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National
Qualifications
2016

Mark

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X726/76/01

Environmental Science

FRIDAY, 3 JUNE

9:00 AM – 11:30 AM



Fill in these boxes and read what is printed below.

Full name of centre

Town

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Forename(s)

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Scottish candidate number

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Total marks — 100

Attempt ALL questions.

Questions 10 and 11 each contain a choice.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers and rough work is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting. Any rough work must be written in this booklet. You should score through your rough work when you have written your final copy.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not you may lose all the marks for this paper.



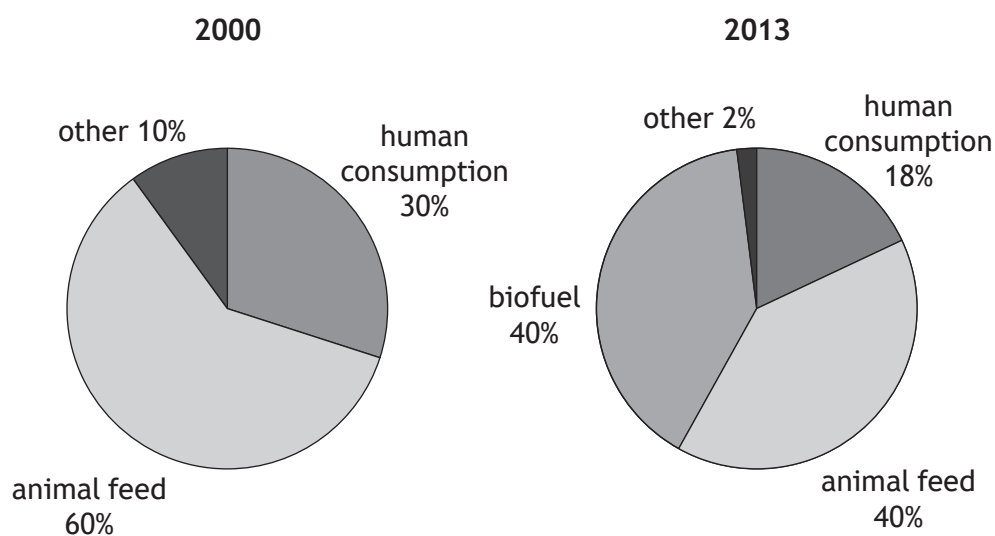
Total marks — 100 marks

Attempt ALL questions

Questions 10 and 11 each contain a choice

1. Corn, also known as maize, is one of the most widely grown crops on the planet.
- (a) The pie charts show global changes in the percentage uses of corn between 2000 and 2013.

Percentage uses of corn



(i) State what is meant by *biofuel*.

1

(ii) Describe fully the changes in the percentage uses of corn between 2000 and 2013.

2



1. (a) (continued)

(iii) State **one** advantage to the farmer of growing corn for biofuel.

1

(iv) State **one** disadvantage to the consumer of corn being grown for biofuel.

1

(b) A biofuel plant in the USA processes the corn into bioethanol:

- Up to 220 truckloads of corn are delivered each day
- Each truckload contains sufficient corn to produce 2800 gallons of bioethanol
- 110 million gallons of bioethanol are produced each year at the plant.

Calculate, to the nearest whole truckload, how many truckloads of corn must be processed to yield 110 million gallons of bioethanol.

1

Space for calculation



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1. (continued)

- (c) Biofuels produced from crops are often said to be *carbon-neutral*.

The term *carbon-neutral* implies that there is no net release of carbon dioxide into the atmosphere and therefore does not contribute to global warming.

The claim that biofuels are carbon-neutral could be disputed.

Suggest **one** reason for and **one** reason against the claim.

2

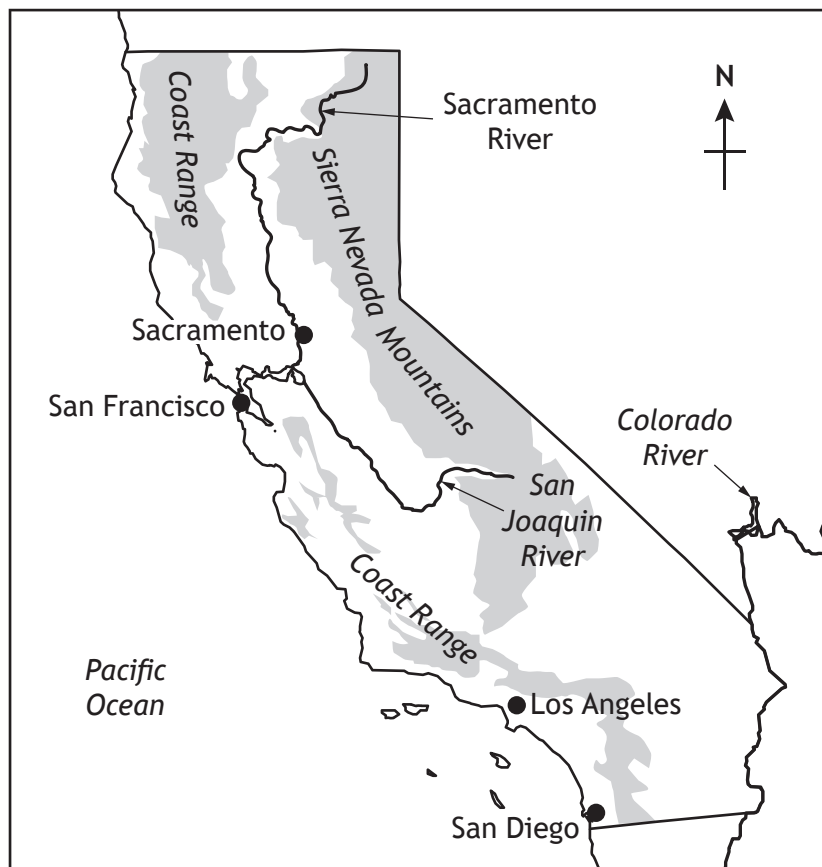
- (d) Describe, using a named example, a legislative role that Government plays in food production.

2



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2.



California is the most populated state in the USA. Rain normally falls in California only during the winter and spring months. The coastal urban centres are supplied by a series of pipelines and canals transporting water from snow melt and streams from the Sierra Nevada mountains. This is supplemented by aquifers near the coast.

(a) Suggest a possible impact of global warming on availability of freshwater from the following:

(i) the mountains;

1

(ii) aquifers near the coast.

1



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2. (continued)

(b) The table displays data on water usage in California.

<i>Sector</i>	<i>Water usage in a normal rainfall year (%)</i>	<i>Water usage in a drought year (%)</i>
Urban	10	14
Agricultural	40	53
Environmental (maintaining river systems and wetlands)	50	33

Explain the changes in the water usage for each sector between normal rainfall and drought years.

3



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2. (continued)

(c) Agriculture in California is located mainly in the valleys of the Sacramento and San Joaquin rivers and in the south by the Colorado River. California produces an estimated one-third of vegetables and two-thirds of fruit and nuts grown in the USA.

In the period 2011–2014, California experienced continual drought and farmers had to make choices as to which crops were viable.

(i) Suggest whether fruit trees or vegetables should get priority for irrigation during drought years.

Give a reason for your answer.

1

(ii) Farmers are turning to drilling wells to access water stored in aquifers.

Explain why this could be unsustainable.

2

(iii) Suggest **one** strategy that farmers could adopt to continue food production in areas subject to ongoing drought.

1



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3. The snowshoe hare is a herbivore and is the principal prey of the lynx.

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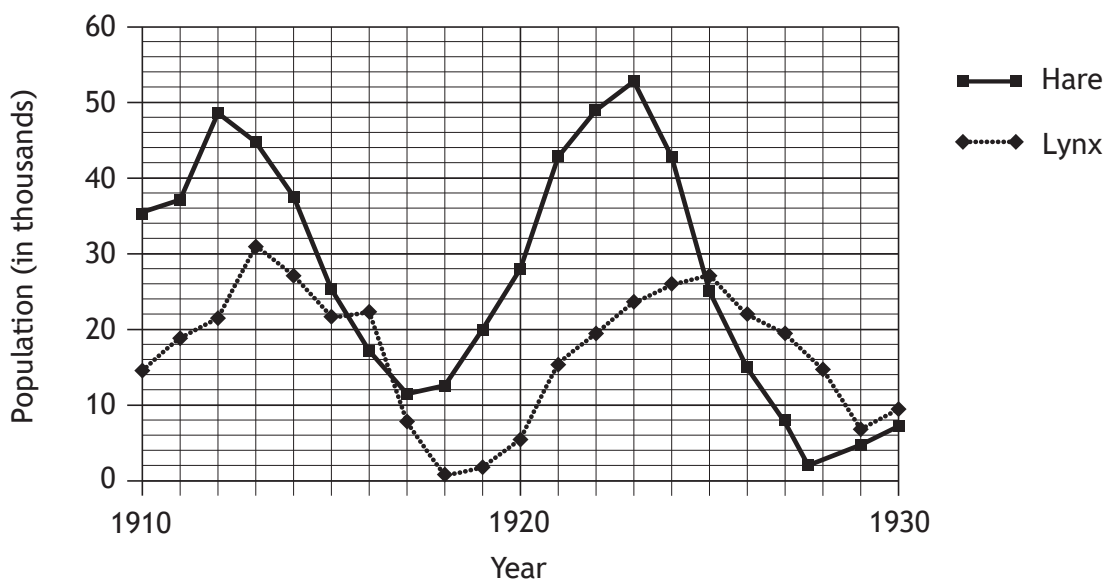


Snowshoe hare



Lynx

The graph below shows cycles in the populations of snowshoe hare and lynx in northern Canada over a 20-year period.



(a) Explain how the data in the graph show that lynx predation of the hare is density-dependent.

1

(b) Using information from the graph, explain why the evidence suggests that the hare is not the only food source for the lynx.

2



3. (continued)

- (c) Predict the effect that increased hunting of lynx by humans would have on the hare population cycle.

Explain your answer.

2

- (d) Explain what impact a crash in the hare population may have on local biodiversity.

2

- (e) There are proposals to reintroduce the European lynx into Scotland. Name **one** other previously extinct species that has been reintroduced into Scotland.

1



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4. Product obsolescence refers to the time and state in which a piece of technology or a product ceases to be useful, productive or compatible.



There are different categories of obsolescence, including:

- **Technological** — a new technology or product supersedes the old, even if the old technology is still functional
- **Planned** — a product is deliberately designed to have an artificially limited lifespan
- **Psychological** — a consumer is persuaded that they need a new product even when their existing product is working well.

(a) The table shows the types of obsolescence associated with different products.

<i>Product</i>	<i>Technological obsolescence</i>	<i>Planned obsolescence</i>	<i>Psychological obsolescence</i>	<i>Designed to last</i>
Light bulb		✓		
Computer software	✓			
Mobile phone				
Luxury car eg Rolls Royce				✓
Printer cartridge				

Complete the table to show which category each of the following would be most likely to fit into.

Justify your answers.

(i) Mobile phone

1

(ii) Printer cartridge

1



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4. (continued)

(b) A computer manufacturer may use parts that have a lifespan of only a few years but are cheaper to produce than longer lasting parts.

(i) Describe **one** economic, **one** social, and **one** environmental outcome of this type of obsolescence.

3

(ii) Describe a possible sustainable outcome for an obsolete computer. 1



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4. (continued)

- (c) Waste laptop batteries must be processed according to the EU's Hazardous Waste Directive. Transportation and disposal should only be carried out by a licenced waste carrier.

Other than the Hazardous Waste Directive, name another piece of waste management legislation.

1



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5. In 2010 the International Union for the Conservation of Nature (IUCN) identified species in danger of extinction.

The table shows the numbers of species identified in 2010 as being in danger of extinction, as a percentage of the number of species evaluated.

Group	Number of recorded species	Number of species evaluated	Number of evaluated species in danger of extinction	Evaluated species in danger of extinction (%)
Amphibians	6433	6351	2236	35
Birds	9998	9865	1381	
Fish	31 300	8814	1851	21
Invertebrates	1 305 300	9526	2858	30
Mammals	5501	5491	1131	21
Reptiles	9084	2829	594	21
Flowering plants	281 821	12 914	8781	68

(a) (i) Calculate the percentage of evaluated bird species estimated to be in danger of extinction.

1

Space for calculation

(ii) Suggest a reason why so few of the invertebrate species have been evaluated.

1



5. (continued)

- (b) Flowering plants is the group with the highest percentage of species in danger of extinction.

State **two** ways in which intensive agriculture might have contributed to the endangered status of some flowering plants.

2

- (c) Scotland is home to six species of amphibian: three newts, two toads and one frog.

All these amphibians begin life as eggs laid in ponds and ditches, which hatch into tadpoles that initially feed on algae and invertebrates. Over a period of 4 to 18 months, the tadpoles metamorphose into adults. They then leave the water and become active terrestrial carnivores, feeding mainly on insects, slugs and worms. During winter they are found inactive in damp sheltered places under rocks and logs, or in mud at the bottom of ponds. They become sexually mature between the ages of three to five years, returning in early spring to breed in the pond where they hatched.

- (i) Explain how the over-use of fertilisers could decrease amphibian populations.

2



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5. (c) (continued)

(ii) State **one** role of each of the following in the conservation of amphibians.

(A) SEPA

1

(B) SSSIs

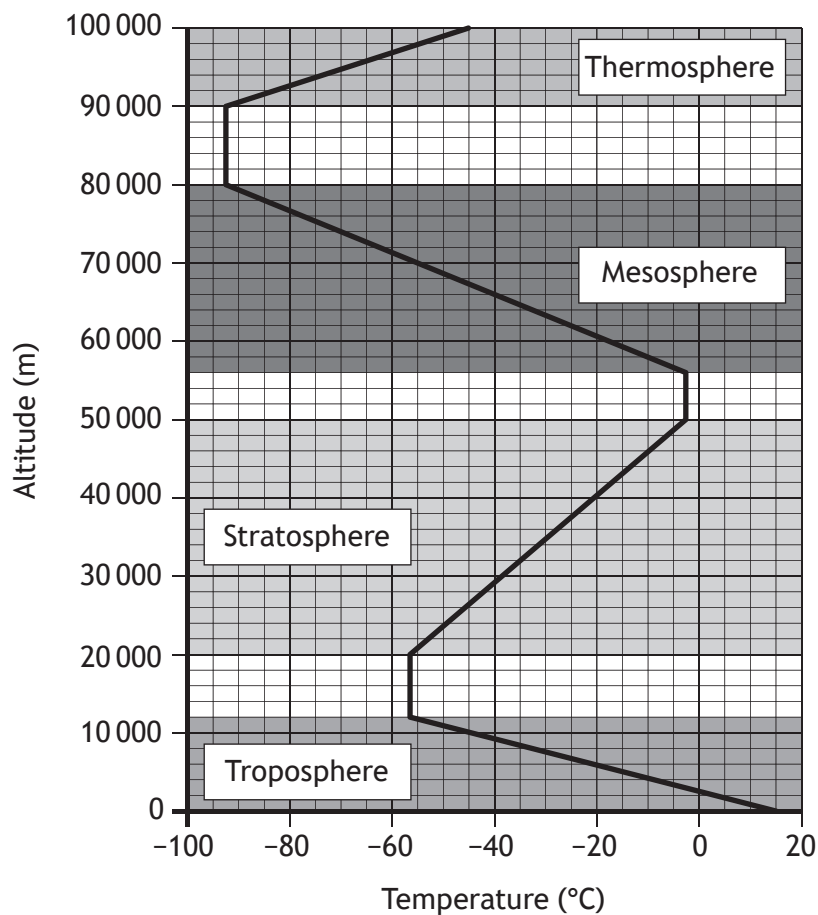
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6. The graph below shows altitude and temperature changes associated with the layers in the Earth's atmosphere.



- (a) (i) Name the layer where most weather events take place. 1
- (ii) After take-off, some aircraft climb rapidly to above 10 000 m. Explain an environmental advantage in doing this. 2



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6. (a) (continued)

(iii) The Earth's atmosphere contains a high abundance of oxygen compared with other planets. This allows for the formation of ozone (O₃).

State where in the atmosphere the highest concentration of ozone is found.

1

(b) Ozone is an example of a natural greenhouse gas.

(i) Name an anthropogenic greenhouse gas.

1

(ii) Explain the contribution of this anthropogenic greenhouse gas to the enhanced greenhouse effect.

3



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7. The proportion of a country's population living in either urban or rural locations changes over time.

(a) Scotland saw considerable urban growth during the 18th and 19th centuries.

State **two** factors that contributed to this change.

2

(b) Between 2001 and 2010, the rural population of Scotland increased by approximately 10% and the urban population increased by 1.7%.

Suggest **two** reasons why the rural population has increased at a greater rate than the urban population.

2

(c) Suggest an environmental advantage of urban living, in terms of:

(i) waste;

1

(ii) domestic energy.

1



7. (continued)

- (d) Explain the impacts that the development of road transport links has on biodiversity.

3

- (e) Changes in land use, such as developing new transport links, requires environmental assessment.

(i) State the purpose of environmental assessment.

1

(ii) Describe the difference between an EIA and SEA.

1



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8. India has the world's second largest population, with over 1.3 billion citizens. This is currently increasing by 1.41% per year. Since the 1960s, the country has introduced a range of strategies to improve crop yields and improve food security.

(a) Name a global strategy used for increasing land-based food production and another strategy used for increasing aquatic food production.

2



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8. (continued)

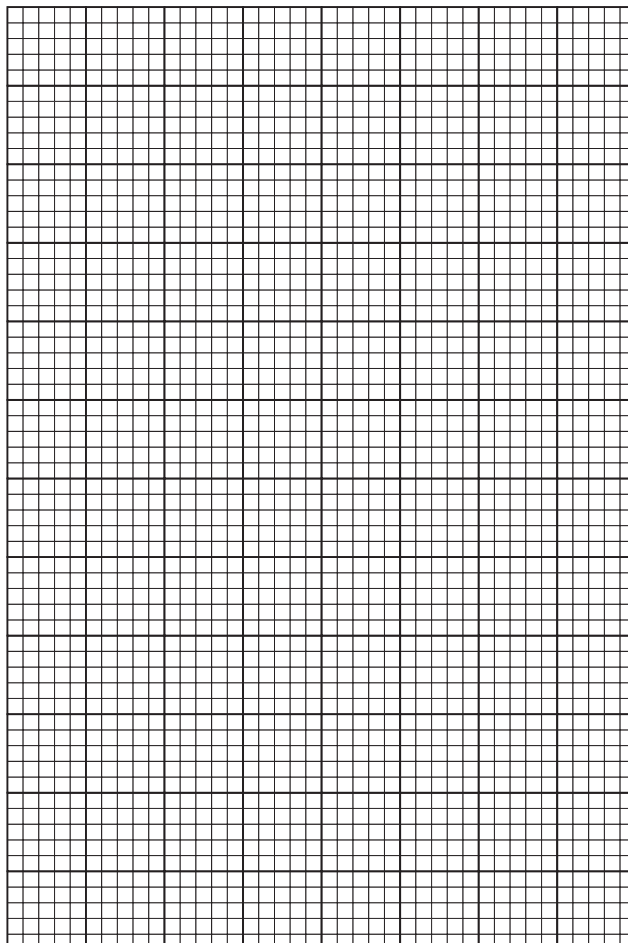
(b) The data in the table below refer to cereal production in India between 2010 and 2012.

Crop	Area (million hectares)			Production (million tonnes)			Yield (tonnes/hectare)		
	2010	2011	2012	2010	2011	2012	2010	2011	2012
Rice	42	43	44	89	96	105	2.12	2.23	2.39
Wheat	29	29	30	81	87	95	2.79	3.00	3.17

Draw a line graph to show the production of rice and wheat between 2010 and 2012.

3

(Additional graph paper, if required, can be found on Page 33)



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8. (continued)

- (c) Crop production is reliant on the conversion of light energy into chemical energy.

Net productivity = gross productivity – respiration

Explain what is meant by *gross productivity*.

2

- (d) Increasing affluence has resulted in an increase in meat consumption in many places.

Explain why an increase in meat consumption may **not** be sustainable.

2



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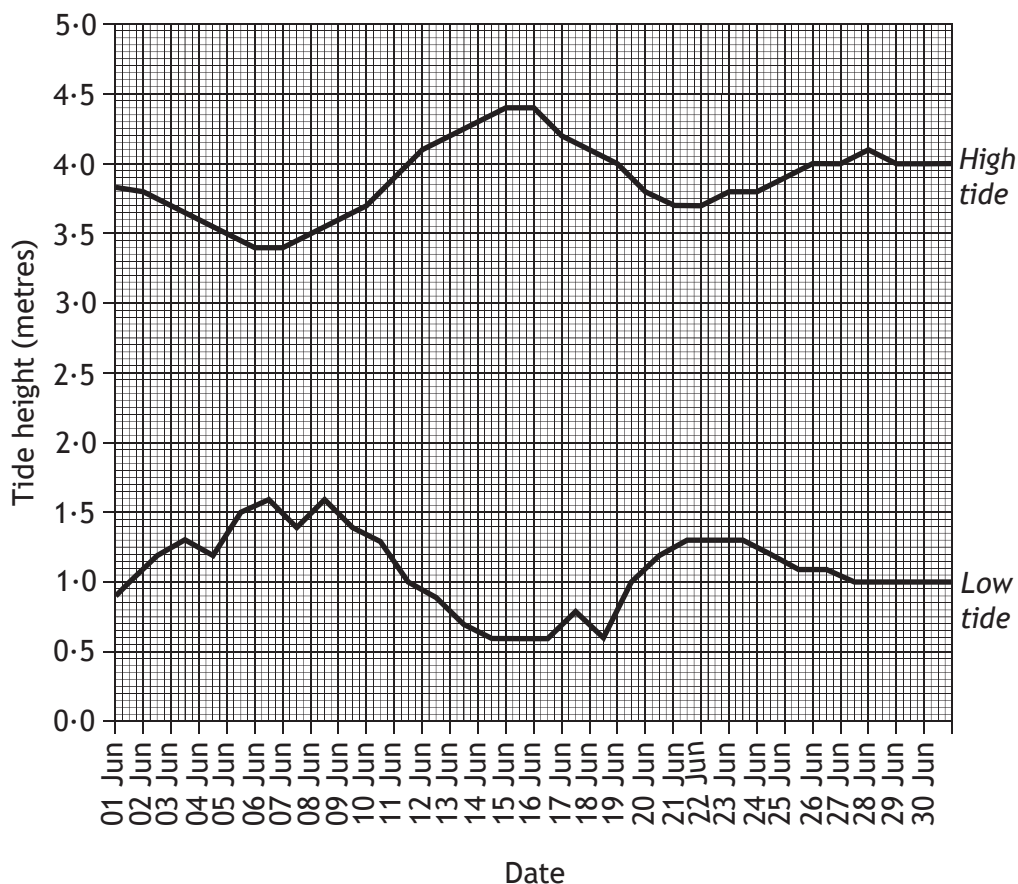


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9. Oceanic currents can move water both horizontally and vertically, and occur at both local and global scale.

(a) The graph below shows minimum and maximum tide heights recorded for Aberdeen during June 2014.

Tide graph for Aberdeen during June 2014
(daily min and max heights)



(i) Describe the trends shown in the graph.

2



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9. (a) (continued)

(ii) The daily tidal range is the difference between the high and low tide heights.

A “spring tide” occurs when the daily tidal range is at its maximum.

A “neap tide” occurs at the point where there is least change.

Calculate the range for the neap tide shown in the graph.

1

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(iii) Identify the dates on which the spring tide occurred.

1

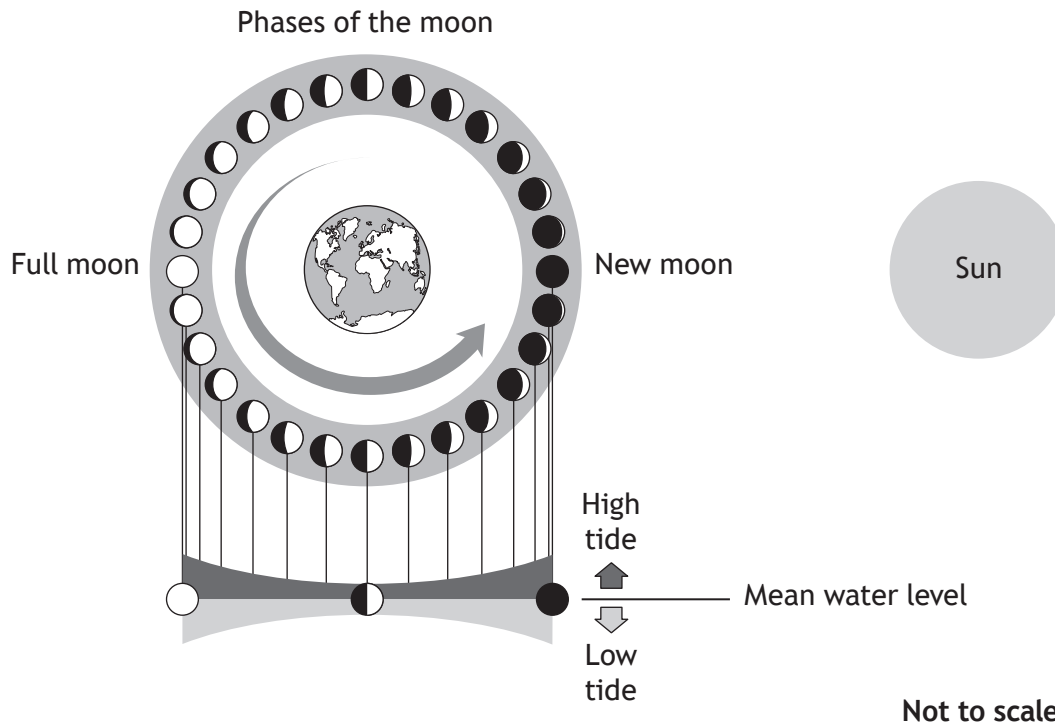
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9. (continued)

(b) The diagram below shows the impact of phases of the moon on tidal range.



Describe the relationship between phases of the moon and the spring and neap tides.

2

9. (continued)

- (c) The Coriolis effect plays a role in both oceanic and atmospheric circulation.

Explain the differing impact of the Coriolis effect on **atmospheric circulation** at the equator compared with its effect in the northern and southern hemispheres.

4

You may wish to include a diagram as part of your answer.



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For questions 10 and 11 choose to answer **either** A or B. Write your answers on the following pages. Diagrams may be used where appropriate.

10.A Water footprinting is a method used for assessing the direct and indirect use of water during the manufacture of a product.

Water footprinting is defined as “the total volume of freshwater that is used to produce the goods and services consumed by the individual or community or produced by the business” (The Water Footprint Assessment Manual, 2011).

Discuss the potential water footprint of the following industries:

(a) Brewing

(b) Papermaking

10

OR

B The “hydrogen economy” refers to a vision whereby hydrogen could be used as an energy carrier for the future, reducing our reliance on fossil fuels for powering industry, transportation and domestic needs.

Discuss the hydrogen economy under the following headings:

(a) The benefits of using hydrogen as a fuel

(b) The challenges of using hydrogen as a fuel

10

11.A Give an account of the qualitative and quantitative techniques used for sampling named plant and animal groups or species found in terrestrial ecosystems.

10

OR

B Give an account of the impact of climate change on terrestrial biodiversity and species distribution.

10





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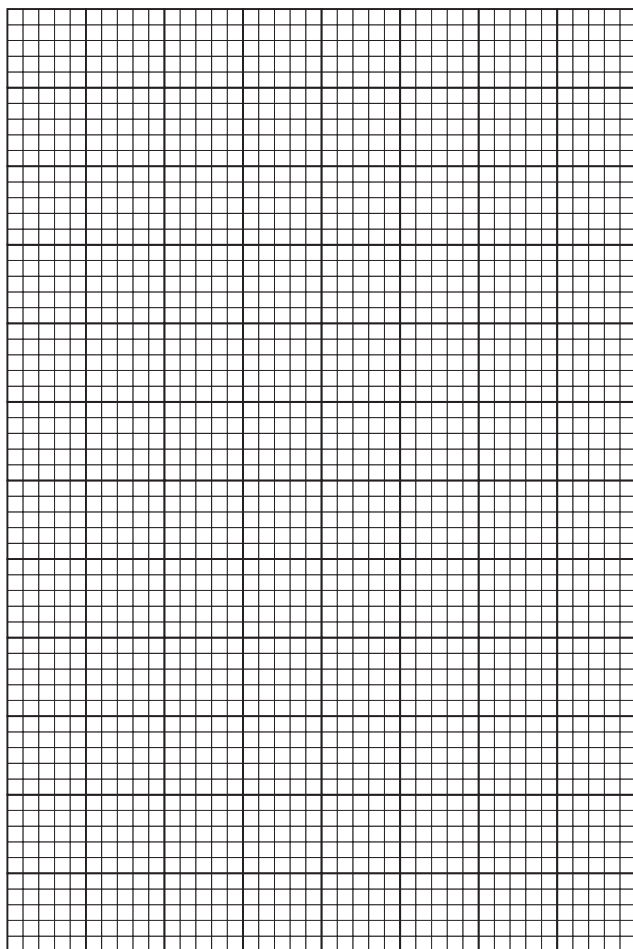


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ADDITIONAL GRAPH PAPER FOR QUESTION 8 (b)



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ACKNOWLEDGEMENTS

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Question 10.A – Water Footprint definition is taken from *Hoekstra et al., 2011, The Water Footprint Assessment Manual: Setting the Global Standard*. Published by Earthscan. Reproduced by kind permission of Arjen Hoekstra.



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