH_4)

14. If the volume in a snorkeller's lungs is 4L at the surface and she dives to a depth of 28 m, what will be the volume of her lungs at 28 m?

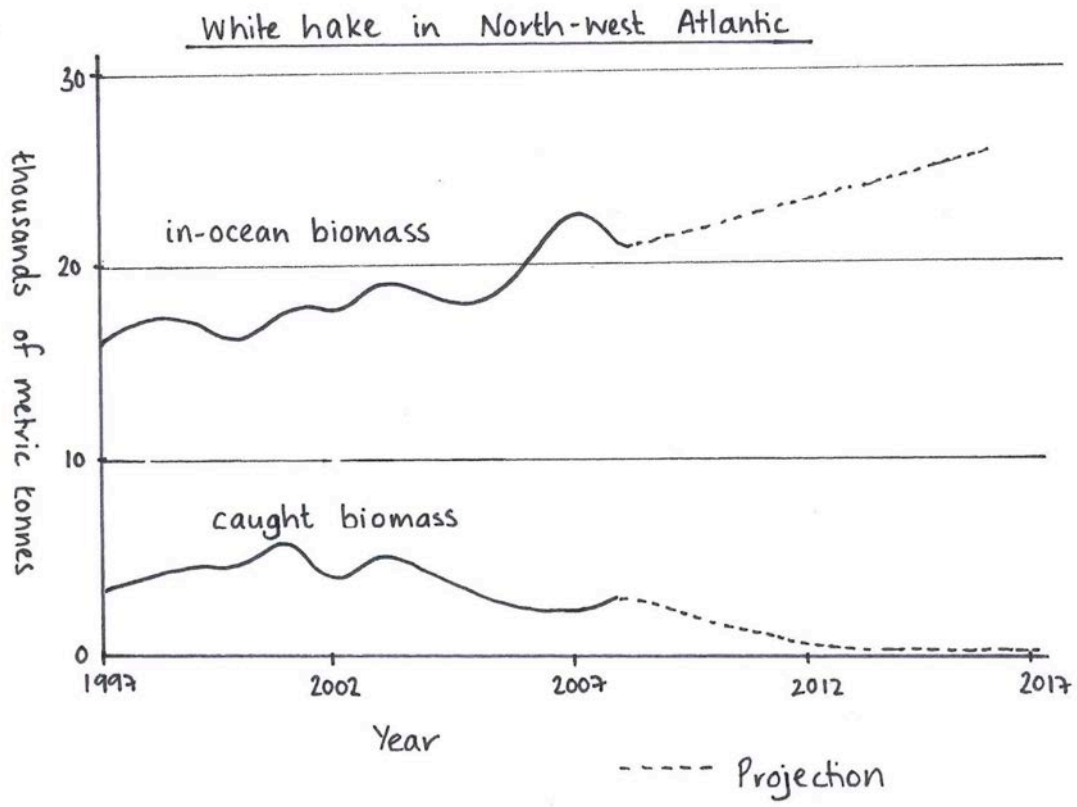
    a. 1.05L
    b. 1.43L
    c. 11.2L
    d. 15.2L

15. Which type of ecosystem would have a higher rate of biomass production in Winter?

    a. temperate rocky reef
    b. deep sea
    c. estuarine
    d. open ocean

See next page

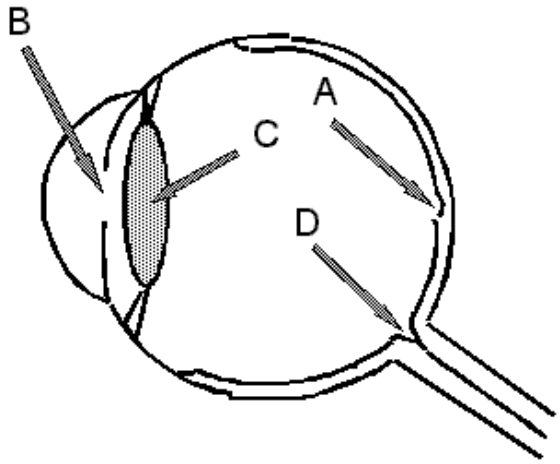
16. Consider the information provided by the following graph, which shows the biomass of White hake in the North-west Atlantic.



Based on the information presented in the graph, it would be reasonable to conclude that:

a. Overall biomass is dramatically increasing.
b. In-ocean biomass is projected to increase due to a decrease in fishing effort.
c. An increase in caught biomass will increase the in-ocean biomass due to an increase in the availability of food.
d. In-ocean biomass will always increase following an increase in caught biomass.

17. In the figure of the human eye shown below, which of the following labels are correct?



a. 'A' is the blind spot
b. 'B' is the pupil
c. 'C' is the retina
d. 'D' is the fovea

See next page

The next three questions are based on the following information.

Single-celled marine algae, such as *Isochrysis*, are grown on a large scale to provide food for cultivated molluscs and fish larvae. An experiment was carried out to investigate the effect of temperature on the growth of *Isochrysis*. In this experiment, cultures of *Isochrysis* were grown in test tubes containing a culture solution of mineral salts. These solutions included magnesium and phosphorus.

At the beginning of the experiment, each test tube contained 5×10^4 cells of *Isochrysis*. All tubes were illuminated with fluorescent lights and incubated at a range of temperatures from 14 °C to 34 °C. After 10 days, the cells were counted using a counting chamber and a microscope. The results are shown in the table below.

Temperature (°C)	Number of cells (cm^3)
14	25×10^5
18	120×10^5
22	61×10^6
26	85×10^6
30	722×10^5
34	23×10^6

18. What is the independent variable for this experiment?

    a. number of cells of *Isochrysis*
    b. intensity of fluoresecent lights
    c. incubation temperature.
    d. solution of mineral salts

19. What is the dependent variable for this experiment?

    a. number of cells of *Isochrysis*
    b. intensity of fluorescent lights
    c. incubation temperature.
    d. solution of mineral salts

20. Which incubation temperature had the highest number of *Isochrysis* cells?

    a. 14 °C
    b. 18 °C
    c. 26 °C
    d. 30 °C

End of Section One

See next page

Section Two: Short answer **50% (90 marks)**

This section has **6** questions. Answer **all** questions. Write your answers in the spaces provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare page for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 90 minutes.

Question 21 **(11 marks)**

a. What material are SCUBA/snorkelling fins usually made of?

_____

1 mark

b. Explain why a person would choose to wear fins whilst snorkelling.

_____

_____

_____

_____

3 marks

c. Give two symptoms of poor fitting SCUBA/snorkelling fins.

_____

_____

2 marks

d. Describe the correct technique that should be used when finning during a SCUBA/snorkel dive.

_____

_____

_____

2 marks

See next page

e. List the steps that should be taken post-dive to care properly for a pair of SCUBA/snorkelling fins.

_____

_____

_____

_____

3 marks

Question 22 **(17 marks)**

a. What is the thermohaline current?

_____

_____

_____

2 marks

b. Why is the thermohaline current important?

_____

_____

_____

2 marks

c. How is the thermohaline current thought to operate?

_____

_____

_____

_____

_____

_____

5 marks

See next page

d.

i. What impact is a sustained enhanced greenhouse effect predicted to have on the thermohaline current?

_____

1 mark

ii. Explain how the enhanced greenhouse effect is predicted to influence the thermohaline current if anthropogenic activities, such as burning fossil fuels, are not reduced.

_____

_____

_____

_____

_____

_____

_____

_____

7 marks

Question 23 **(15 marks)**

a. Give two advantages of an artificial reef to:

i. humans.

_____

_____

_____

2 marks

ii. fish such as Pink Snapper, West Australian Dhufish and Baldchin Groper.

_____

_____

_____

2 marks

See next page

b. What considerations should be made prior to the installation of an artificial reef in terms of:

i. choice of material.

_____

_____

_____

2 marks

ii. subsequent effect on coastal areas.

_____

_____

_____

2 marks

c. The marine ecosystems found along the West Australian coastline are considered to be unique in terms of species abundance and diversity.

i. What is the main factor that contributes to this unusual mix of temperate and tropical species?

_____

1 mark

ii. Which group of organisms are likely to be the first to settle on a newly constructed artificial reef?

_____

_____

2 marks

iii. How might the installation of an artificial reef aid in maintaining this high level of biodiversity and species endemism found along the WA coastline?

_____

_____

_____

_____

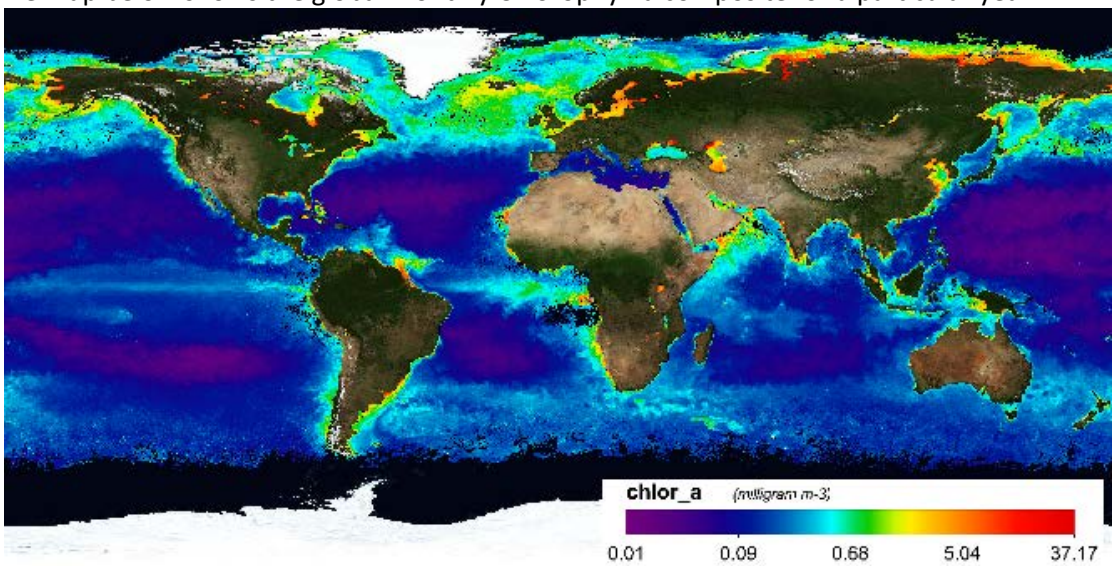
4 marks

See next page

Question 24 **(26 marks)**

The following maps are generated from the National Aeronautics and Space Administration (NASA) global ocean colour monitoring satellite technology called Sea-viewing Wide Field-of-view Sensor (SeaWiFs).

a. The map below shows the global monthly Chlorophyll-a composite for a particular year.



i. Why is it important to know the concentration of chlorophyll-a in the ocean?

_____

_____

_____

_____

_____

4 marks

ii. What do the red/yellow areas indicate?

_____

_____

2 marks

iii. What do the purple areas indicate?

_____

_____

2 marks

See next page

iv. Is this data taken during a Northern hemisphere or Southern hemisphere summer? Explain you answer.

_____

_____

_____

_____

3 marks

v. Why are the red/yellow areas commonly associated with areas of large land mass?

_____

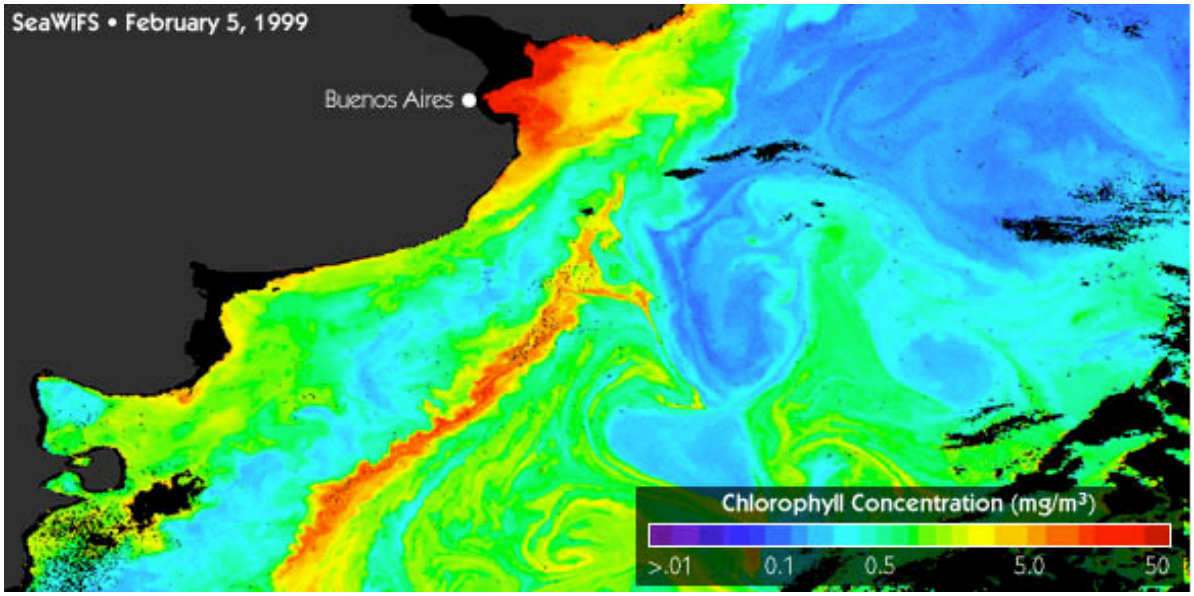
_____

_____

_____

3 marks

b. The image below shows a SeaWiFs image off the coast of Argentina (South America).



i. What do the 'swirls' indicate on the image?

_____

1 mark

See next page

ii. Why are the 'swirls' important in a marine ecosystem?

_____

_____

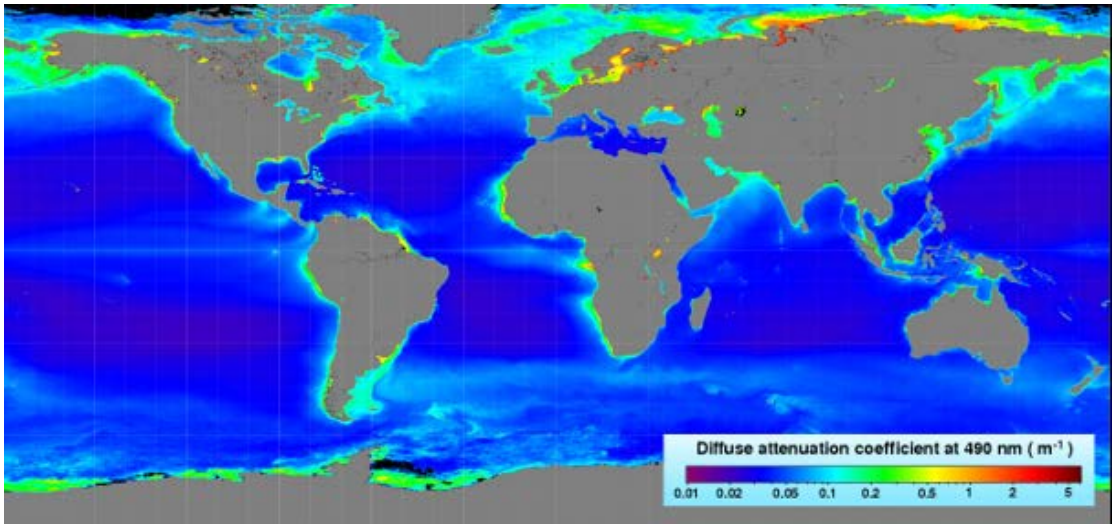
_____

_____

3 marks

c. An issue with SeaWiFs data is that although the return signals come from a variety of different depths, the signals are then aggregated to provide a single measurement for that area.

The map below shows the diffuse attenuation depth at 490 nm (blue light). This image is generated by an instrument that will be on-board future Ship-Aircraft Bio-Optical Research (SABOR) campaigns and aims to rectify the SeaWiFs data issue.



i. Why is it better to have ocean colour data from different depths as opposed to the aggregated version?

_____

_____

_____

_____

_____

4 marks

See next page

ii. The diffuse attenuation coefficient is a measure of the depth that the satellite signal penetrates. The higher the value, the shallower the depth of maximum passive light penetration by the signal (and vice versa).

Why does the signal penetrate further in the open ocean?

_____

_____

_____

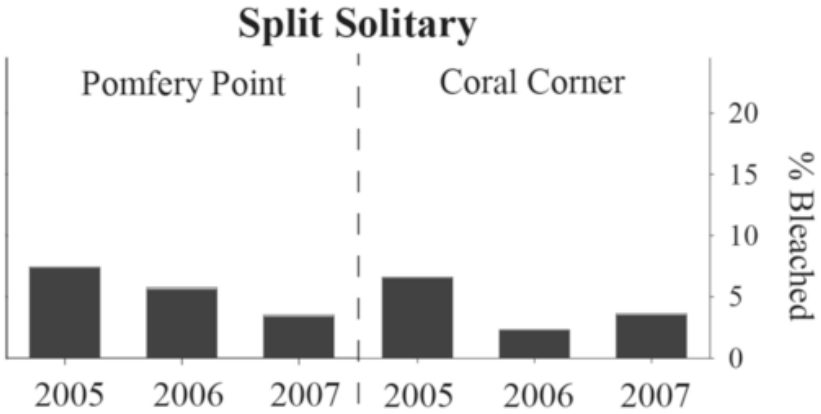
_____

_____

4 marks

Question 25 **(11 marks)**

a. The following graph shows the average proportion of coral bleaching at two northwest sites off Split Solitary Island (in the Solitary Islands Marine Park that is situated in northern New South Wales).



In the space below, present the data shown by this graph in a suitable table format.

5 marks

b. Elevated sea surface temperatures that are sustained for periods of time are often the cause of coral bleaching events. Explain how high water temperatures can cause coral bleaching.

_____

_____

_____

_____

_____

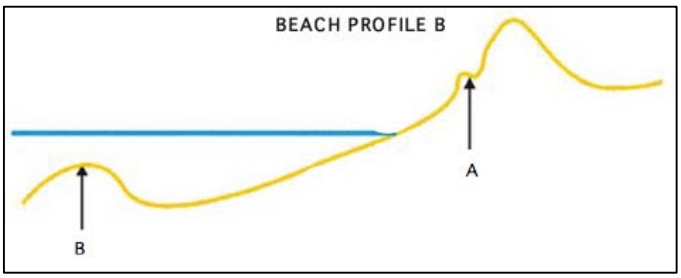
_____

_____

6 marks

Question 26 **(10 marks)**

The diagrams below represent the same beach at different times of the year.



a. Which beach profile is typical of a beach undergoing erosion? Explain your answer.

_____

_____

_____

3 marks

See next page

b. What occurs at B and why is it important to the beach?

_____

_____

_____

3 marks

c. Assuming that there are no storms for the next 12 months, redraw the beach profile in the box below (Beach profile C). Include annotations in your drawing to account for the predicted change in profile.

4 marks

End of Section Two

See next page

Section Three: Extended answer **30% (50 marks)**

This section contains **four (4)** questions. You must answer **two (2)** questions. Write your answers on the lined pages provided following Question 30.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 70 minutes.

Question 27 **(25 marks)**

a. It is generally recognised that the cuttlebone not only serves the cuttlefish, *Sepia officinalis*, as a skeleton but also gives it buoyancy.

Define the terms 'positive buoyancy', 'neutral buoyancy' and 'negative buoyancy'.

6 marks

b. It has been observed that cuttlefish kept in aquaria sometimes tend to float at the surface and appear to be lighter than seawater.

Using your understanding of Archimedes Principle, explain why cuttlefish kept in aquaria sometimes tend to float at the surface.

5 marks

c. Scientists have shown that cuttlefish do change in density, and that the difference between a 'light' and a 'heavy' cuttlefish is almost entirely due to a difference between the densities of their cuttlebones (while the density and volume of the rest of the animal remains almost constant).

Design an experimental method that could be used to test this observation. *Your answer should include reference to an hypothesis, the independent, dependent and controlled variables, and a possible method of conducting the research.*

10 marks

d. The cuttlefish usually lives at a depth of about 150 m in the ocean.

i. What is the pressure exerted by water at a depth of 150 m?

ii. If a live cuttlebone usually contains 20 mL of air at the surface, what volume of air would be present at a depth of 150m?

4 marks

See next page

Question 28 **(25 marks)**

At around 2,000 km long, the Great Barrier Reef is the largest coral reef system in the world. It includes 3,581 individual reefs and an immense lagoon. But the likelihood of future generations being able to enjoy the beauty of the Great Barrier Reef is dwindling, as it comes under increasing pressure from the degradation of water quality and climate change.

a. Describe two different roles that coral communities play in the marine environment and explain the importance of each of these roles.

6 marks

b. Explain how a decline in the water quality, due to domestic wastes such as sewerage, can affect a coral reef community.

6 marks

c. Explain how climate change is predicted to alter the concentration of dissolved oxygen in seawater and thus change the species composition of coral communities.

7 marks

d. Describe how ocean acidification is predicted to influence the expansion of coral reefs.

6 marks

Question 29 **(25 marks)**

a. The Fremantle Traffic Bridge has recently been closed for several days after erosion was found at the foundation of one of the bridge's piers.

   i. Explain the role that water plays in the weathering and erosion of materials that are commonly associated with engineering structures such as the Fremantle traffic bridge.

   5 marks

   ii. Would you expect the water adjacent to the Fremantle traffic bridge to be an area of high or low wave energy? Explain your answer.

   6 marks

b. Using named examples/locations, explain what is the functional difference between a ‘groyne’ and a ‘breakwater’.

10 marks

c. Explain what is understood by the term ‘sand budget’ and provide three sources of income for the sand budget in a particular beach system.

4 marks

See next page

Question 30 **(25 marks)**

The phyllosoma larva of the southern rock lobster, *Jasus edwardsii*, is thought to be among the longest larval phases of any planktonic larva, with estimates in the literature ranging from 12 to 24 months.

a. Based on your understanding of plankton, draw the type of life cycle that you would expect the southern rock lobster to have.

5 marks

b. Using named examples, explain the difference between 'phytoplankton' and 'zooplankton'.

6 marks

c. What role would you expect the phyllosoma larva of the southern rock lobster to play in the trophic interactions of a marine community?

3 marks

d. Recruitment is the term used to describe the number of juveniles that settle in a given marine environment.

If the southern rock lobster population experiences a year of poor recruitment levels in a marine community, what effect would this have on the fish stock population and the production of biomass for the marine community?

6 marks

e. Scientists investigated the physiological response that *Jasus edwardsii* larvae have to increasing temperature. Their results suggested that exposure to elevated temperatures may result in decreased larval growth.

Based on this information, what influence would you expect the enhanced greenhouse effect to have on a population of southern rock lobster in a given marine community?

5 marks

End of questions

See next page

Question number: _____

See next page

Question number: _____

Question number: _____

See next page

Question number: _____

Question number: _____

See next page

Question number: _____

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Spare working space

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