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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

4543660758

ENVIRONMENTAL MANAGEMENT **0680/21**

Paper 2 Management in Context **May/June 2024**

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

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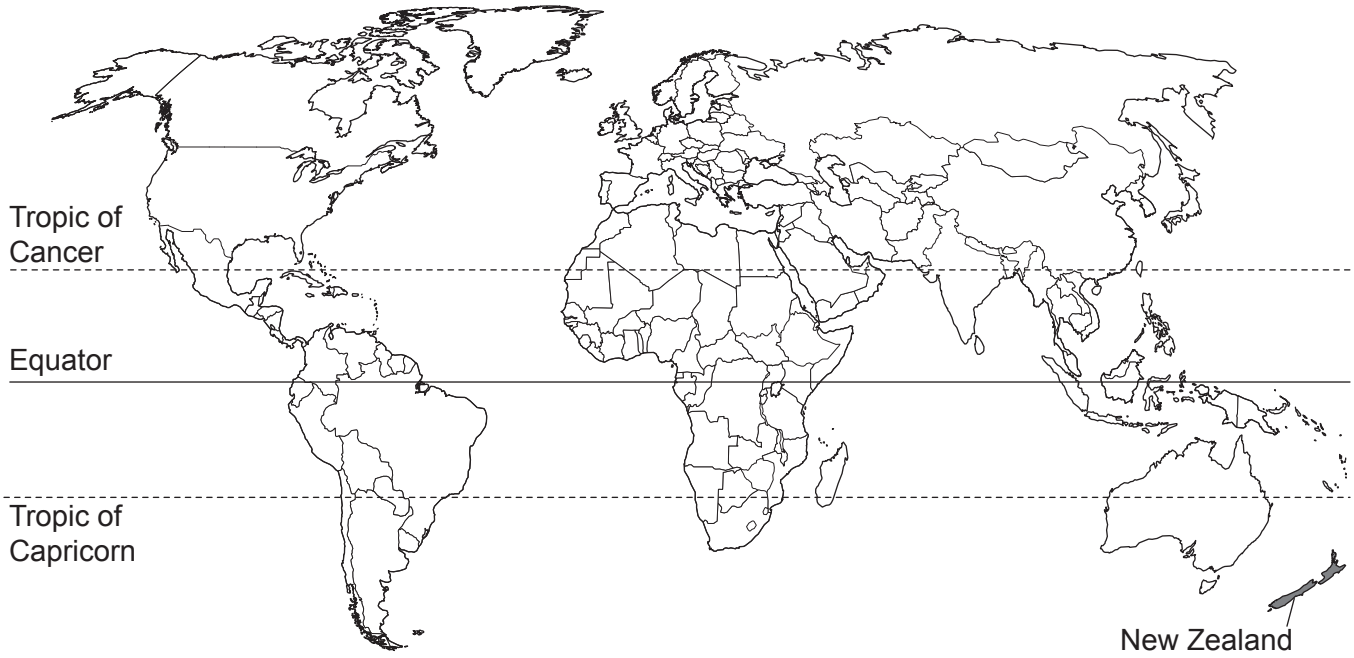
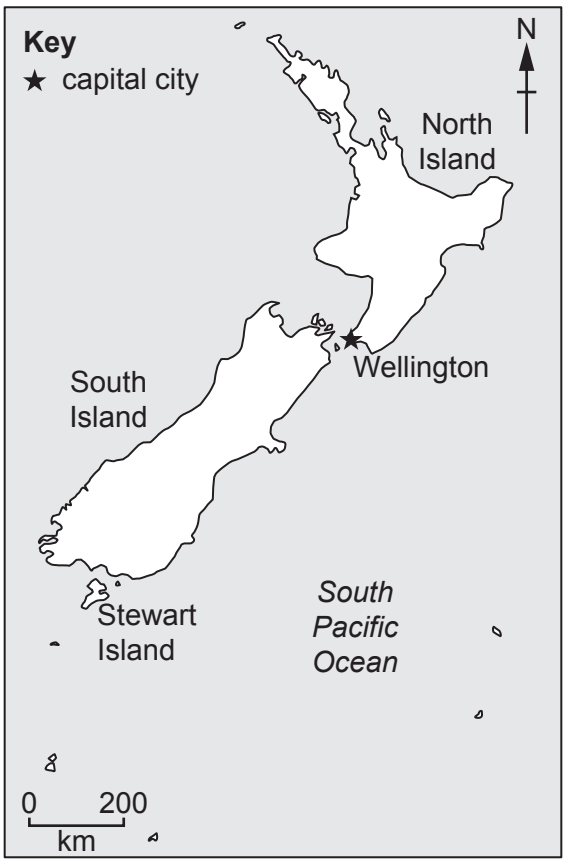
[Turn over

world map showing the location of New Zealand



map of New Zealand



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Area of New Zealand: 268 838 km^2

Population of New Zealand: 5.1 million (in 2022)

Children per woman: 1.86 (in 2022)

Life expectancy: 82.5 years

Currency: New Zealand dollar (1.47 NZD = 1 USD)

Language: English, Māori

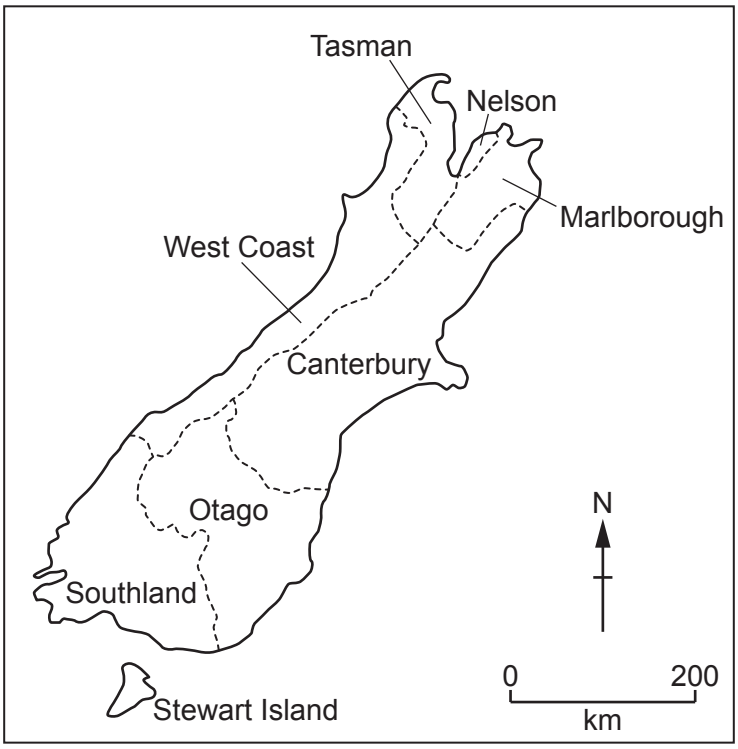
Climate of New Zealand: warm summers and cool winters with rainfall throughout the year

Terrain of New Zealand: mountains, low land along the coast

Main economic activities of New Zealand: agricultural production, silver and gold mining, services, consumer goods and tourism

New Zealand relies on exporting many agricultural products. Cereal crops, fruit and vegetables are mainly grown in the regions of Canterbury, Otago and Southland on South Island.

Map of South Island showing major regions



1 **(a)** **(i)** State **one** fact from the source information that indicates New Zealand is a more economically developed country (MEDC).

..... [1]

(ii) Describe the typical population pyramid of a MEDC.

.....

.....

.....

.....

.....

..... [3]

(iii) 25% of the population of New Zealand live on the South Island.

Calculate the number of people living on the South Island in 2022.

..... [1]

(iv) Circle the best estimate for the percentage of the total area of land of South Island occupied by the regions of Canterbury, Otago and Southland.

35 **50** **75** **90**

[1]

(b) Canterbury, Otago and Southland are the main regions for growing crops in New Zealand.

Farmers grow wheat, barley and oats. Other crops are then grown to feed livestock. Wheat is mainly grown for human consumption.

Explain why changing the crops grown in fields each year is a sustainable method of farming.

.....

.....

.....

.....

.....

..... [3]

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(c) The table shows the mean temperature and rainfall recorded at a farm in Canterbury.

month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
mean temperature / °C	17.5	17.0	16.5	13.0	10.0	8.0	7.5	8.5	10.0	13.0	14.0	16.0
mean rainfall / mm	41	37	54	52	54	64	77	67	45	51	42	47

Calculate the total annual rainfall.

..... mm [1]

(d) The photograph shows part of a farmer's field in drought conditions.

(i) The farmer expects drought conditions to occur on South Island.

Explain how climate change may cause drought.

.....

.....

.....

.....

.....

..... [3]

(ii) Identify **two** pieces of evidence in the photograph that suggest drought conditions.

1 .....

.....

2 .....

.....

[2]

(iii) State **three** ways the impact of drought can be managed on farms.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(e) Some farmers plant different varieties of apple trees at high density to give high yields.

(i) Pollination of flowers is needed for apple fruits to develop.

Describe the process of pollination.

.....

.....

.....

..... [2]

(ii) Fertilisers are used to maintain high yields of apples.

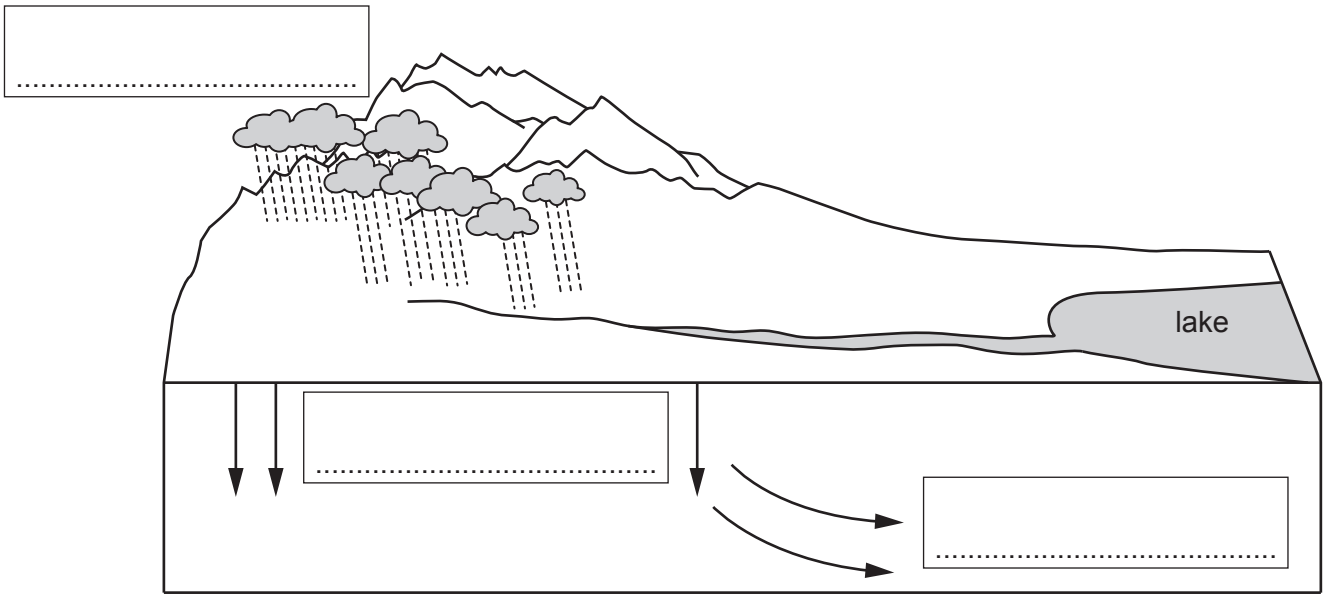
State **two** mineral ions in fertilisers.

1 .....

2 .....

[2]

(f) The diagram shows the water cycle for part of the Canterbury region.



Complete the diagram using terms from the list.

evaporation	**infiltration**	**ground water flow**
precipitation	**surface run-off**	**condensation**

[3]

(g) Suggest how farmers prevent fertilisers entering streams and rivers.

.....

.....

.....

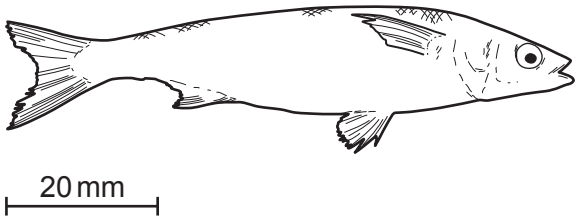
.....

.....

..... [3]

[Total: 28]

2 The diagram shows a yellow eye mullet fish.



This fish lives in the ocean around New Zealand.

(a) Use the scale to estimate the actual length of the fish shown in the diagram.

.....mm [1]

(b) A food chain for the yellow eye mullet is shown.

algae → shrimp → small fish → yellow eye mullet

(i) Explain why algae are producers.

.....

.....

.....

..... [2]

(ii) Identify the secondary consumer in this food chain.

..... [1]

(iii) Explain the meaning of the arrows in a food chain.

.....

..... [1]

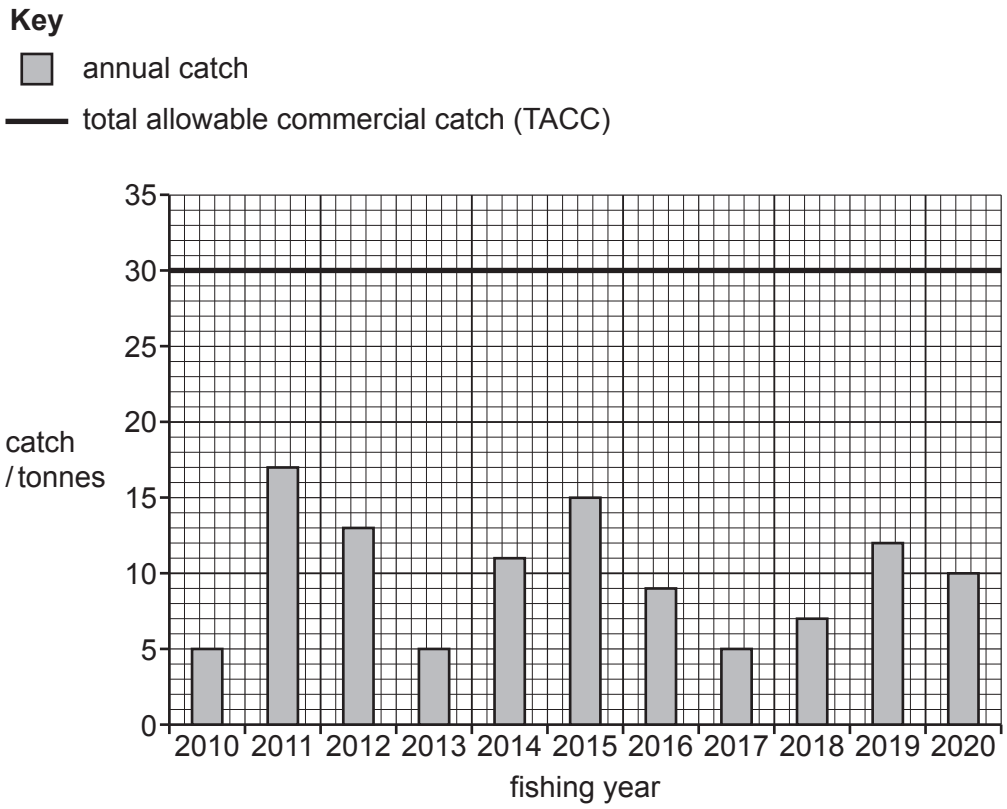
(iv) Explain the difference between a food chain and a food web.

.....

..... [1]

(c) The total allowable commercial catch (TACC) is the total quantity of each fish species that the commercial fishing industry can catch in a given year.

The bar chart shows the catch of yellow eye mullet for an 11-year period from one fishing area.



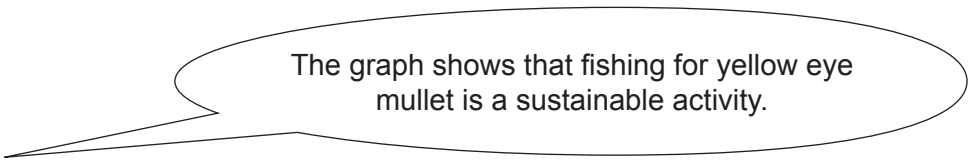
(i) Complete the sentences.

The highest annual catch was ..... tonnes.

The lowest annual catch was ..... tonnes.

[1]

(ii) A scientist said:



Describe **one** piece of evidence from the graph that supports this view.

.....

..... [1]

(iii) Another scientist considers three management options to support sustainable fishing.

option one
Reduce the TACC to 29 tonnes per year.

option two
Reduce the TACC to 17 tonnes per year.

option three
Reduce the TACC to 10 tonnes per year.

Suggest **one** reason why the scientist recommends **option three** to manage this fishing area.

.....

..... [1]

(d) Quotas are one strategy for managing this fishing area.

State **three** other management strategies that can keep a fishing area sustainable in the future.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(e) There is salmon fish farming in the cold water around Stewart Island.

The photograph shows sea cages full of salmon.

The table shows the exports of salmon from New Zealand between 2016 and 2020.

year	mass of salmon exported / thousand tonnes
2016	3.8
2017	4.4
2018	5.0
2019	5.3
2020	4.6

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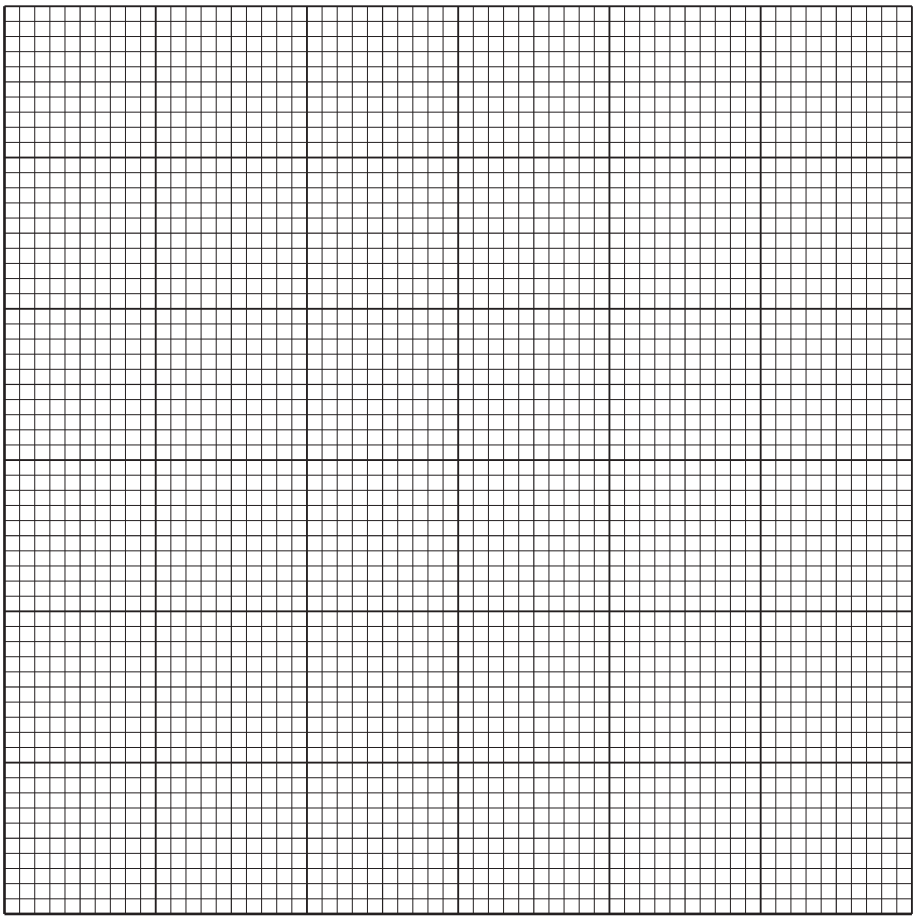
(i) Plot a bar chart of the data.



[4]

(ii) Calculate the percentage increase in the mass of exported salmon from 2016 to 2020.

..... [2]

(iii) In 2020, the sea around Stewart Island was 6 °C above the mean temperature.

Suggest **one** reason why the mass of salmon exports decreased in 2020.

.....

..... [1]

(f) Increased ocean temperatures around New Zealand are predicted to be more frequent in the future.

Explain how the enhanced greenhouse effect can cause this change.

.....

.....

.....

.....

.....

..... [3]

(g) The demand for fish exported from New Zealand increases every year.

A company applies for a licence to build a new fish farm.

A licence is only given if an environmental impact assessment shows that the impacts to the local environment can be managed effectively.

Suggest **three** possible impacts of a fish farm.

1 .....

2 .....

3 .....

[3]

[Total: 25]

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3 The photograph shows a gold and silver mine on North Island. This mine is expected to close in 2030.

(a) (i) State the type of mining shown in the photograph.

..... [1]

(ii) Suggest **one** risk to miners working in this mine.

..... [1]

(iii) The rock at this mine is igneous. Gold and silver can be found in other rock types.

State the names of **two** other rock types.

1 ……..……..

2 ……..……..

[2]

(iv) The waste from this mine contains rock and soil.

Complete the table to show the components of soil.

components of soil
mineral particles
living plants
.....
.....
.....

[3]

(b) A scientist investigates grass growth in waste rock around the mine.

The scientist collects seeds from one species of grass growing on waste rock.

This species of grass can only grow in a pH range of 4.7 to 8.5.

The scientist uses this method:

- fill 5 pots with soil
- fill 5 pots with waste rock
- put 10 seeds in each pot
- water each pot every 5 days
- measure the height of the tallest leaf and count the number of flowers in each pot at 30, 60 and 90 days.

The table shows the results of the investigation.

	soil			waste rock		
days after planting	30	60	90	30	60	90
mean height of the tallest leaf / cm	4.8	9.3	13.9	1.5	2.8	5.7
mean number of flowers	1	4	8	0	0	0

(i) Explain why the scientist includes pots with soil in this investigation.

.....

..... [1]

(ii) Suggest **three** factors the scientist should keep the same in this investigation.

1 .....

2 .....

3 .....
[3]

(iii) Write **two** suitable conclusions for this investigation.

1 .....

.....

2 .....

.....
[2]

(iv) The scientist wants to use genetic modification (GM) to produce a grass that is resistant to insect pests.

Describe how the scientist uses GM to produce grass that is resistant to insect pests.

.....

.....

.....

.....

.....

..... [3]

(c) The photograph shows part of a mine that closed several years ago.

There has been some bioremediation of this mine.

(i) Suggest how bioremediation can be used to restore this mine.

.....

.....

.....

.....

.....

..... [4]

(ii) This mine is going to become a nature reserve.

Describe **two** benefits of nature reserves.

1 .....

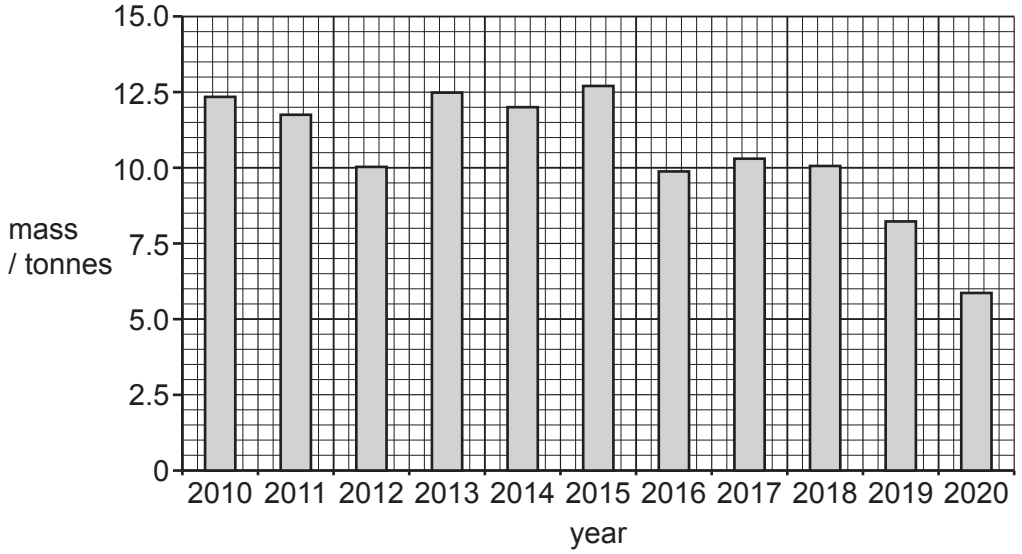
.....

2 .....

.....

[2]

(d) The bar chart shows gold production in New Zealand from 2010 to 2020.



Describe the trends shown in the bar chart.

.....

.....

.....

..... [2]

(e) A new gold mine is planned in New Zealand.

Suggest reasons why some people object to a new gold mine.

.....

.....

.....

.....

.....

..... [3]

[Total: 27]

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ENVIRONMENTAL MANAGEMENT **0680/21**

Paper 2 Management in Context **May/June 2024**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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PUBLISHED

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	‘List rule’ guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

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Question	Answer	Marks
1(a)(i)	*any one from:* M1 low birth rate ; M2 high life expectancy ; M3 low children per woman ;	**1**
1(a)(ii)	*any three from* M1 similar shape / width for males and females ; M2 narrow base ; M3 wider in the middle ; M4 tall / high ;	**3**
1(a)(iii)	1 275 000 ;	**1**
1(a)(iv)	75 ;	**1**
1(b)	*any three from:* M1 soil is fertile ; M2 soil erosion avoided ; M3 different crops need different nutrients / minerals / named ions ; M4 reduces risk of pests / disease ; M5 reduced use of pesticides / fertilisers ; M6 some crops / legumes add nutrients / minerals / mineral ions ;	**3**
1(c)	631 ;	**1**
1(d)(i)	*any three from* M1 high / increased temperatures / global warming / (enhanced) greenhouse effect ; M2 (high temperatures increases) evaporation / less surface water ; M3 dry soils / land ; M4 no / less rain / ppt ; M5 (global warming) alters weather patterns ; M6 more chances of extreme weather ;	**3**
1(d)(ii)	*any two from:* M1 cracks in soil ; M2 no / few plants ; M3 no water (visible) / dry soil / land;	**2**

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Question	Answer	Marks
1(d)(iii)	*any three from* M1 rainwater harvesting ; M2 irrigation /described ; M3 drought tolerant / resistant crops ; M4 dams and reservoirs (on farm) ;	**3**
1(e)(i)	M1 the movement of pollen from an anther to a stigma ; M2 animal / insect / named insect pollination / wind pollination ;	**2**
1(e)(ii)	*any two from*: M1 nitrate ; M2 potassium ; M3 phosphate ;	**2**
1(f)	M1 precipitation ; M2 infiltration ; M3 ground water (flow) ;	**3**
1(g)	*any three from*: M1 do not use on rainy / windy days; M2 control/use less fertiliser/follow instructions e.g. use correct quantity; M3 keep animals / animal waste out of / organic matter/away from rivers; M4 ensure plant cover / no bare soil; M5 plant trees / shrubs, around edges of field / near rivers / *idea of* a buffer at edge of field; M6 contour ploughing / terracing / use of bund; M7 direct drilling ;	**3**

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Question	Answer	Marks
2(a)(i)	75 (mm) ;	**1**
2(b)(i)	*any two from* M1 they produce their own glucose; M2 use process of photosynthesis / trap sunlight / convert light energy; M3 first trophic level;	**2**
2(b)(ii)	small fish ;	**1**
2(b)(iii)	(direction) of energy transfer / flow / nutrient / food flow / feeding;	**1**
2(b)(iv)	food chain only shows one feeding relationship / food webs show alternative sources of food for organisms or consumers / food web is more than one food chain;	**1**
2(c)(i)	17 **AND** 5 ;	**1**
2(c)(ii)	*any one from:* M1 catch are fluctuating and not decreasing; M2 does not exceed TACC / 30 tonnes ; M3 catch recovers (from a lowest point or three times) / always between 5 and 17 tonnes; M4 if it was not sustainable the catch would not recover ;	**1**
2(c)(iii)	(lowest quota so) most likely to prevent overfishing / extinction / collapse of fish population / fish stock;	**1**
2(d)	*any three from* M1 use smaller nets; M2 use larger mesh size; M3 limit size of boats; M4 limit number of boats / licences; M5 closed seasons; M6 protected areas / reserves / no fish zones; M7 laws / international agreements / legislation/regulations/fines/enforcement ; M8 monitoring fishing / patrols;	**3**

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Question	Answer	Marks
2(e)(i)	**M1** axes labelled with unit: x-axis year **AND** y-axis mass (of salmon exported) **AND** thousand tonnes **M2** sensible linear scale such that the data occupies half the grid area; **M3** data plotted correctly; **M4** bars of equal width;	**4**
2(e)(ii)	M1 4.6 – 3.8 or 0.8 ; M2 (M1 ÷ 3.8 × 100) = 21 % ;	**2**
2(e)(iii)	*any one from:* M1 conditions no longer ideal for reproduction / growth / survival ; M2 reduced feeding by salmon ; M3 they grow better in cold water / slower in hot ; M4 more disease ; M5 stress ; M6 (some) died;	**1**
2(f)(i)	*any three from* M1 (increased) greenhouse gases **OR** named greenhouse gas ; M2 (solar) radiation / sunlight passes through the Earth's atmosphere ; M3 (some solar) radiation is lost to space; M4 (some solar) radiation is reflected back to the Earth's surface ; M5 (solar) radiation is absorbed by the oceans;	**3**
2(g)	*any three from* M1 (fish / food) wastes / eutrophication; M2 chemical pollution from boats ; M3 use of pesticides; M4 (escaped fish) disrupt food chain / spread of disease (to wild fish stocks); M5 reduction of overfishing; M6 economic impact described; M7 damage to (wild) fish stocks used as food for salmon;	**3**

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Question	Answer	Marks
3(a)(i)	surface mining / open pit / opencast ;	**1**
3(a)(ii)	falling rocks / rockfall / landslides;	**1**
3(a)(iii)	sedimentary ; metamorphic ;	**2**
3(a)(iv)	*any three from* M1 micro-organisms; M2 air; M3 water ; M4 organic matter / humus;	**3**
3(b)(i)	control / to compare the growth of plants;	**1**
3(b)(ii)	*any three from* M1 **volume / mass** of soil / waste ; M2 **volume** of water ; M3 **volume** / size of pot ; M4 temperature ; M5 light (intensity) / daylength; M6 humidity;	**3**
3(b)(iii)	*any two from* M1 plants in waste rock are shorter / stunted ; M2 plants in waste rock **do not** flower ;	**2**
3(b)(iv)	*any three from* M1 identify / find a plant that is resistant (to insects) ; M2 identify / extract gene(s) for resistance (to insects); M3 insert / introduce gene(s) into grass plants ;	**3**

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Question	Answer	Marks
3(c)(i)	*any four from* M1 add microbes / bacteria / fungi / microorganisms ; M2 add organic matter ; M3 add soil; M4 plant seeds/vegetation/trees ; M5 introduce (grazing) animals ;	**4**
3(c)(ii)	*any two from* M1 reduces human interference / stated example eg hunting ; M2 creates / maintains many habitats ; M3 increases / maintains biodiversity ; M4 protects (rare / endangered) species;	**2**
3(d)	*any two from:* M1 fluctuates ; M2 then decrease ; M3 overall decrease ;	**2**
3(e)	*any three from* M1 (risk of) water / land / soil / air / noise / visual pollution ; M2 loss of, habitat / biodiversity / wildlife ; M3 need to relocate people ; M4 scare animals away ; M5 damage due to transport ; M6 loss of farm land ;	**3**

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

1360133771

ENVIRONMENTAL MANAGEMENT **0680/22**

Paper 2 Management in Context **May/June 2024**

1 hour 45 minutes

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No additional materials are needed.

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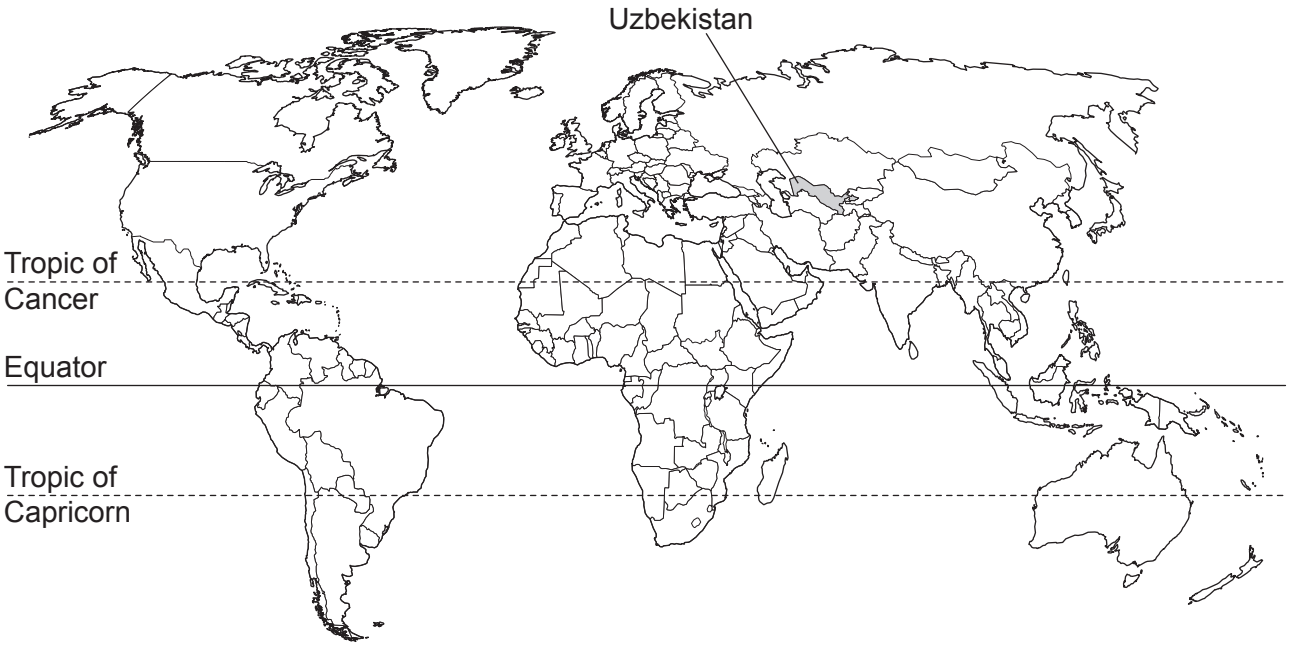
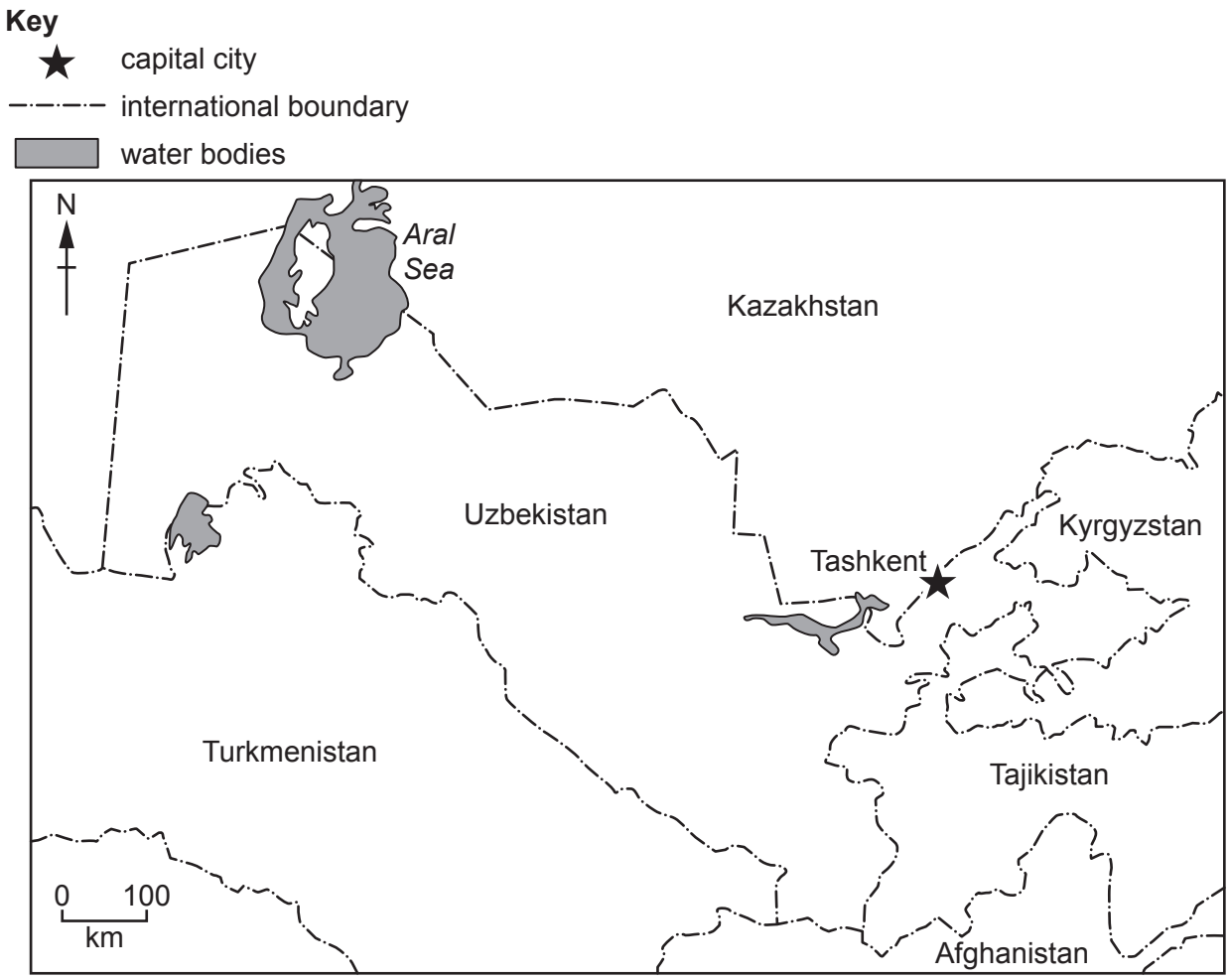
[Turn over

world map showing the location of Uzbekistan



map of Uzbekistan



Area of Uzbekistan: 447 400 km^2

Population of Uzbekistan: 31 million (in 2021)

Children per woman: 1.73 (in 2021)

Life expectancy: 75.0 years

Currency: Uzbek Som UZS (10 755 UZS = 1.00 USD)

Language: Uzbek, Russian, Tajik

Climate of Uzbekistan: dry**,** long hot summers, cold winters

Terrain of Uzbekistan: mostly flat sandy desert with dunes, river valleys in east, Aral Sea in north west

Main economic activities of Uzbekistan: textile and chemical manufacturing, food processing, engineering, mining and oil extraction

51% of the population live in urban areas. The valleys in the east are the most densely populated.
The valleys are also good for agriculture. Cotton is an important crop. Uzbekistan is the world's fifth largest cotton exporter.

1 **(a)** **(i)** Calculate the population density in Uzbekistan in 2021.

..... people / km^2 [1]

(ii) 51% of the population of Uzbekistan live in urban areas.

Suggest **two** reasons why the population is **not** evenly distributed across the country.

1 .....

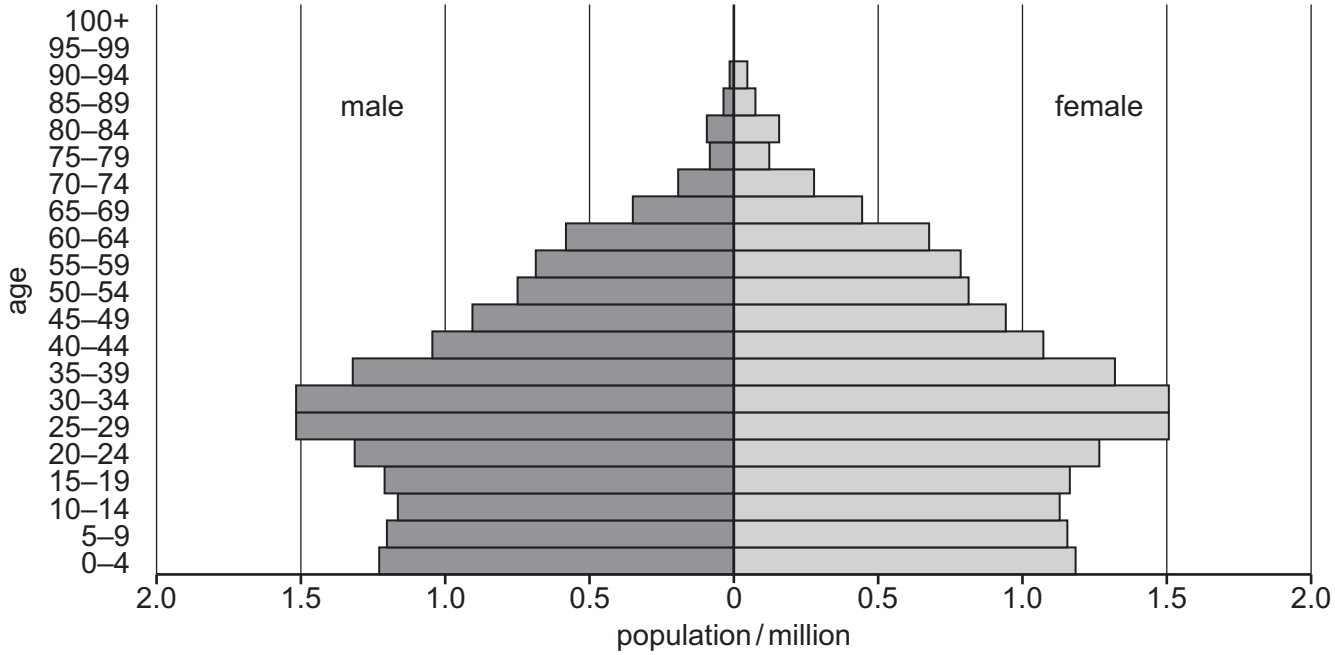
.....

2 .....

.....

[2]

(b) The diagram shows the population pyramid for Uzbekistan in 2021.



(i) Calculate the number of females between the ages of 25 and 34.

..... million [1]

(ii) Compare the population of males to females in the age ranges:

0–54 years .....

.....

55–100+ years. .....

.....

[2]

(iii) The birth rate of Uzbekistan has decreased in the past 30 years.
Suggest **two** reasons why there are fewer people aged 10–14 than people aged 25–29.

1 .....

.....

2 .....

.....

[2]

(iv) Suggest how a reduction in birth rate affects the economy of a country in the future.

.....

.....

.....

..... [2]

(c) The table compares three economic sectors in Uzbekistan.

economic sector	percentage of people employed	percentage contribution to the economy
agriculture	25.9	17.9
industry	13.2	33.6
services	60.9	48.5

State the economic sector which produces the greatest percentage contribution to the economy per person employed.

..... [1]

(d) Improving irrigation systems increases agricultural yields.

State **three** other ways to increase agricultural yields.

1 .....

.....

2 .....

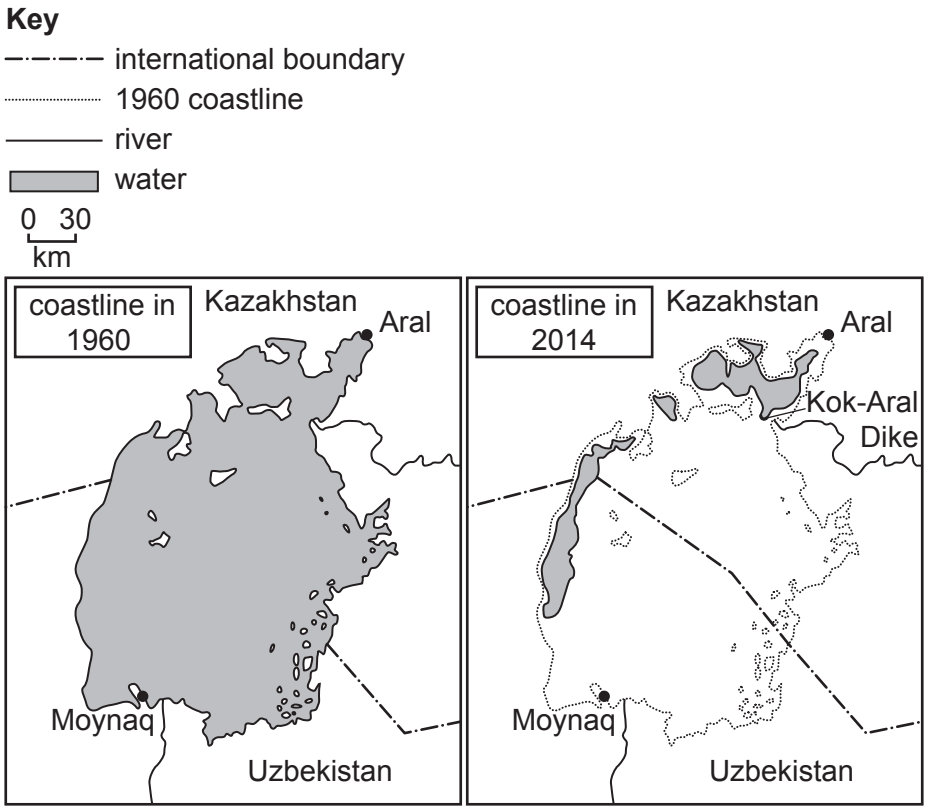
.....

3 .....

.....

[3]

(e) The Aral Sea is an area of salt water in Uzbekistan.
The size of the Aral Sea has changed over time.
The maps show this change.



(i) Calculate the straight-line distance from Aral to Moynaq in km.

distance = ... km [1]

(ii) In 1960, the volume of the Aral Sea was 1100 km^3.
In 2014, the volume was 95 km^3.

Calculate the percentage decrease in the volume between 1960 and 2014.

.....% [2]

(iii) Suggest how the changes in the Aral Sea have affected the economic activities of the people of Moynaq.

.....

.....

.....

..... [2]

(iv) Increased use of water to irrigate crops caused the decrease in the size of the Aral Sea.

State **three** ways farmers can use water more efficiently.

1 .....

.....

2 .....

.....

3 .....

.....
[3]

(v) The salinity has increased in the Aral Sea.

A scientist is concerned this has affected the biodiversity.

Describe how the scientist can randomly sample the Aral Sea.

.....

.....

.....

..... [2]

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[Turn over

(vi) The scientist repeats the sampling at different times of the year.
Suggest **two** benefits of repeat sampling.

1 .....

.....

2 .....

.....
[2]

(vii) The table shows the data from two identical sampling investigations of the Aral Sea.

	sampling year	
	1960	**2014**
mean salinity / arbitrary units	10	135
number of fish species	25	28
number of shellfish species	13	6
number of plant species	40	22

Write a suitable conclusion about the effect of salinity on the number of species in the Aral Sea.

.....

..... [1]

(f) Cotton is a major crop in Uzbekistan.

The table shows the percentage of water used at each stage of the production of cotton textiles.

production process	**percentage of water use**
crop irrigation	33
processing	25
colouring	23
finishing	19

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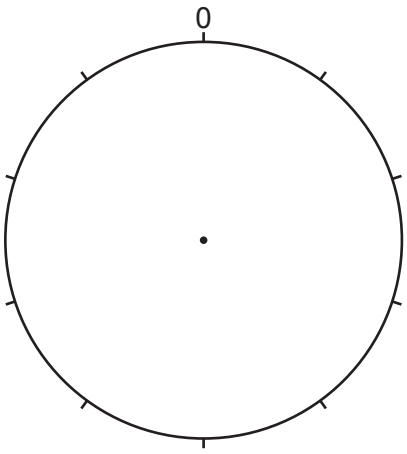
(i) Plot the data in the table as a pie chart and complete the key.



Key

.....

.....

.....

.....

[4]

(ii) A student reads some information about the production of cotton textiles and synthetic textiles.
The synthetic textiles are made from oil.

	resources used to make 1 kg of textile	
textile	**energy use / MJ**	**water use / dm^3**
cotton	49	10 000
synthetic	109 000	10

The student concludes that the synthetic textile is less harmful to the environment.

Do you agree with the student's conclusion?
Use the information in the table to support your answer.

.....

.....

.....

..... [2]

[Total: 33]

2 **(a)** The government of Uzbekistan has introduced strategies to conserve biodiversity.

One strategy is a biosphere reserve in an area close to the Aral Sea.

(i) Explain how biosphere reserves conserve biodiversity.

.....

.....

.....

.....

.....

..... [3]

(ii) The photograph shows a Bukhara deer.

They prefer to live in large groups in the biosphere reserve.

Scientists recorded the number of Bukhara deer in the biosphere reserve.

year	1980	2000	2010	2015	2020
Bukhara deer population	20	58	500	750	2100

Plot a line graph of the data.

[4]

(b) A scientist is concerned that the population of Bukhara deer is now greater than the carrying capacity of the biosphere reserve.

(i) Define the term carrying capacity.

.....

..... [1]

(ii) Suggest what will happen if the Bukhara deer population continues to increase in the biosphere reserve.

.....

.....

.....

..... [2]

(c) Scientists want to move some Bukhara deer to a new location to start a new population. The location is a disused surface mine.

(i) Describe what must be done to this disused surface mine before the Bukhara deer are introduced.

.....

.....

.....

.....

.....

..... [3]

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(ii) Suggest the benefits and negative impacts of introducing Bukhara deer to a new location.

benefits .....

.....

.....

.....

.....

.....

negative impacts .....

.....

.....

.....

.....

.....

[4]

[Total: 17]

3 **(a)** Uzbekistan is rich in energy resources.

The table shows reserves of energy resources and their annual extraction.

energy resource	reserves / arbitrary units	annual extraction / arbitrary units	remaining supply / years
natural gas	2240	60.0	37.3
oil	178	0.7	.....
coal	1950	4.0	487.5
uranium	97	3.6	26.9

(i) Complete the table for oil. [1]

(ii) Suggest **three** reasons why Uzbekistan has been slower to invest in renewable energy sources than some other countries.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(iii) The government of Uzbekistan plans to increase its generation of electricity from renewable sources by 2026. This will reduce the country's emission of carbon dioxide gas.

Explain why reducing emissions of carbon dioxide gas is important.

.....

.....

.....

.....

.....

..... [3]

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(b) The table shows the percentage electricity consumption for different economic sectors in Uzbekistan.

economic sector	percentage electricity consumption
industry	40
domestic	23
agriculture	20
services	.....
transport	3
construction	1

(i) Complete the table for the services sector. [1]

(ii) Describe strategies to reduce electricity consumption in the domestic sector.

.....

.....

.....

.....

.....

..... [3]

(iii) Suggest reasons why the amount of electricity consumed by the transport sector differs between a less economically developed country (LEDC) and a more economically developed country (MEDC).

.....

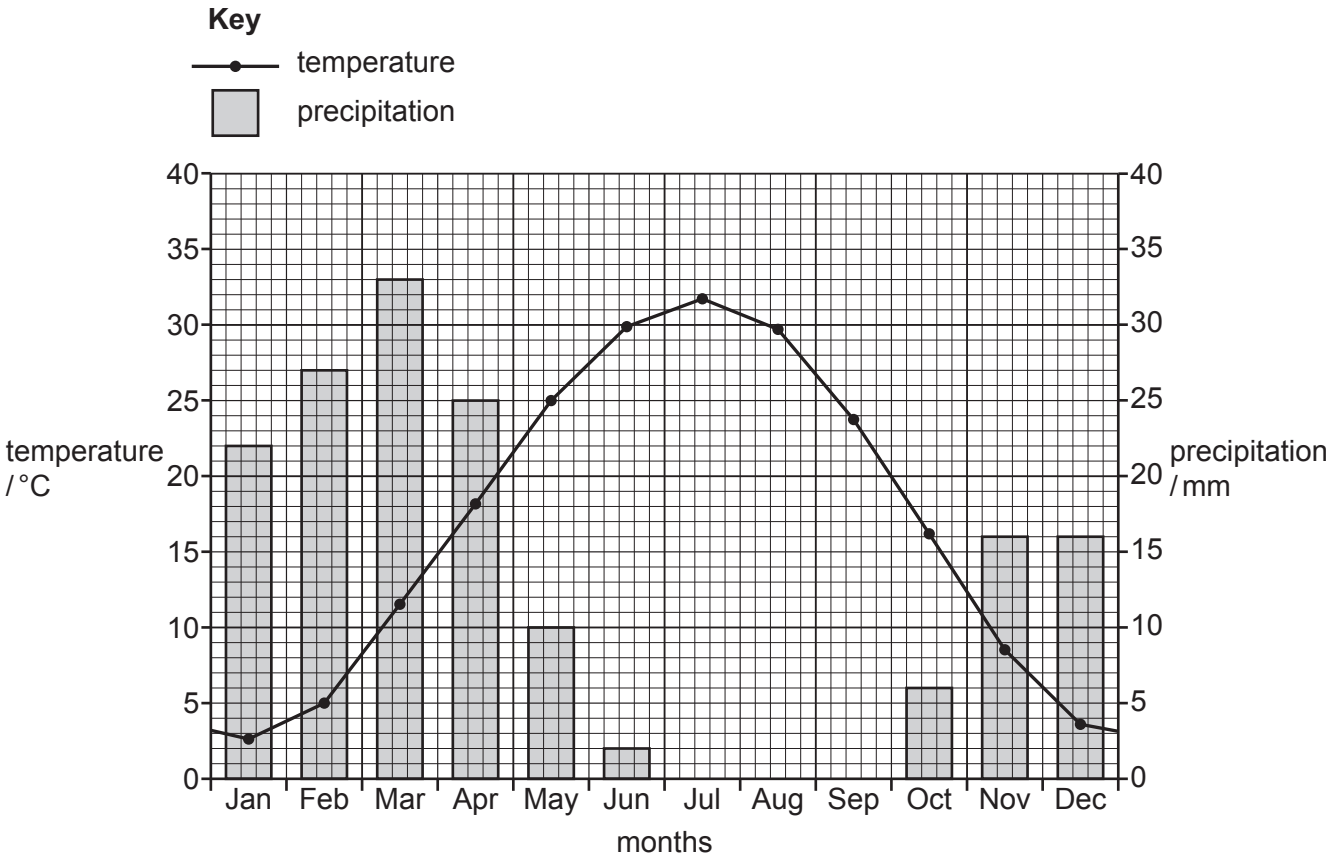
.....

.....

..... [2]

[Total: 13]

4 The graph shows the mean temperature and precipitation at a weather station in Uzbekistan over a ten-year period.



(a) (i) Calculate the temperature range at this weather station.

.....°C [1]

(ii) State the months of the year with the lowest precipitation.

..... [1]

(iii) Explain why low rainfall can increase the risk of soil erosion.

.....

.....

.....

..... [2]

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(b) (i) The table shows some components of soil.
Complete the table.

component of soil	example
mineral particles	
mineral ions	
organic matter	

[3]

(ii) Describe ways the addition of organic matter improves the fertility of a soil.

.....

.....

.....

..... [2]

(iii) Soil contains air. Carbon dioxide is a gas in air.

State **two** processes in the carbon cycle that release carbon dioxide.

1 .....

2 .....
[2]

(iv) State **two** other gases in clean air.

..... and ..... [1]

(v) State **two** ways the concentration of atmospheric carbon dioxide can be reduced.

.....

.....

.....

..... [2]

(c) Explain why it is important for ecosystems to be managed sustainably.

.....

.....

.....

.....

.....

..... [3]

[Total: 17]

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ENVIRONMENTAL MANAGEMENT **0680/22**

Paper 2 Management in Context **May/June 2024**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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PUBLISHED

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	‘List rule’ guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

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Question	Answer	Marks
1(a)(i)	69(.3);	**1**
1(a)(ii)	*any two from:* M1 mainly desert; M2 soil is infertile (most of country) / (only) fertile in east or valleys; M3 availability of jobs; M4 availability of stated resource e.g. water / food / agriculture / energy; M5 availability of infrastructure or named example e.g. roads; M6 availability of education; M7 availability of healthcare / sanitation or named example e.g. hospitals; M8 risk of natural disasters e.g. drought;	**2**
1(b)(i)	3.1 (million);	**1**
1(b)(ii)	M1 *0–54:* (approximately) the same / similar / even; M2 *55–100+:* more females than males / females live longer / for both males and females from 55 to 100 population decreasing;	**2**
1(b)(iii)	*any two from:* M1 education, use or access to or lower cost of, birth control/contraceptives; M2 stated or described government policy that limits or discourages number of children born e.g. anti-natalist; M3 idea of change healthcare; M4 reduction in availability of stated resource e.g. food, (clean) water; M5 improved education / increased opportunities for women; M6 disease;	**2**
1(b)(iv)	*any two from:* M1 reduced, economy / GDP; M2 less taxation / less income, (for government or country); M3 reduction in, work force / economically active people / less people available to work; M4 idea of increase in **share of cost** to workers or younger people for, healthcare / education / pensions / elder care; M5 less spending on, schools / education;	**2**
1(c)	industry;	**1**

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Question	Answer	Marks
1(d)	*any three from:* M1 crop rotation; M2 use of fertilisers / named method e.g. manure; M3 use of, pesticide / insecticide / herbicide / fungicide; M4 mechanisation; M5 selective breeding; M6 genetic modification / GM; M7 controlled environments e.g. greenhouse / hydroponics / aquaculture / aeroponics; M8 lower price of seeds or seedlings; M9 reduce soil erosion / or described method of reducing soil erosion, e.g., bunds, contour ploughing, terracing, intercropping, wind breaks M10 use of biological control;	**3**
1(e)(i)	distance in range 260–285 (km)	**1**
1(e)(ii)	M1 1100 – 95 **OR** 1005; M2 91(.4)%;	**2**
1(e)(iii)	*any two from:* M1 reduction in stated sector e.g. industry, agriculture, services; M2 no longer able to fish / reduced fish exports; M3 reduction in food or reduction in yield or food **AND** so people need to buy it or food prices increase; M4 decrease in agriculture or crop yield **AND** as less water available or need to pay for water or irrigation; M5 loss of jobs; M6 less tourism; M7 reduced work force **AND** due to migration; M8 idea of time involved or distance to travel to collect water;	**2**
1(e)(iv)	*any three from:* M1 trickle or drip irrigation; M2 rainwater harvesting; M3 use of, reservoirs / dams; M4 use of bunds;	**3**
1(e)(v)	M1 use of, coordinates / grid (on a map); M2 (random) number generator (to identify sampling point);	**2**

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Question	Answer	Marks
1(e)(vi)	*any two from:* M1 idea of impact of different, times / seasons / weather / climate; M2 results can be compared / identify a trend; M3 identifies, anomalous results or outliers; M4 improves, reliability / validity;	**2**
1(e)(vii)	**total** number of (different) species decreases (when salinity increases); **OR** overall decrease in species (when salinity increases); **OR** correct description of individual groups fully described, e.g. fish increase **AND** shellfish decrease **AND** plants decrease;	**1**
1(f)(i)	M1 sectors in clockwise rank order; M2 largest first starting at 'noon' going clockwise or anticlockwise; M3 correct plotting; M4 key completed and matches sector shading;	**4**
1(f)(ii)	(synthetic materials) *any two reasons from:* M1 uses or extracts less water / uses a lot of water; M2 energy needed could come from non-renewable sources; M3 need a large quantity of energy / uses more energy; M4 idea that oil is, a fossil fuel / non-renewable or finite or energy comes from fossil fuels; M6 more CO_2 / greenhouse gases, emitted;	**2**

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Question	Answer	Marks
2(a)(i)	*any three from:* M1 prevent or limits hunting or poaching; M2 prevents or limits, mineral extraction / mining; M3 zoned / access restricted / controlled environment / protected area; M4 monitoring / allows for research / idea of scientists allowed in some areas; M5 raises awareness / education (of public); M6 treatment of diseases / medical support; M7 (eco)tourism / minimises impact of tourism;	**3**
2(a)(ii)	M1 labelled axes: *y*-axis (Bukhara deer) population AND *x*-axis year M2 sensible linear scale that allows for plotted points to cover at least half the grid; M3 5 correct plot; M4 plotted points joined point to point with a ruled straight line;	**4**
2(b)(i)	the **maximum** population or number of species that the ecosystem can sustain;	**1**
2(b)(ii)	*any two from:* M1 shortage of food / starvation; M2 shortage of water; M3 migration; M4 overcrowding; M5 idea of deer may need to be culled or killed; M6 animals become weak / disease spreads;	**2**
2(c)(i)	*any three from:* M1 removal of waste; M2 fill with stated material / replace or put back overburden; M3 addition of (top) soil; M4 test (water or soil) for toxins; M5 bioremediation or described / improve soil / add fertiliser or organic matter; M6 planting (of vegetation) / food source / plant trees or plants; M7 provide water supply (for deer);	**3**

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Question	Answer	Marks
2(c)(ii)	*max four: max three benefits:* M1 increases number of deer / increases population of the deer / reintroduction where deer had been extinct; M2 increases area or geographical range (deer found); M3 less risk of a whole deer population being affected by disease; M4 manage plant growth through grazing; M5 provide food source for predators; M6 AVP e.g. ecotourism; *negative effects:* M7 may not be adapted to conditions; M8 displacement of other species; M9 changes to the food chain / not enough food; M10 overgrazing / damage agriculture / eat trees or crops; M11 may become an invasive species or non-native species; M12 disease (to native species or deer); M13 risk of hunting (in new location);	**4**

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Question	Answer	Marks
3(a)(i)	254.3 (years);	**1**
3(a)(ii)	*any three from:* M1 large amount of, non-renewable resources / coal / oil / (natural) gas/ fossil fuels, in the country; M2 infrastructure for existing resources already in place; M3 cost (of investing in renewables); M4 lack of expertise or knowledge (of workers) / lack of technology or machinery; M5 idea of lack of natural resources to support renewables e.g. not enough sunshine hours / low wind speed; M6 country has other priorities e.g. drought / famine / disease / education; M7 stated environmental concern from use of renewables e.g. habitat loss with wind farms; M8 concern that renewables will not meet energy needs; M9 exporting existing energy resources increases GDP / oil extraction is main economic activity / idea of fossil fuels employ a lot of people;	**3**
3(a)(iii)	*any three from:* M1 greenhouse gas; M2 contributes to global warming / (enhanced) greenhouse effect; M3 causes climate change; M4 stated effect of climate change e.g. sea level rise;	**3**
3(b)(i)	13(%);	**1**
3(b)(ii)	*any three from:* M1 stated example of how to reduce use e.g. switch off lights / turn off equipment when not in use / turn water or heating thermostat down / avoid very hot water / do not use 'standby'; M2 insulation / double glazing / loft insulation / filling cavity walls; M3 increase number of windows to replace lighting / decrease number of windows to reduce heat loss; M4 open windows to replace air conditioning; M5 use of more efficient appliances or stated example e.g. use LED lightbulbs / heat pumps; M6 education / raise awareness; M7 stated **government** strategy e.g. making electricity more expensive / increased tax on electricity / limits on energy use / rationing / load shedding;	**3**

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Question	Answer	Marks
3(b)(iii)	*any two from:* M1 MEDC population can afford or more people own, **electric** cars or EVs / MEDCs have invested more in EV infrastructure; M2 MEDC has a larger **electric** public transport system; M3 MEDCs, **employment** may not be local / people travel to **work**; M4 MEDCs have, consistent supply / more supply; M5 MEDCs, use more technology / technology is more advanced;	**2**

Question	Answer	Marks
4(a)(i)	29 (˚C);	**1**
4(a)(ii)	July **AND** Aug **AND** Sept ;	**1**
4(a)(iii)	*any two from:* M1 plants die; M2 less roots to hold or bind the soil; M3 less water in the soil / soil dries out; M4 soil (particles), become lighter / easier to blow in wind / risk of wind erosion; M5 less infiltration;	**2**
4(b)(i)	*one from each component of soil:* M1 *mineral particles:* sand / silt / clay; M2 *mineral ions:* nitrate / phosphate / potassium; M3 *organic content:* (living) plants / (living) animals / microorganisms / dead remains;	**3**
4(b)(ii)	*any two from:* M1 increases water-holding capacity (of the soil); M2 reduces the risk of soil erosion; M3 increases the nutrient or mineral content of the soil / acts as a fertiliser; M4 improve soil structure / increase air spaces; M5 adds microbes / microorganisms; M6 increases oxygen;	**2**

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Question	Answer	Marks
4(b)(iii)	M1 respiration; M2 combustion;	**2**
4(b)(iv)	*any two from for one mark:* nitrogen / oxygen / water (vapour) / argon;	**1**
4(b)(v)	M1 carbon, capture / storage; M2 plant trees / afforestation / reforestation; M3 reduce combustion or burning of fossil fuels / increase use of renewables;	**2**
4(c)	*any three from:* M1 available for future generations; M2 prevents extinction / preserves biodiversity / prevents genetic depletion; M3 prevents disruption of, food webs / chains; M4 prevents loss of habitats or stated example of habitat destruction e.g. deforestation / soil erosion; M5 reduce risk of relevant natural disaster e.g. flooding or mass movement or land slides / reduce impact of drought or crop diseases;	**3**

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7562384176

ENVIRONMENTAL MANAGEMENT **0680/23**

Paper 2 Management in Context **May/June 2024**

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

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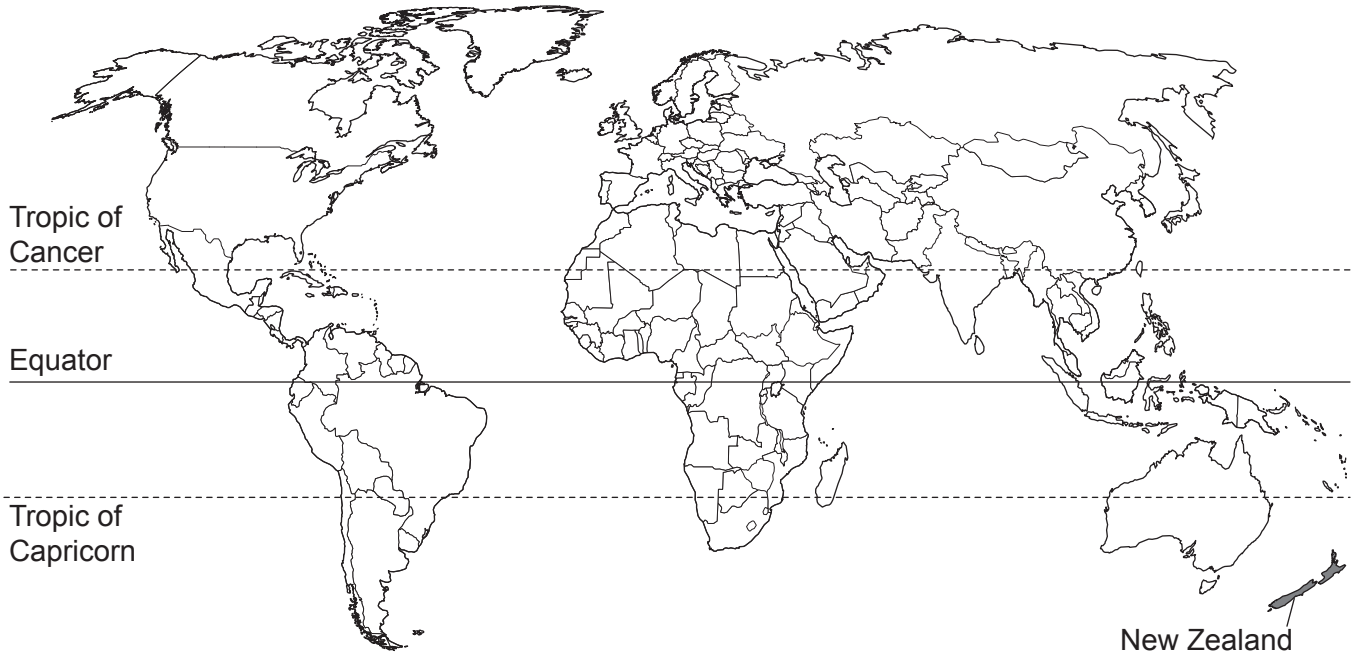
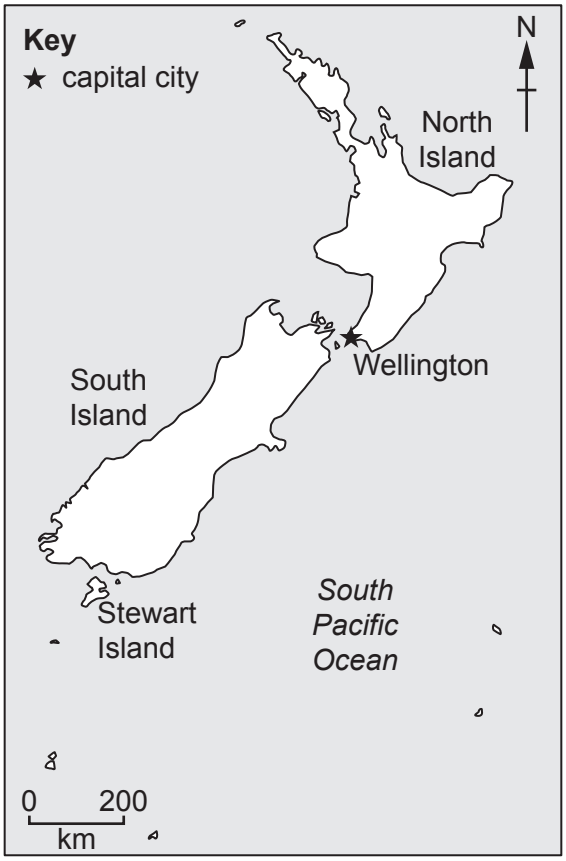
world map showing the location of New Zealand



map of New Zealand



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Area of New Zealand: 268 838 km^2

Population of New Zealand: 5.1 million (in 2022)

Children per woman: 1.86 (in 2022)

Life expectancy: 82.5 years

Currency: New Zealand dollar (1.47 NZD = 1 USD)

Language: English, Māori

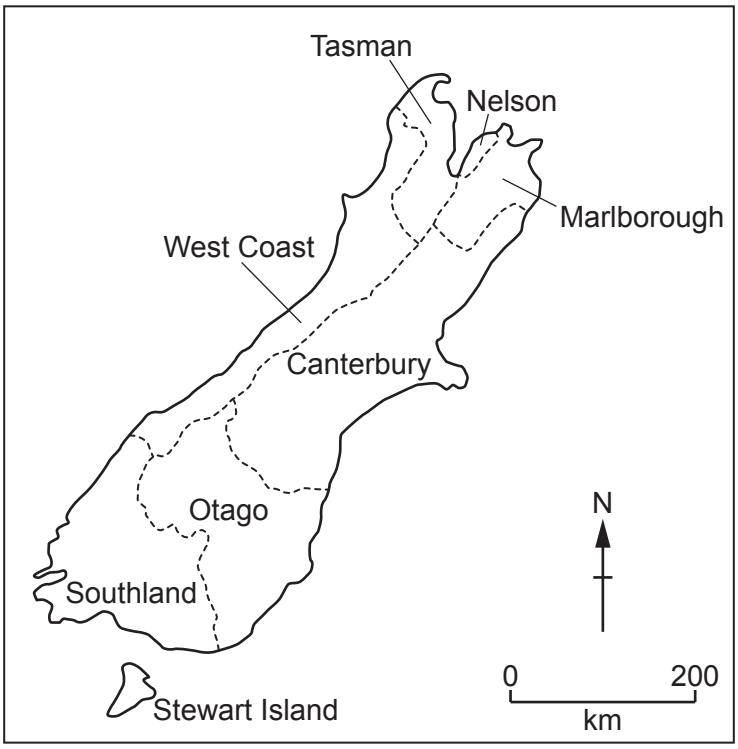
Climate of New Zealand: warm summers and cool winters with rainfall throughout the year

Terrain of New Zealand: mountains, low land along the coast

Main economic activities of New Zealand: agricultural production, silver and gold mining, services, consumer goods and tourism

New Zealand relies on exporting many agricultural products. Cereal crops, fruit and vegetables are mainly grown in the regions of Canterbury, Otago and Southland on South Island.

Map of South Island showing major regions



1 **(a)** **(i)** State **one** fact from the source information that indicates New Zealand is a more economically developed country (MEDC).

..... [1]

(ii) Describe the typical population pyramid of a MEDC.

.....

.....

.....

.....

.....

..... [3]

(iii) 25% of the population of New Zealand live on the South Island.

Calculate the number of people living on the South Island in 2022.

..... [1]

(iv) Circle the best estimate for the percentage of the total area of land of South Island occupied by the regions of Canterbury, Otago and Southland.

35 **50** **75** **90**

[1]

(b) Canterbury, Otago and Southland are the main regions for growing crops in New Zealand.

Farmers grow wheat, barley and oats. Other crops are then grown to feed livestock. Wheat is mainly grown for human consumption.

Explain why changing the crops grown in fields each year is a sustainable method of farming.

.....

.....

.....

.....

.....

..... [3]

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(c) The table shows the mean temperature and rainfall recorded at a farm in Canterbury.

month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
mean temperature / °C	17.5	17.0	16.5	13.0	10.0	8.0	7.5	8.5	10.0	13.0	14.0	16.0
mean rainfall / mm	41	37	54	52	54	64	77	67	45	51	42	47

Calculate the total annual rainfall.

..... mm [1]

(d) The photograph shows part of a farmer's field in drought conditions.

(i) The farmer expects drought conditions to occur on South Island.

Explain how climate change may cause drought.

.....

.....

.....

.....

.....

..... [3]

(ii) Identify **two** pieces of evidence in the photograph that suggest drought conditions.

1 .....

.....

2 .....

.....

[2]

(iii) State **three** ways the impact of drought can be managed on farms.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(e) Some farmers plant different varieties of apple trees at high density to give high yields.

(i) Pollination of flowers is needed for apple fruits to develop.

Describe the process of pollination.

.....

.....

.....

..... [2]

(ii) Fertilisers are used to maintain high yields of apples.

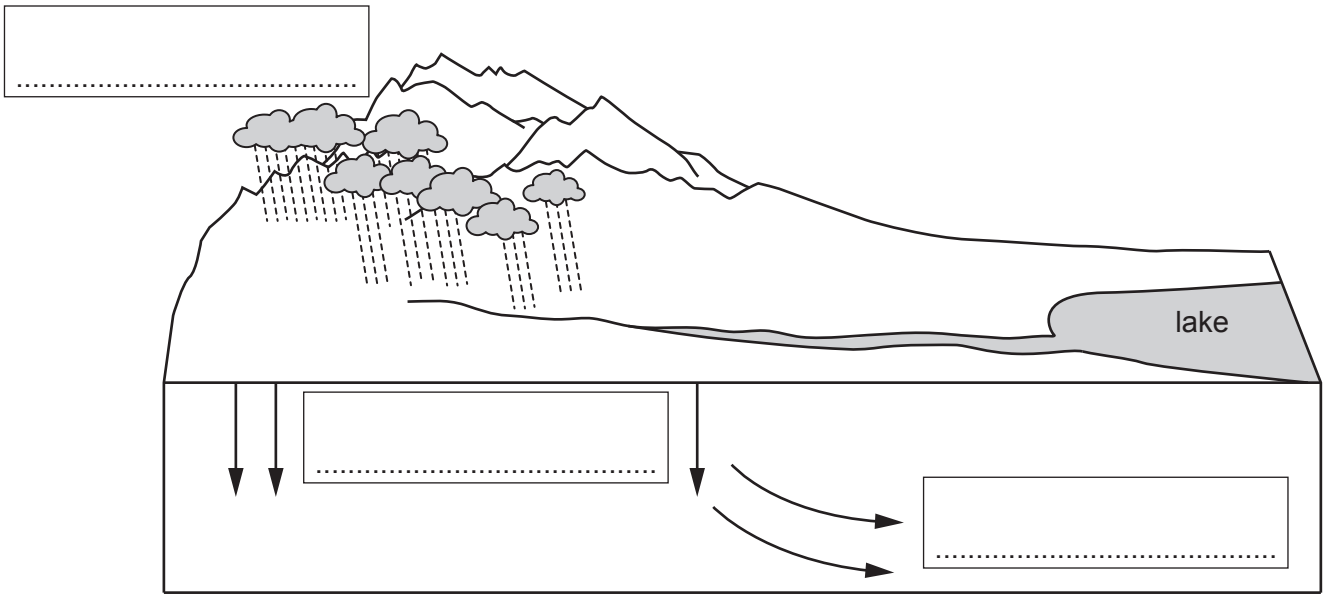
State **two** mineral ions in fertilisers.

1 .....

2 .....

[2]

(f) The diagram shows the water cycle for part of the Canterbury region.



Complete the diagram using terms from the list.

evaporation	**infiltration**	**ground water flow**
precipitation	**surface run-off**	**condensation**

[3]

(g) Suggest how farmers prevent fertilisers entering streams and rivers.

.....

.....

.....

.....

.....

..... [3]

[Total: 28]

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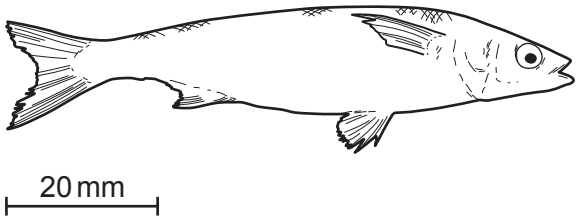
2 The diagram shows a yellow eye mullet fish.



This fish lives in the ocean around New Zealand.

(a) Use the scale to estimate the actual length of the fish shown in the diagram.

.....mm [1]

(b) A food chain for the yellow eye mullet is shown.

algae → shrimp → small fish → yellow eye mullet

(i) Explain why algae are producers.

.....

.....

.....

..... [2]

(ii) Identify the secondary consumer in this food chain.

..... [1]

(iii) Explain the meaning of the arrows in a food chain.

.....

..... [1]

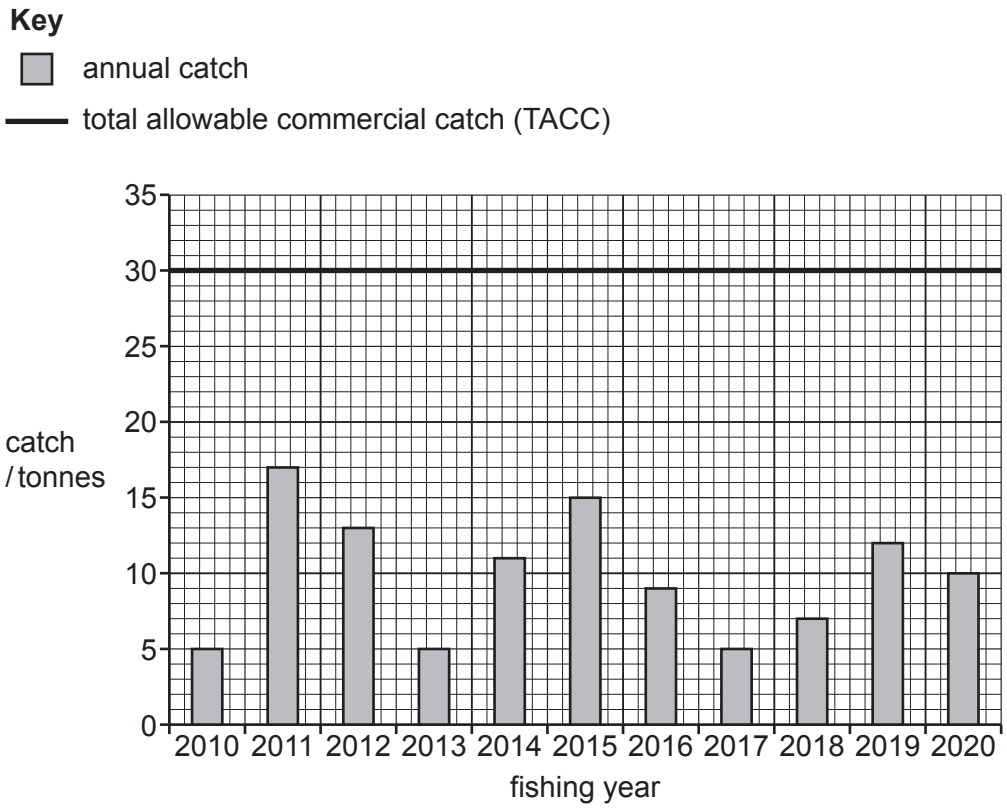
(iv) Explain the difference between a food chain and a food web.

.....

..... [1]

(c) The total allowable commercial catch (TACC) is the total quantity of each fish species that the commercial fishing industry can catch in a given year.

The bar chart shows the catch of yellow eye mullet for an 11-year period from one fishing area.



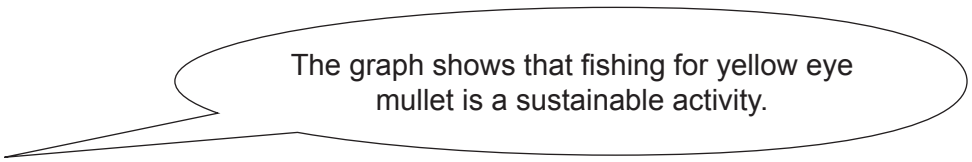
(i) Complete the sentences.

The highest annual catch was ..... tonnes.

The lowest annual catch was ..... tonnes.

[1]

(ii) A scientist said:



Describe **one** piece of evidence from the graph that supports this view.

.....

..... [1]

(iii) Another scientist considers three management options to support sustainable fishing.

option one
Reduce the TACC to 29 tonnes per year.

option two
Reduce the TACC to 17 tonnes per year.

option three
Reduce the TACC to 10 tonnes per year.

Suggest **one** reason why the scientist recommends **option three** to manage this fishing area.

.....

..... [1]

(d) Quotas are one strategy for managing this fishing area.

State **three** other management strategies that can keep a fishing area sustainable in the future.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(e) There is salmon fish farming in the cold water around Stewart Island.

The photograph shows sea cages full of salmon.

The table shows the exports of salmon from New Zealand between 2016 and 2020.

year	mass of salmon exported / thousand tonnes
2016	3.8
2017	4.4
2018	5.0
2019	5.3
2020	4.6

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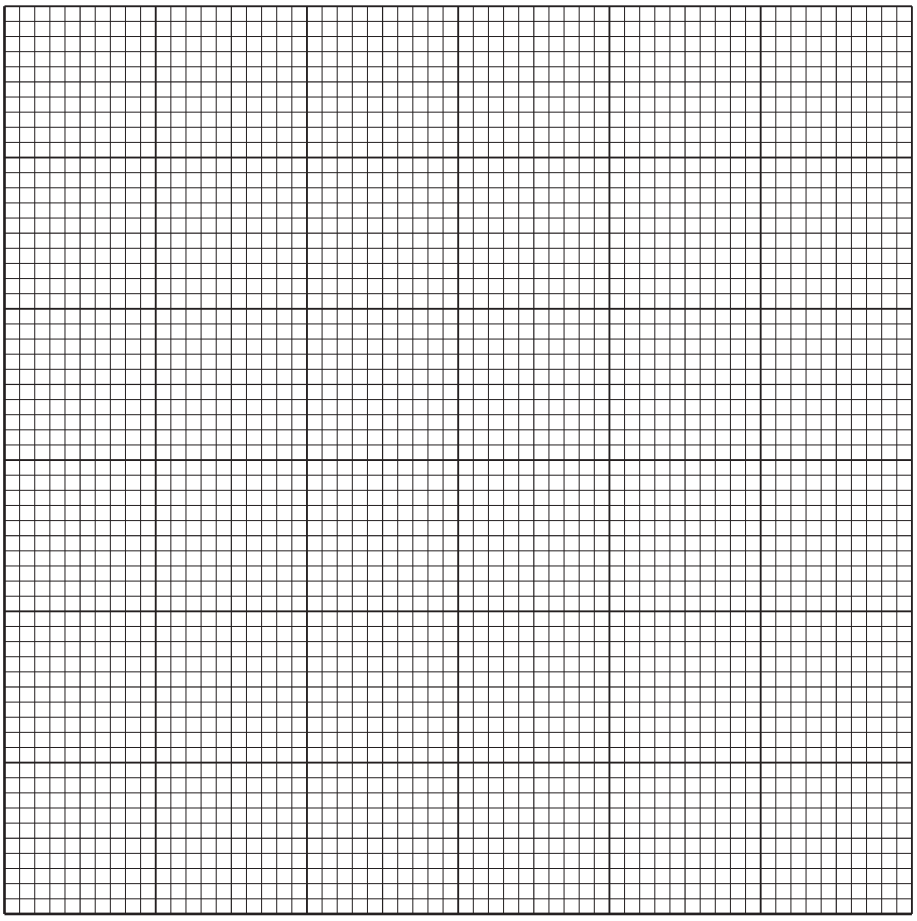
(i) Plot a bar chart of the data.



[4]

(ii) Calculate the percentage increase in the mass of exported salmon from 2016 to 2020.

..... [2]

(iii) In 2020, the sea around Stewart Island was 6 °C above the mean temperature.

Suggest **one** reason why the mass of salmon exports decreased in 2020.

.....

..... [1]

(f) Increased ocean temperatures around New Zealand are predicted to be more frequent in the future.

Explain how the enhanced greenhouse effect can cause this change.

.....

.....

.....

.....

.....

..... [3]

(g) The demand for fish exported from New Zealand increases every year.

A company applies for a licence to build a new fish farm.

A licence is only given if an environmental impact assessment shows that the impacts to the local environment can be managed effectively.

Suggest **three** possible impacts of a fish farm.

1 .....

2 .....

3 .....

[3]

[Total: 25]

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3 The photograph shows a gold and silver mine on North Island. This mine is expected to close in 2030.

(a) (i) State the type of mining shown in the photograph.

..... [1]

(ii) Suggest **one** risk to miners working in this mine.

..... [1]

(iii) The rock at this mine is igneous. Gold and silver can be found in other rock types.

State the names of **two** other rock types.

1 ……..……..

2 ……..……..

[2]

(iv) The waste from this mine contains rock and soil.

Complete the table to show the components of soil.

components of soil
mineral particles
living plants
.....
.....
.....

[3]

(b) A scientist investigates grass growth in waste rock around the mine.

The scientist collects seeds from one species of grass growing on waste rock.

This species of grass can only grow in a pH range of 4.7 to 8.5.

The scientist uses this method:

- fill 5 pots with soil
- fill 5 pots with waste rock
- put 10 seeds in each pot
- water each pot every 5 days
- measure the height of the tallest leaf and count the number of flowers in each pot at 30, 60 and 90 days.

The table shows the results of the investigation.

	soil			waste rock		
days after planting	30	60	90	30	60	90
mean height of the tallest leaf / cm	4.8	9.3	13.9	1.5	2.8	5.7
mean number of flowers	1	4	8	0	0	0

(i) Explain why the scientist includes pots with soil in this investigation.

.....

..... [1]

(ii) Suggest **three** factors the scientist should keep the same in this investigation.

1 .....

2 .....

3 .....
[3]

(iii) Write **two** suitable conclusions for this investigation.

1 .....

.....

2 .....

.....
[2]

(iv) The scientist wants to use genetic modification (GM) to produce a grass that is resistant to insect pests.

Describe how the scientist uses GM to produce grass that is resistant to insect pests.

.....

.....

.....

.....

.....

..... [3]

(c) The photograph shows part of a mine that closed several years ago.

There has been some bioremediation of this mine.

(i) Suggest how bioremediation can be used to restore this mine.

.....

.....

.....

.....

.....

..... [4]

(ii) This mine is going to become a nature reserve.

Describe **two** benefits of nature reserves.

1 .....

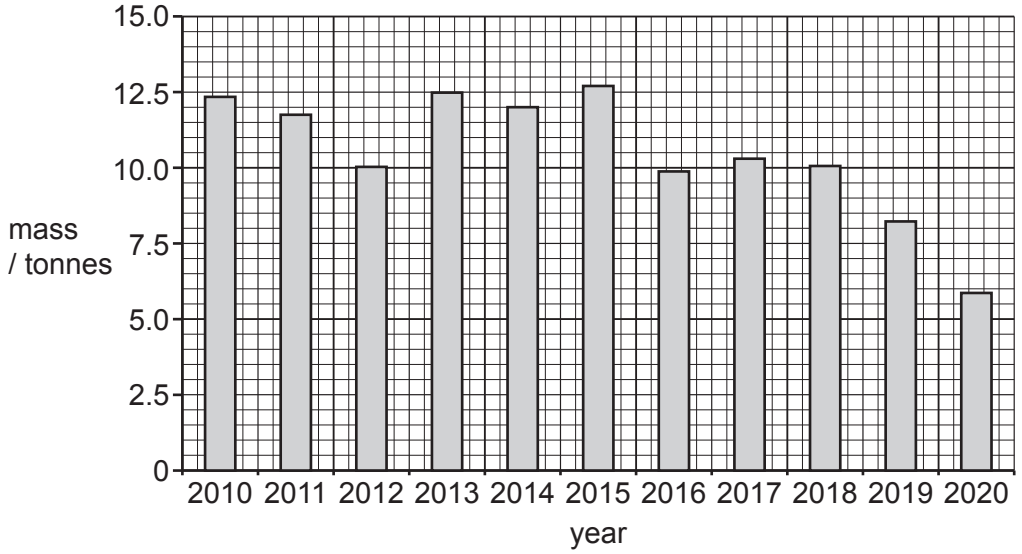
.....

2 .....

.....

[2]

(d) The bar chart shows gold production in New Zealand from 2010 to 2020.



Describe the trends shown in the bar chart.

.....

.....

.....

..... [2]

(e) A new gold mine is planned in New Zealand.

Suggest reasons why some people object to a new gold mine.

.....

.....

.....

.....

.....

..... [3]

[Total: 27]

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ENVIRONMENTAL MANAGEMENT **0680/23**

Paper 2 Management in Context **May/June 2024**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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PUBLISHED

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	‘List rule’ guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

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Question	Answer	Marks
1(a)(i)	*any one from:* M1 low birth rate ; M2 high life expectancy ; M3 low children per woman ;	**1**
1(a)(ii)	*any three from* M1 similar shape / width for males and females ; M2 narrow base ; M3 wider in the middle ; M4 tall / high ;	**3**
1(a)(iii)	1 275 000 ;	**1**
1(a)(iv)	75 ;	**1**
1(b)	*any three from:* M1 soil is fertile ; M2 soil erosion avoided ; M3 different crops need different nutrients / minerals / named ions ; M4 reduces risk of pests / disease ; M5 reduced use of pesticides / fertilisers ; M6 some crops / legumes add nutrients / minerals / mineral ions ;	**3**
1(c)	631 ;	**1**
1(d)(i)	*any three from* M1 high / increased temperatures / global warming / (enhanced) greenhouse effect ; M2 (high temperatures increases) evaporation / less surface water ; M3 dry soils / land ; M4 no / less rain / ppt ; M5 (global warming) alters weather patterns ; M6 more chances of extreme weather ;	**3**
1(d)(ii)	*any two from:* M1 cracks in soil ; M2 no / few plants ; M3 no water (visible) / dry soil / land;	**2**

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Question	Answer	Marks
1(d)(iii)	*any three from* M1 rainwater harvesting ; M2 irrigation /described ; M3 drought tolerant / resistant crops ; M4 dams and reservoirs (on farm) ;	**3**
1(e)(i)	M1 the movement of pollen from an anther to a stigma ; M2 animal / insect / named insect pollination / wind pollination ;	**2**
1(e)(ii)	*any two from*: M1 nitrate ; M2 potassium ; M3 phosphate ;	**2**
1(f)	M1 precipitation ; M2 infiltration ; M3 ground water (flow) ;	**3**
1(g)	*any three from*: M1 do not use on rainy / windy days; M2 control/use less fertiliser/follow instructions e.g. use correct quantity; M3 keep animals / animal waste out of / organic matter/away from rivers; M4 ensure plant cover / no bare soil; M5 plant trees / shrubs, around edges of field / near rivers / *idea of* a buffer at edge of field; M6 contour ploughing / terracing / use of bund; M7 direct drilling ;	**3**

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Question	Answer	Marks
2(a)(i)	75 (mm) ;	**1**
2(b)(i)	*any two from* M1 they produce their own glucose; M2 use process of photosynthesis / trap sunlight / convert light energy; M3 first trophic level;	**2**
2(b)(ii)	small fish ;	**1**
2(b)(iii)	(direction) of energy transfer / flow / nutrient / food flow / feeding;	**1**
2(b)(iv)	food chain only shows one feeding relationship / food webs show alternative sources of food for organisms or consumers / food web is more than one food chain;	**1**
2(c)(i)	17 **AND** 5 ;	**1**
2(c)(ii)	*any one from:* M1 catch are fluctuating and not decreasing; M2 does not exceed TACC / 30 tonnes ; M3 catch recovers (from a lowest point or three times) / always between 5 and 17 tonnes; M4 if it was not sustainable the catch would not recover ;	**1**
2(c)(iii)	(lowest quota so) most likely to prevent overfishing / extinction / collapse of fish population / fish stock;	**1**
2(d)	*any three from* M1 use smaller nets; M2 use larger mesh size; M3 limit size of boats; M4 limit number of boats / licences; M5 closed seasons; M6 protected areas / reserves / no fish zones; M7 laws / international agreements / legislation/regulations/fines/enforcement ; M8 monitoring fishing / patrols;	**3**

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Question	Answer	Marks
2(e)(i)	**M1** axes labelled with unit: x-axis year **AND** y-axis mass (of salmon exported) **AND** thousand tonnes **M2** sensible linear scale such that the data occupies half the grid area; **M3** data plotted correctly; **M4** bars of equal width;	**4**
2(e)(ii)	M1 4.6 – 3.8 or 0.8 ; M2 (M1 ÷ 3.8 × 100) = 21 % ;	**2**
2(e)(iii)	*any one from:* M1 conditions no longer ideal for reproduction / growth / survival ; M2 reduced feeding by salmon ; M3 they grow better in cold water / slower in hot ; M4 more disease ; M5 stress ; M6 (some) died;	**1**
2(f)(i)	*any three from* M1 (increased) greenhouse gases **OR** named greenhouse gas ; M2 (solar) radiation / sunlight passes through the Earth's atmosphere ; M3 (some solar) radiation is lost to space; M4 (some solar) radiation is reflected back to the Earth's surface ; M5 (solar) radiation is absorbed by the oceans;	**3**
2(g)	*any three from* M1 (fish / food) wastes / eutrophication; M2 chemical pollution from boats ; M3 use of pesticides; M4 (escaped fish) disrupt food chain / spread of disease (to wild fish stocks); M5 reduction of overfishing; M6 economic impact described; M7 damage to (wild) fish stocks used as food for salmon;	**3**

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Question	Answer	Marks
3(a)(i)	surface mining / open pit / opencast ;	**1**
3(a)(ii)	falling rocks / rockfall / landslides;	**1**
3(a)(iii)	sedimentary ; metamorphic ;	**2**
3(a)(iv)	*any three from* M1 micro-organisms; M2 air; M3 water ; M4 organic matter / humus;	**3**
3(b)(i)	control / to compare the growth of plants;	**1**
3(b)(ii)	*any three from* M1 **volume / mass** of soil / waste ; M2 **volume** of water ; M3 **volume** / size of pot ; M4 temperature ; M5 light (intensity) / daylength; M6 humidity;	**3**
3(b)(iii)	*any two from* M1 plants in waste rock are shorter / stunted ; M2 plants in waste rock **do not** flower ;	**2**
3(b)(iv)	*any three from* M1 identify / find a plant that is resistant (to insects) ; M2 identify / extract gene(s) for resistance (to insects); M3 insert / introduce gene(s) into grass plants ;	**3**

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Question	Answer	Marks
3(c)(i)	*any four from* M1 add microbes / bacteria / fungi / microorganisms ; M2 add organic matter ; M3 add soil; M4 plant seeds/vegetation/trees ; M5 introduce (grazing) animals ;	**4**
3(c)(ii)	*any two from* M1 reduces human interference / stated example eg hunting ; M2 creates / maintains many habitats ; M3 increases / maintains biodiversity ; M4 protects (rare / endangered) species;	**2**
3(d)	*any two from:* M1 fluctuates ; M2 then decrease ; M3 overall decrease ;	**2**
3(e)	*any three from* M1 (risk of) water / land / soil / air / noise / visual pollution ; M2 loss of, habitat / biodiversity / wildlife ; M3 need to relocate people ; M4 scare animals away ; M5 damage due to transport ; M6 loss of farm land ;	**3**

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