FOR OFFICIAL USE

Total for Sections A and B

X055/12/01

NATIONAL QUALIFICATIONS 2012

THURSDAY, 7 JUNE
1.00 PM – 3.30 PM

MANAGING ENVIRONMENTAL RESOURCES HIGHER

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth

Day Month Year

Scottish candidate number

Number of seat

1 (a) All questions should be attempted.

(b) It should be noted that in **Section B** questions 8 and 9 each contain a choice.

2 The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, and must be written clearly and legibly in ink.

3 Additional space for answers will be found at the end of the book. If further space is required, supplementary sheets may be obtained from the Invigilator and should be inserted inside the **front** cover of this book.

4 The numbers of questions must be clearly inserted with any answers written in the additional space.

5 Rough work, if any should be necessary, should be written in this book and then scored through when the fair copy has been written.

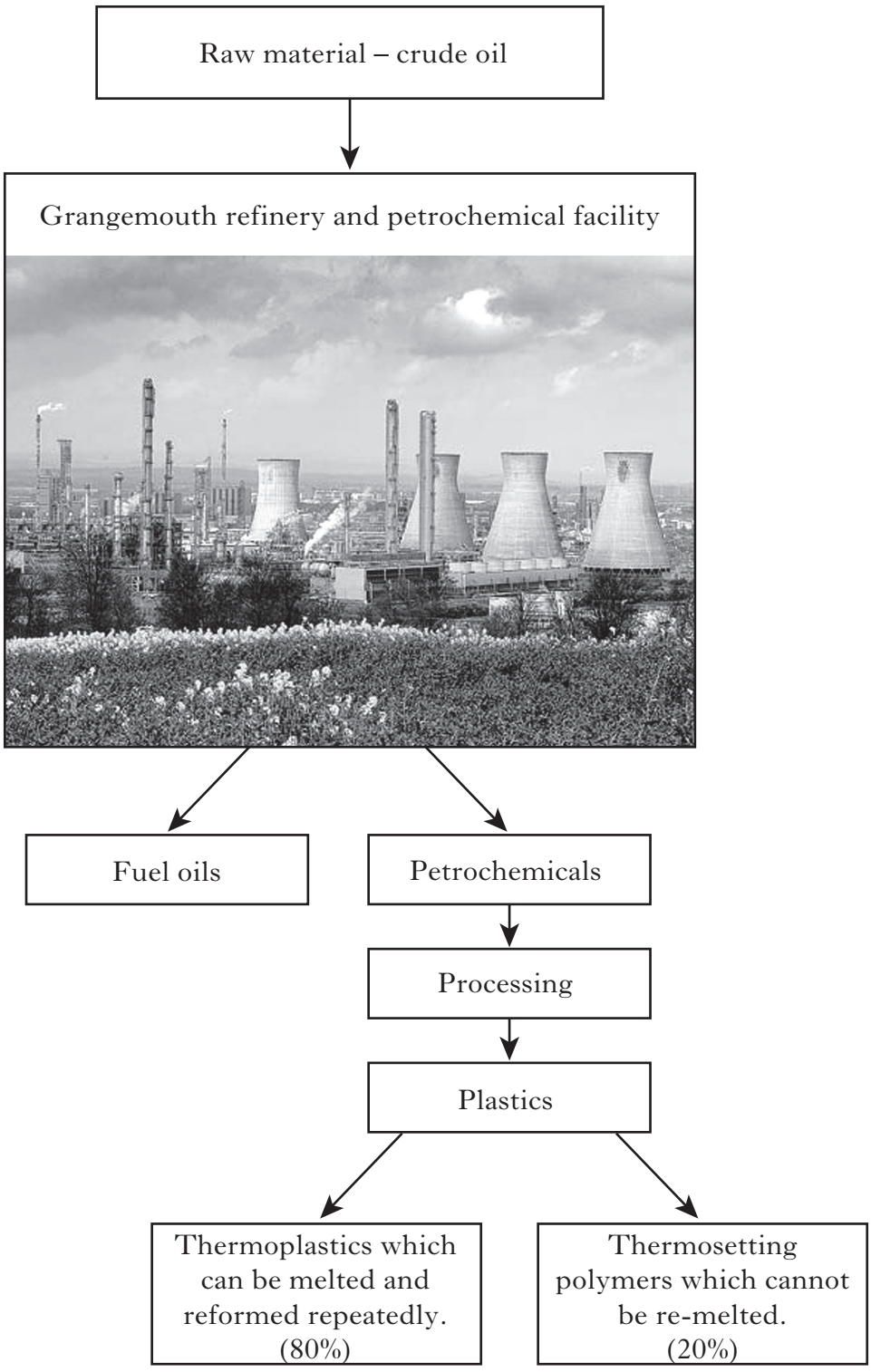
6 Before leaving the examination room you must give this book to the Invigilator If you do not, you may lose all the marks for this paper.

SECTION A

Answer ALL questions in this section.

1. (*a*) Scotland's largest oil refinery and petrochemicals facility at Grangemouth processes 10 million tonnes of crude oil annually.

The diagram below shows some stages in the refining of crude oil.



1. (*a*) (continued) *Marks*

(i) Is plastic made from a renewable or non-renewable resource? Circle your choice and give a reason for your answer.

Renewable Non-renewable

Reason _____

_____ **1**

(ii) Products made from thermosetting polymers are non-recyclable.

Explain why this is a disadvantage to the environment.

_____

_____ **1**

(iii) Give **two** reasons why the demand for fuel oils is increasing.

1 _____

2 _____ **1**

(*b*) (i) Plastic bottles can be used in innovative and environmentally friendly ways. The diagram below shows a greenhouse constructed from two-litre plastic bottles.

Producing a two-litre plastic bottle requires 6·8 megajoules (MJ) of energy. This is known as embedded energy.

Calculate the embedded energy required in a greenhouse made from 1500 two-litre plastic bottles.

Space for calculation

Answer _____ MJ **1**

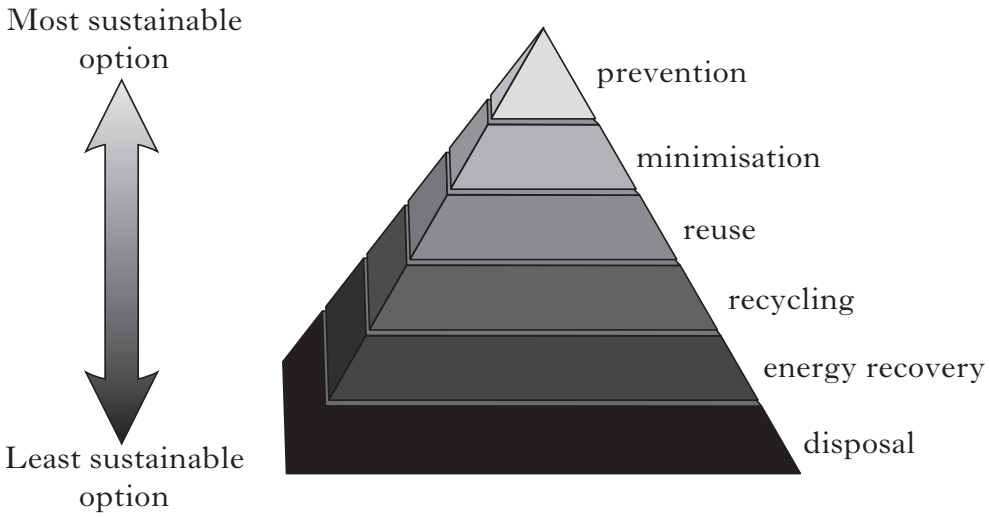
1. (*b*) (continued) *Marks*

(ii) Name the type of assessment which considers the materials, energy input, transportation and disposal of plastic bottles.

_____ **1**

(*c*) The "Waste Hierarchy" is a major aspect of the waste management policies of the Scottish Government, the UK Government and the European Union.

The diagram below shows the "Waste Hierarchy" indicating how waste materials can be managed in the most sustainable ways.



(i) Prevention or minimisation are the most sustainable options for dealing with waste.

Suggest how **one** of these options can be achieved.

_____

_____ **1**

(ii) Give **two** ways in which local authorities encourage recycling.

1 _____

2 _____ **1**

(iii) How could households contribute to the sustainable use of organic waste?

_____ **1**

(iv) Name **one** piece of UK legislation which encourages waste minimisation.

_____ **1**

[Turn over for Question 2 on *Page six*

2. Read the information below and answer the questions that follow. *Marks*

Preventing pollution of the environment is a major concern in Scotland. The Scottish Environment Protection Agency (SEPA) is a statutory organisation concerned with monitoring pollution. It is accountable through Scottish ministers to the Scottish Parliament. Its main role is to protect and improve the environment. This is done by helping business and industry to understand their environmental responsibilities: to comply with legislation, to encourage good practice and to promote the many economic benefits of good environmental practice.

SEPA helps to protect communities from harmful pollution to water, air and land. It monitors levels of pollution by analysing water quality, emissions from transport and waste. SEPA also has responsibility for Scotland's flood warning systems.

SEPA employs a range of specialists in areas such as chemistry, ecology, environmental regulation, hydrology, engineering, quality control, planning, communications, business support and management functions.

(*a*) Complete the table below to show information about activities which can cause pollution.

Ecosystem affected by pollution	*Activity example*	*Pollution problem which arises to cause conflict*	*Possible solution to conflict*
Land		Visual scarring of landscape	Legal requirement to restore site to encourage the return of wildlife
Air	Increasing car emissions as a result of increased domestic car use	Car emissions contribute to acid rain formation	
Water	Excessive run-off of fertilisers resulting from poor agricultural practices		

2

DO NOT WRITE IN THIS MARGIN

2. (continued) *Marks*

(*b*) (i) At which level does SEPA operate? Circle your answer.

Local National International **1**

(ii) Describe **one** role of SEPA which benefits:

the environment;

_____

_____

the general public;

_____

_____

industry and business.

_____

_____ **2**

(iii) Explain why flooding could become a bigger problem for Scotland in the future.

_____

_____

_____ **2**

(iv) Suggest why a wide range of specialists are employed by SEPA.

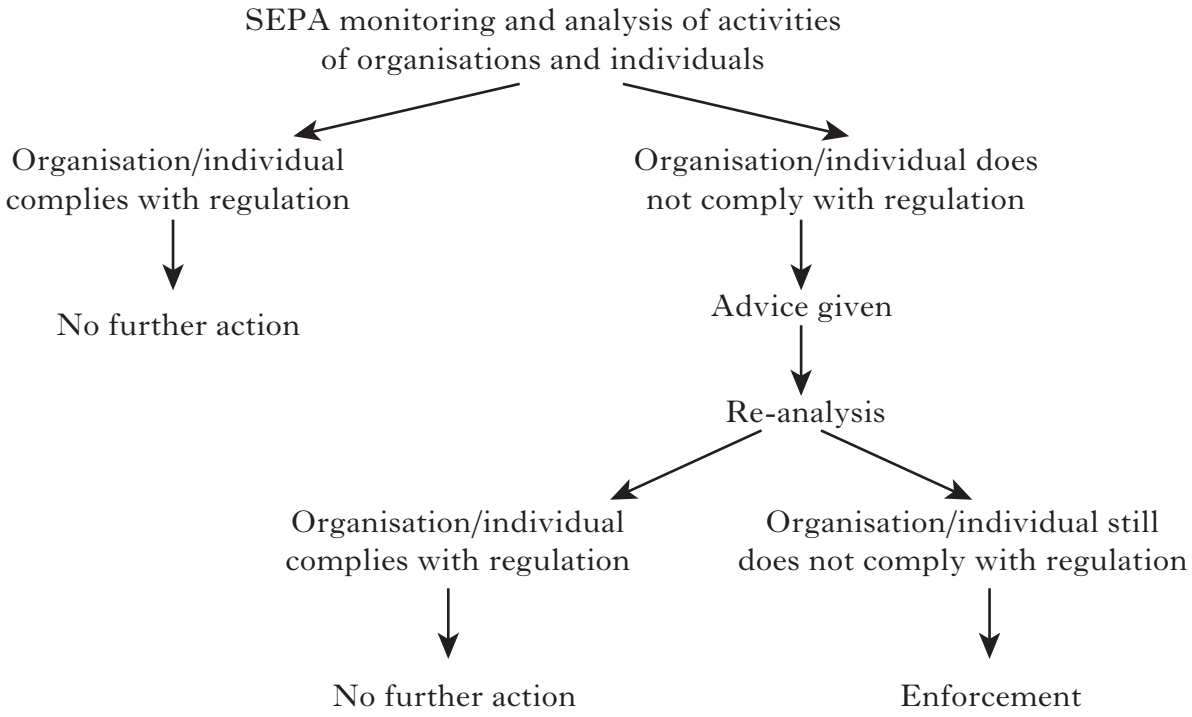
_____

_____ **1**

[Turn over

2. (continued) *Marks*

(*c*) SEPA works with many organisations and individuals throughout Scotland. The flow chart below summarises the action taken by SEPA when regulating activities, carried out by organisations and individuals, that may cause pollution.



(i) Explain why monitoring is an essential role of SEPA.

_____

_____

_____ **1**

(ii) Suggest **one** way by which SEPA's statutory powers are enforced to ensure compliance.

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

3. (*a*) The table below shows some of the advantages and disadvantages of different energy sources.

(i) Complete the table by giving **two** advantages of nuclear and **one** disadvantage of wave as an energy source.

Energy source	*Advantages*	*Disadvantages*
Nuclear	•	• Produces radioactive waste which is difficult to handle and store.
	•	• Possibility of nuclear accident and long term contamination.
Biomass	• Good use of organic waste.	• Felling of woodland and forest displaces wildlife and decreases biodiversity.
	• Is a carbon neutral fuel source.	• Production of biomass for fuel replaces food production in some countries.
Wave	• Extensive coastline around Scotland and its islands.	• Location of wave turbines could impact on shipping, fishing and recreation.
	• Has minimal visual impact.	•

2

(ii) Compare the use of biomass as an energy source in an economically less developed country (ELDC) with that in an economically more developed country (EMDC) in terms of:

1 the type of fuel used;
2 the extent to which it is used compared to other energy sources.

ELDC _____

_____

EMDC _____

_____ **2**

3. (continued) *Marks*

(*b*) The table below shows the generation of electricity in gigawatt hours (GW h) from some renewable sources in Scotland between 2004 and 2008.

Energy source	*Generation of electricity from renewable sources in GW h by year*				
	2004	2005	2006	2007	2008
Wind and wave	850	1280	2025	2645	3300
Landfill gas	340	395	425	465	500
Biofuels	170	195	290	395	445

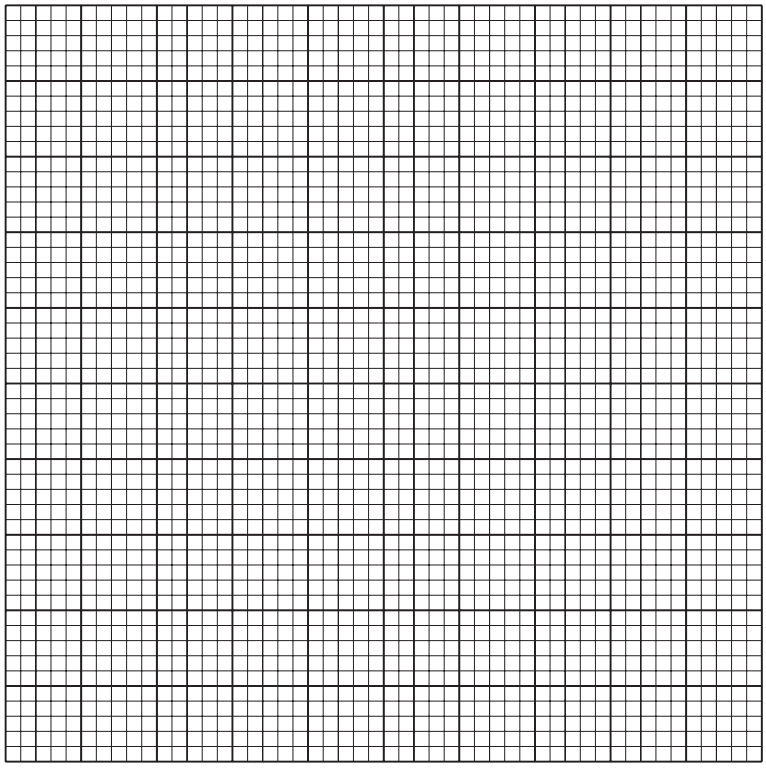
(i) Construct a bar graph for **biofuels** by adding:

the label and scale to the vertical (*y*) axis;

the labels to the horizontal (*x*) axis;

the data for biofuels.

(Additional graph paper, if required, can be found on *Page thirty-two*.)



3

(ii) Describe the trend in electricity generation from renewable resources between 2004 and 2008.

_____

1

Marks

3. (continued)

(*c*) Explain why large scale hydroelectric power generation is unlikely to increase significantly in Scotland in the future.

_____

_____ **1**

(*d*) Name the initiative used in Scotland to encourage electricity suppliers to source electricity from renewable sources.

_____ **1**

(*e*) Give **two** ways in which domestic electricity consumption could be reduced.

1 _____

2 _____ **1**

(*f*) Describe how acid rain is formed.

_____

_____

_____ **1**

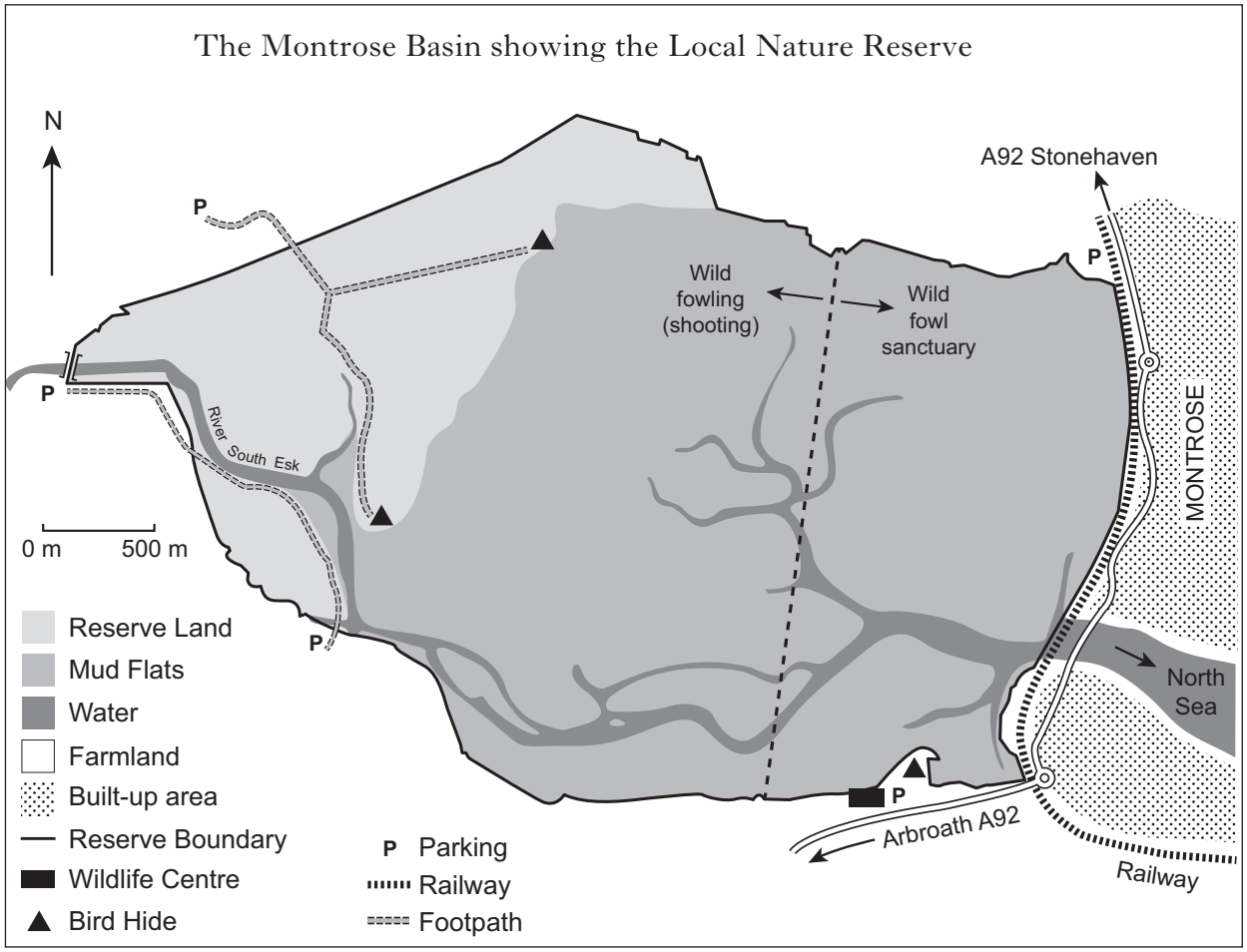
[Turn over

Marks

4. The sketch map below shows part of the Montrose Basin, a tidal estuary, where the South Esk River meets the North Sea. Extensive mud flats are exposed at low tide, while only a few isolated islands remain visible at high tide.

The basin attracts thousands of birds to its rich feeding grounds and has Local Nature Reserve (LNR) status and is protected by twenty byelaws. It is managed by the Scottish Wildlife Trust (SWT) which has developed strong links with the local community.

The Montrose Basin showing the Local Nature Reserve



(*a*) Using the information above, answer the following questions:

(i) Name **three** habitats found in the LNR.

_____ **1**

(ii) Give **two** pieces of evidence that indicate protection from disturbance is part of the management strategy for birds on the reserve.

1 _____

2 _____ **1**

4. (*a*) (continued) *Marks*

(iii) Explain how the management of the reserve has balanced the interests of conservation and the traditional activity of wildfowling (the shooting of ducks).

_____

_____

_____ **1**

(iv) Give **two** additional ways in which the SWT can provide environmental protection to the area from visitors exploring the reserve.

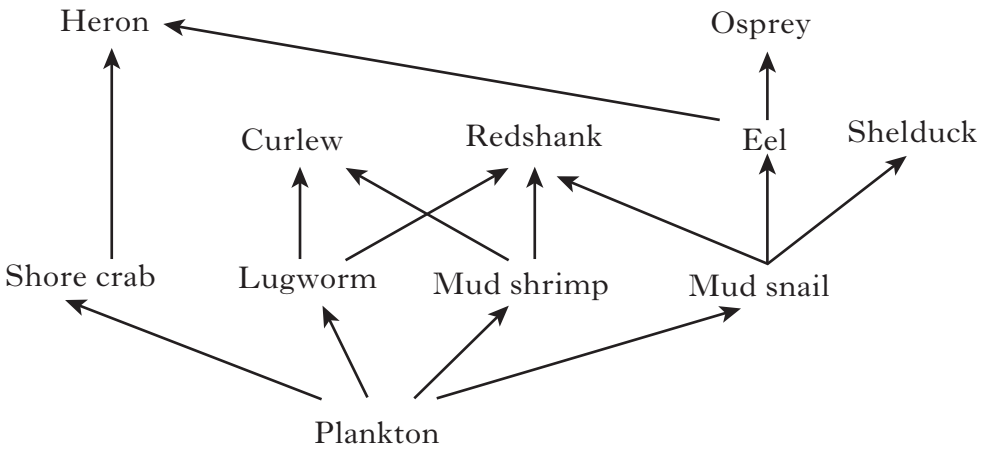
1 _____

2 _____ **1**

[Turn over

4. (continued) *Marks*

(*b*) The diagram below shows part of a food web found in the basin.



From the food web:

(i) name **one** autotroph;

_____ **1**

(ii) describe the niche of the shore crab;

_____

_____ **1**

(iii) give **one** example of inter-specific competition for a named food source;

food source _____

example _____ **1**

(iv) draw a pyramid of biomass which includes four trophic levels.

2

[Turn over for Question 4(*c*) on *Page sixteen*]

4. (continued) *Marks*

(*c*) The table below gives information about several bird species found in the basin.

Species	*Body size* (cm)	*Head colour of male*	*Description of beak*	*Type of feeding*
Shelduck	55–65	Dark green	Red in colour. Long and wide.	Forages in the mud for mud snails.
Wigeon	40–50	Chestnut brown	Grey in colour. Short and stubby.	Grazes on eel grass and green seaweeds.
Teal	30–40	Brown and green	Grey in colour. Long and wide.	Strains seeds and larvae from the water and snails from the mud.
Mallard	55–65	Dark green	Yellow in colour. Wide.	Surface feeds on seeds, pondweed and acorns.
Eider	55–65	Black and white	Grey in colour. Large and wedge shaped.	Collects and crushes mussels.

(i) Use information from the table to complete a paired statement key for the species named.

1	Ducks below 55 cm in body size	go to 2
	Ducks 55 cm and above in body size	go to 3
2	_____	
	_____	
3	Head colour of male dark green	
	Head colour of male black and white	
4	_____	
	_____	

2

4. (*c*) (continued) *Marks*

(ii) Distinguish between the terms herbivore and omnivore using information from the table to support your definition.

_____

_____

_____

_____ **1**

(*d*) Sea eagles from Norway have been re-introduced into Eastern Scotland. They can be sighted in the Montrose Basin and are predators of rabbit, duck, goose and swan.

Explain why species such as the sea eagles have had to be re-introduced.

_____

_____ **1**

(*e*) Giant hogweed is an alien invasive plant which is found in the Montrose Basin. SWT manages the spread of the plant using herbicide.

Explain why the use of herbicides in such circumstances must be carefully controlled.

_____

_____

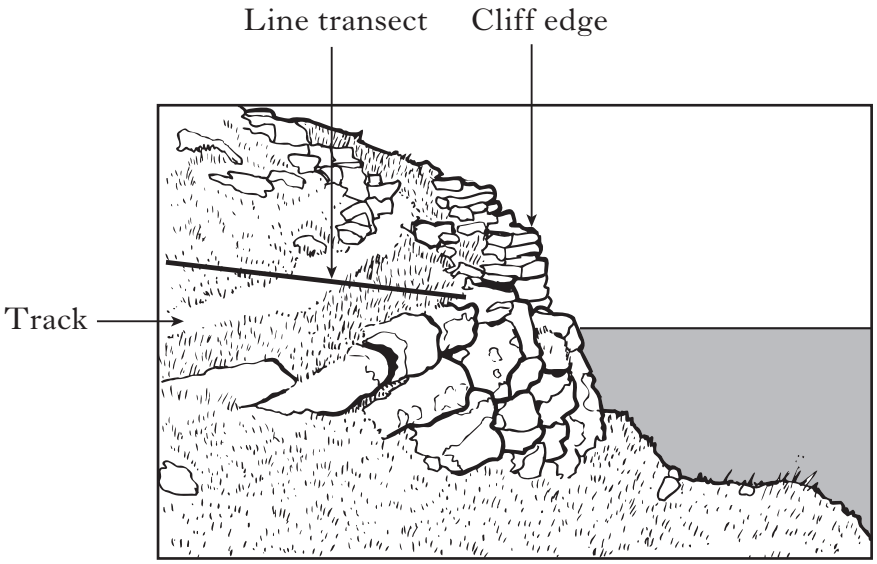
_____ **1**

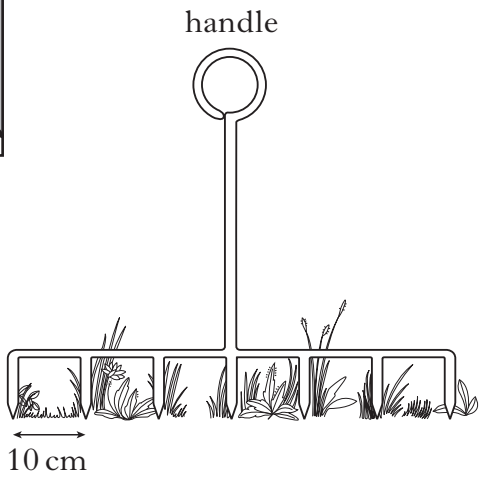
[Turn over

5. (*a*) The vegetation found on Scotland's sea cliffs is unusual and contains some plant species whose adaptations allow them to survive in this ecosystem. The sea cliff flora is affected by a number of extreme environmental conditions because sea cliffs are:

- exposed to wave action
- exposed to the prevailing winds which deliver salt spray
- often subjected to high levels of rainfall
- often unstable due to the effects of geology and slope.

An investigation of the plant species on a sea cliff transect was carried out using the equipment shown below. The results are shown in the table.





Plant species	*Number of times a point touched the plant*
Sea thrift	11
Sea plantain	9
Eyebright	8
Sea campion	5
Thyme	14
Bird's foot trefoil	15
Lady's bedstraw	
Grass or sedge	27
Other plant	9
Bare ground	19
Total	127

5. (*a*) (continued) *Marks*

(i) The frequency of distribution is calculated using the following formula.

$$\% \text{ frequency} = \frac{\text{number of times a point touches a plant}}{\text{total number of points (plants or bare ground) recorded along the transect}} \times 100$$

Calculate the frequency of distribution for lady's bedstraw.

Space for calculation

lady's bedstraw _____ % **1**

(ii) Give **one** reason to account for the presence of bare ground along the transect.

_____

_____ **1**

(iii) Describe how the results of this investigation could be made more reliable.

_____

_____ **1**

(iv) Name **two** abiotic factors which could be measured along the transect.

_____ and _____ **1**

(v) Explain the impacts on the stability of this ecosystem of slope and geology.

Slope _____

_____

Geology _____

_____ **2**

5. (continued) *Marks*

(*b*) Describe **one** other method of measuring the frequency and distribution of vegetation.

_____

_____ **1**

(*c*) During the breeding season the cliffs provide nesting sites for which many sea birds compete.

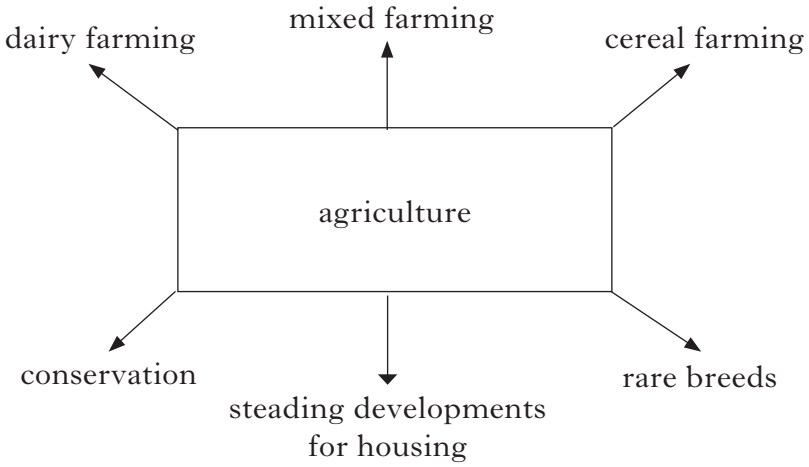
Name **two** other biotic factors which can affect species.

_____ and _____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

6. (*a*) The diagram below shows some different types of land use in agriculture.



(i) Give **one** other type of farming.

_____ **1**

(ii) Name **two** cereal crops grown in Scotland.

_____ and _____ **1**

(iii) Explain what is meant by diversification within agriculture.

_____

_____ **1**

(iv) Describe and explain **two** ways in which farmers can encourage biodiversity.

1 _____

_____

_____

2 _____

_____

_____ **2**

[Turn over

Marks

6. (continued)

(*b*) The table below shows the number of cows, farms and total milk production from 2006 to 2009.

	2006	*2007*	*2008*	*2009*
Number of dairy cows (000's)	199	198	192	187
Number of farms with dairy cows	1874	1830	1734	1628
Average number of dairy cows per farm	106	108	111	115
Total milk production (million litres)	1342	1272	1133	1107

(i) Calculate the percentage decrease in the number of dairy cows from 2006 to 2009.

Space for calculation

Answer _____ % **1**

(ii) Describe and suggest a reason for the trend in average number of dairy cows per farm.

_____

_____ **1**

(iii) Compare the total milk production in 2009 with 2006 in relation to the number of cows.

_____

_____

_____ **1**

(*c*) Edaphic (soil related) and climatic factors contribute to the carrying capacity of farmland producing suitable grazing for dairy cattle.

(i) Name **one** edaphic factor.

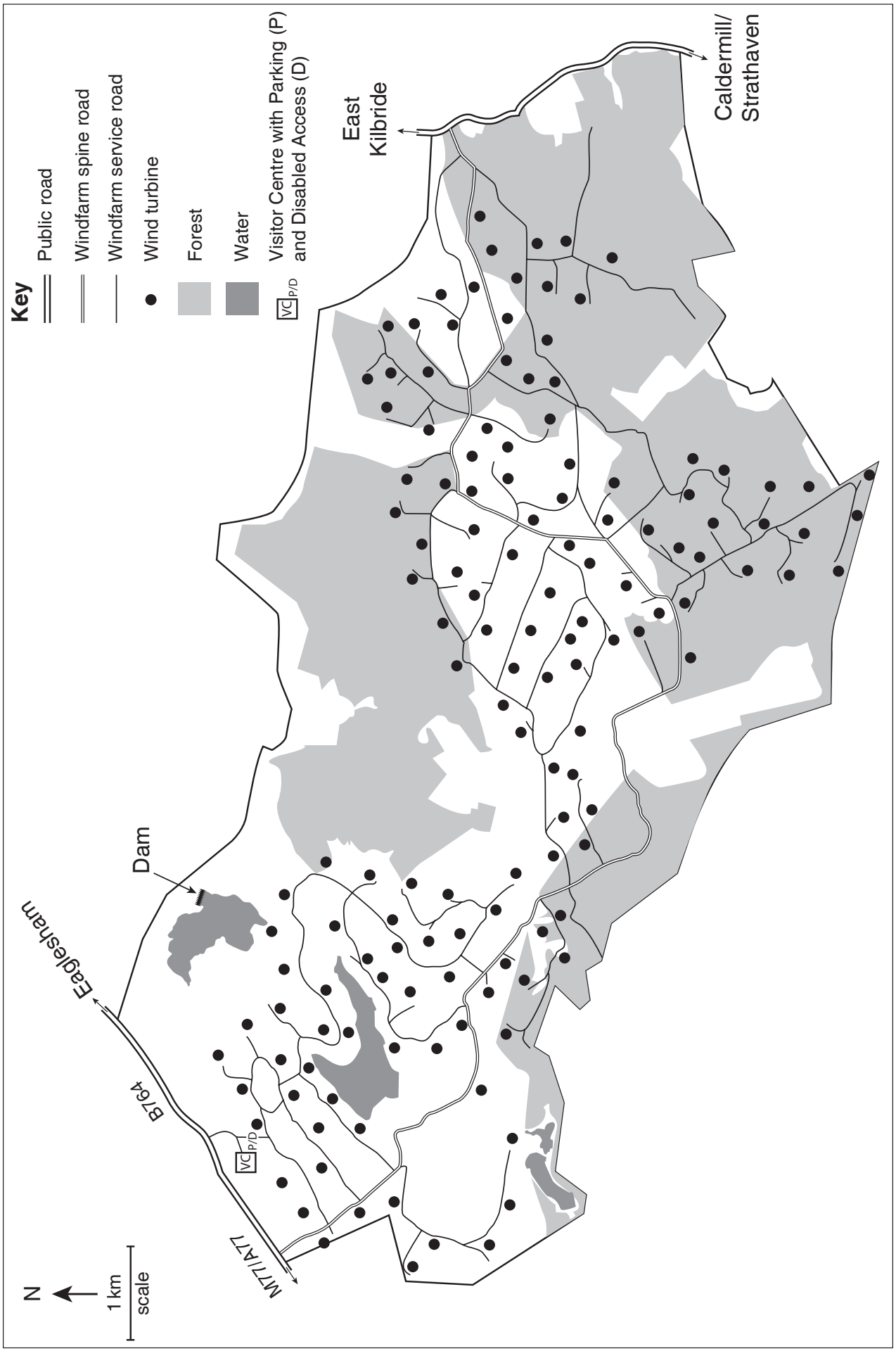
_____ **1**

(ii) Name **one** climatic factor.

_____ **1**

[Turn over for Question 7 on *Page twenty-four*

7. The map shows Whitelee windfarm, the largest on-shore windfarm in the UK. It was opened in 2009. The 55 km^2 site lies south of Glasgow on Eaglesham Moor. Forest was cut down and moorland disturbed to create an area for wind power generation.



DO NOT WRITE IN THIS MARGIN

7. (continued) *Marks*

(*a*) (i) Describe the most recent land use change that has occurred in this area.

_____

_____ **1**

(ii) Explain **one** impact that the change in land use has for natural habitats such as peat bog areas of a moorland environment.

_____

_____

_____ **2**

(iii) Suggest **one** benefit of the windfarm to the landowners/estates in the area.

_____ **1**

(iv) Describe how the infrastructure of the area has been improved to encourage the public to visit the windfarm.

_____

_____ **1**

(*b*) Give **one** historical influence which has affected the area.

_____ **1**

[Turn over

7. (continued) *Marks*

(*c*) The timeline below summarises the major developments in the creation of the windfarm.

Year	*Major developments in the planning and building of the Whitelee Windfarm*
2000	Initial investigations of site.
2001–2005	Scottish Power Renewables unveils plans for the windfarm. Consultations begin involving three local authorities. Statutory and non-statutory bodies are involved in an environmental impact assessment. A mobile exhibition circulates around local communities. Negotiations occur with the Ministry of Defence, British Airports Authority, Civil Aviation Authority, National Air Traffic Services and the Met Office who raise objections to the plan.
2005	An Environmental Statement produced for the area includes Habitat Management plans. Approval is gained from local authorities and local communities. Compromises are reached with objectors to the plan.
2006	Final planning consent is granted. Construction of the site infrastructure and access roads begins.
2007	Foundations for the turbines are created. The first turbines are delivered to the site.
2008	A turf cutting ceremony is held at the site of the eco-friendly visitor centre which aims to attract visitors and help educate the public in renewable technology and sustainable development. Part of the windfarm starts to deliver electricity to the national grid. An application to the Scottish Government is made to extend the windfarm.
2009	The windfarm of 140 turbines is switched on. Planning permission for the extension is granted. A second submission for a further extension is made.
2010	Second submission to extend the windfarm is approved.
2012	Completion date.

(i) Name the piece of legislation under which planning permission for a change in land use must be sought.

_____ **1**

(ii) Suggest why a consultation exercise was carried out.

_____

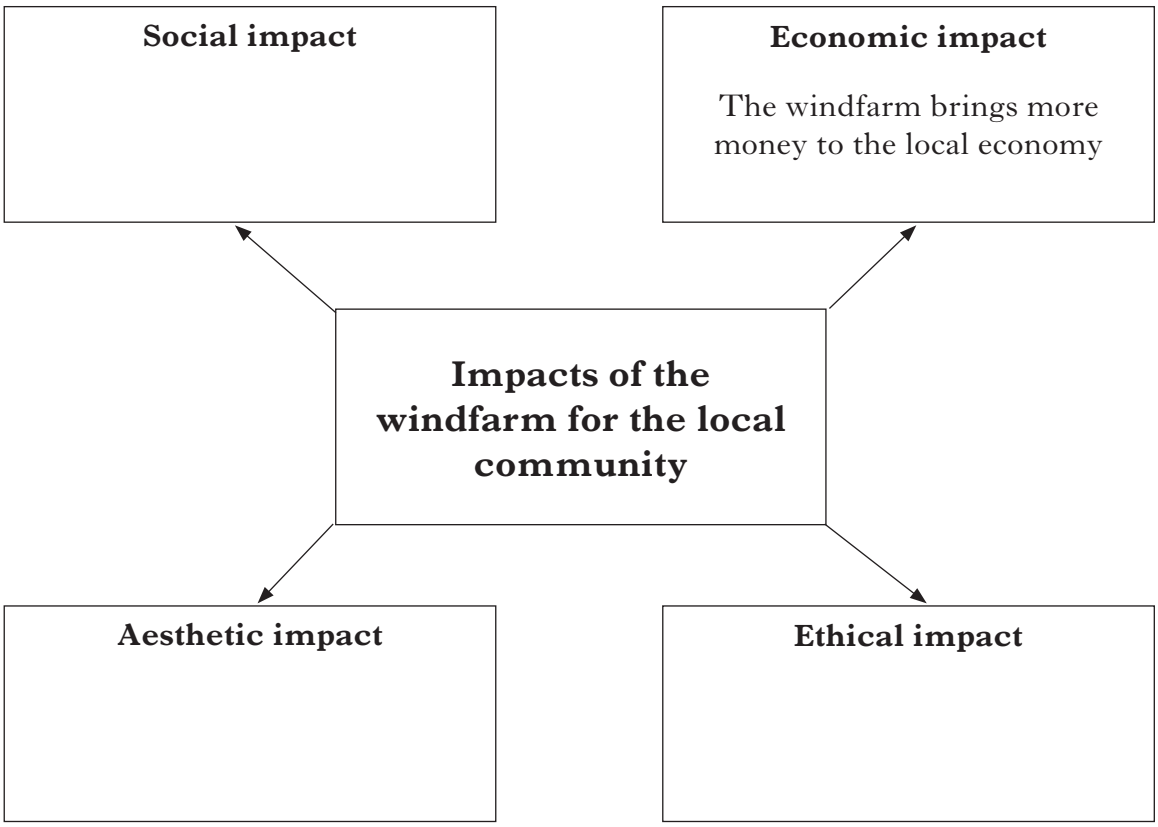
_____ **1**

7. (*c*) (continued) *Marks*

(iii) Name **one** non-statutory organisation which could have been involved in the Environmental Impact Assessment.

_____ **1**

(iv) Complete the diagram below to indicate **one** social, **one** aesthetic and **one** ethical impact that the windfarm development brings for the local community.



2

(v) Suggest **two** ways in which the visitor centre could be eco-friendly.

1 _____

2 _____ **1**

(vi) Suggest why there is a need to "educate the public in renewable technology and sustainable development".

_____

_____ **1**

DO NOT WRITE IN THIS MARGIN

7. (continued) *Marks*

(*d*) As part of the windfarm construction, around 90 km of roads and tracks were built that are open to the public including cyclists, horse-riders, ramblers and organisations interested in wildlife.

Describe **one** conflict arising from the use of the site for recreation by two of these groups and suggest a possible resolution.

Conflict _____

_____ **1**

Resolution _____

_____ **1**

(*e*) The table below shows the phases in the construction of the windfarm at Whitelee.

Phase in the construction of the windfarm	*Number of turbines at each phase*	*Estimated power output in megawatts from turbines at each phase* (MW)
1st phase	140	322
2nd phase	36	130
3rd phase	39	141
On completion		

(i) Complete the table and calculate the average power output per turbine on completion.

Space for calculation

Average power output per turbine _____ MW **1**

(ii) Explain why an increase in energy output from windfarms contributes to a "low carbon economy" for Scotland.

_____

_____

_____ **1**

Section B

BOTH questions in this section should be attempted.

Note that each question contains a choice.

Questions 8 and 9 should be attempted on the blank pages which follow.

Supplementary sheets, if required, may be obtained from the Invigilator.

Labelled diagrams may be used where appropriate.

Marks

8. Answer **EITHER** A **OR** B.

A. Describe the energy conversion and transfer processes occurring in ecosystems under the following headings:

(*a*) photosynthesis; **5**

(*b*) energy efficiency in food chains; **5**

(*c*) decomposition. **5**

(15)

OR

B. Describe population dynamics under the following headings:

(*a*) density dependent factors; **5**

(*b*) natural environmental regulation; **5**

(*c*) succession. **5**

(15)

9. Answer **EITHER** A **OR** B.

A. Describe changes in the management of Scotland's forests and woodlands and give an appraisal of current sustainable practices in the industry. **(15)**

OR

B. Describe the changes in Scotland's industry and give an appraisal of current sustainable practices in industry. **(15)**

[*END OF QUESTION PAPER*]

DO NOT WRITE IN THIS MARGIN

SPACE FOR ANSWERS

Marks

DO NOT WRITE IN THIS MARGIN

SPACE FOR ANSWERS

Marks

DO NOT WRITE IN THIS MARGIN

SPACE FOR ANSWERS

Marks

ADDITIONAL GRAPH PAPER FOR QUESTION 3(*b*) (i)