Teacher Resource Bank

GCE Environmental Studies

ENVS2 Sample Questions and Mark Schemes

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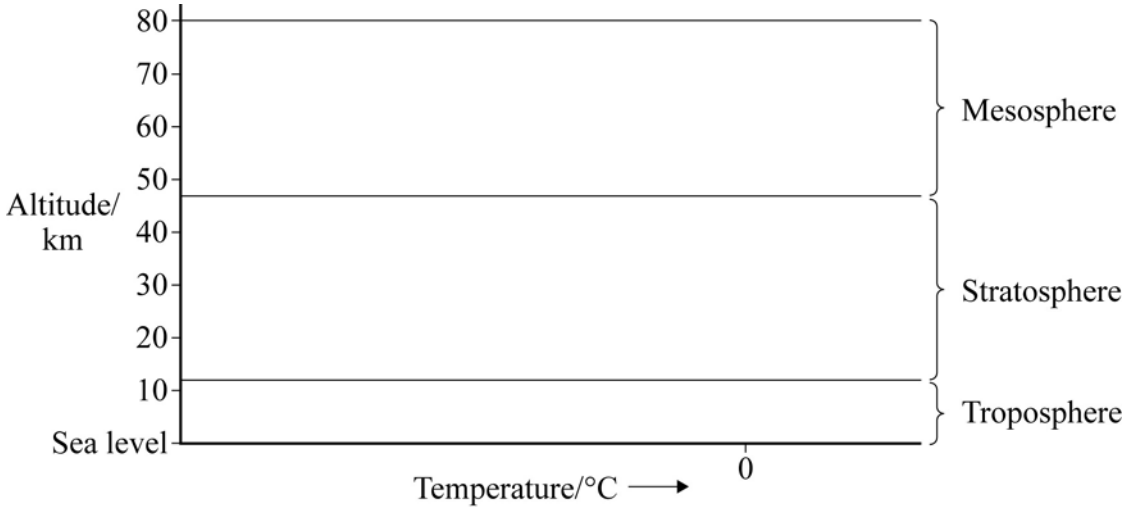
Topic 1: The Atmosphere

1 The diagram below has axes of temperature against altitude and the names of three layers in the atmosphere.



On the diagram, sketch a line to represent the typical changes in temperature with increasing altitude in the atmosphere.

(3 marks)

3

2 Complete the table below.

Gas	Normal atmospheric concentration	Industrial use
Oxygen	21%	
Nitrogen		Fertiliser manufacture
Ozone	0.000007%	
Carbon dioxide		Fire extinguishers

(4 marks)

4

3 How does the solar radiation that reaches the Earth's atmosphere differ from:

3 (a) (i) the solar radiation reaching the Earth's surface;

.....

(1 mark)

3 (a) (ii) the electromagnetic radiation emitted from the Earth's surface?

.....

(1 mark)

3 (b) What is meant by the albedo of a surface?

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(1 mark)

3 (c) (i) Outline the concept of the Gaia hypothesis.

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(1 mark)

3 (c) (ii) Outline how increased cloud cover may be used to illustrate the Gaia hypothesis.

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(2 marks)

6

4 The table shows the composition of the atmosphere.

Component	Chemical formula	Abundance by volume*
	N_2	78.08%
Oxygen	O_2	
Argon	Ar	0.93%
Water vapour	H_2O	Variable
Carbon dioxide	CO_2	
Methane	CH_4	2 ppmv
Carbon monoxide	CO	0.05–0.2 ppmv
Ozone		variable

* ppmv = parts per million by volume

4 (a) Complete the table by including the appropriate component, formula or abundance.

(4 marks)

4 (b) Explain the variable abundance of:

4 (b) (i) water vapour.....

.....

(1 mark)

4 (b) (ii) ozone. .....

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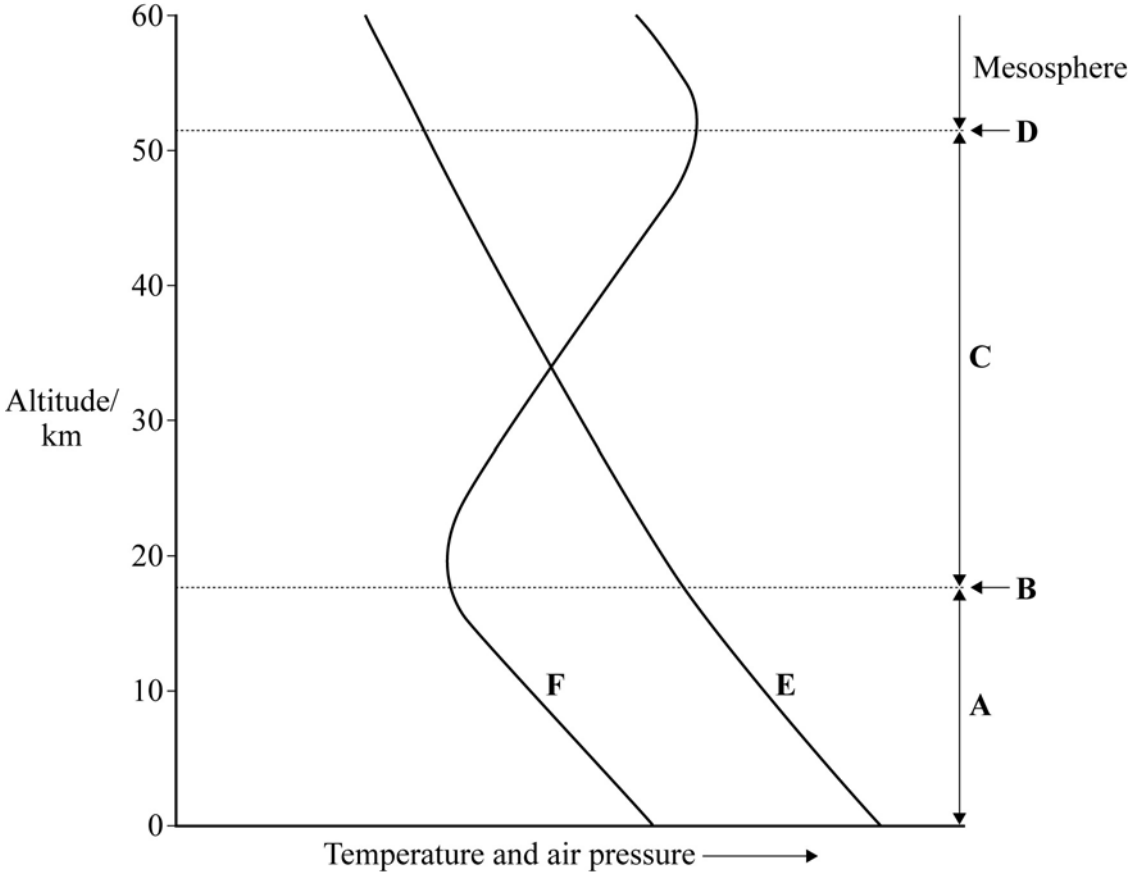
(1 mark)

6

5 The diagram shows some features of the structure of the atmosphere.



Use letters from the diagram to identify the following features of the atmosphere.

Air temperature .....

Troposphere .....

(2 marks)

2

6 The table shows details of some gases found in the atmosphere. Complete the table.

Gas	Normal % of gas in dry air	One source of gas	Type of electromagnetic radiation absorbed by the gas
Nitrogen			N/A
Carbon dioxide	0.035%	Respiration	Infra red
Ozone	0.000007%	Combination of O_2 and O in the stratosphere	
Methane	trace		

(5 marks)

5

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Mark scheme – Topic 1: The Atmosphere

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

Troposphere – line showing temperature decreasing with altitude starting above 0°C at sea level**;**
Stratosphere – line showing temperature increasing with altitude**;**
Mesosphere – line showing temperature decreasing with altitude**;** 3

Total marks = 3

Question 2

Steel/iron purification/breathing gases/cutting and welding/rocket fuel/ sewage treatment**;**
[**R** medical/hospital]
78 – 79%**;**
<u>water</u> sterilisation/treatment/purification**;**
0.03%**;**
[**A** 0.025 – 0.04%] 4

Total marks = 4

Question 3

3	(a)	(i)	More ultraviolet/wider wavelength range**;**	1
3	(a)	(ii)	Shorter wavelength(s)**;**	1
3	(b)		Reflectivity/proportion/amount of light reflected/reflection of light**;**	1
3	(c)	(i)	Negative feedback/homeostasis/balance/equilibrium/ self regulation**;**	1
3	(c)	(ii)	Temperature regulation**;** (temperature) reduced**;** increased albedo/light reflection/reduced light reaching surface**;** **OR** reduced insolation (at surface)**;** reduced evaporation/transpiration**;** reduced condensation/cloud formation**;**	MAX 2

Total marks = 6

Question 4

4	(a)	Nitrogen**;** 20 – 21%**;** 0.025 – 0.04%**;** [A ppm equivalents] O_3**;**	4
4	(b)	Water vapour**:** variable rates of evaporation/evapotranspiration/condensation/ variable saturation**;** affected by (changes in) temp/other specific climatic factor**;**	1
		Ozone**:** varying rates of formation/destruction/varying sunlight/UV/pollution/ dust/seasonal change/ice crystals/CFCs/NO_x/altitude/latitude**;**	1

Total marks = 6

Question 5

5 Air temperature – **F;**
Troposphere – **A;** 2

Total marks = 2

Question 6

79% ± 1%**;**
denitrification/ a named denitrifying bacteria eg pseudomonas/azotobacter/ nitrates in soil/atmosphere**;**
UV/ultraviolet/short wavelength**;**
anaerobic decomposition/respiration//ruminants/livestock (intestines)/rice paddies/landfill sites/anaerobic bacteria/melting permafrost/fossil fuels/plants**;**
infra red/long wavelength**;** 5
[**R** faeces, excretion]

Total marks = 5

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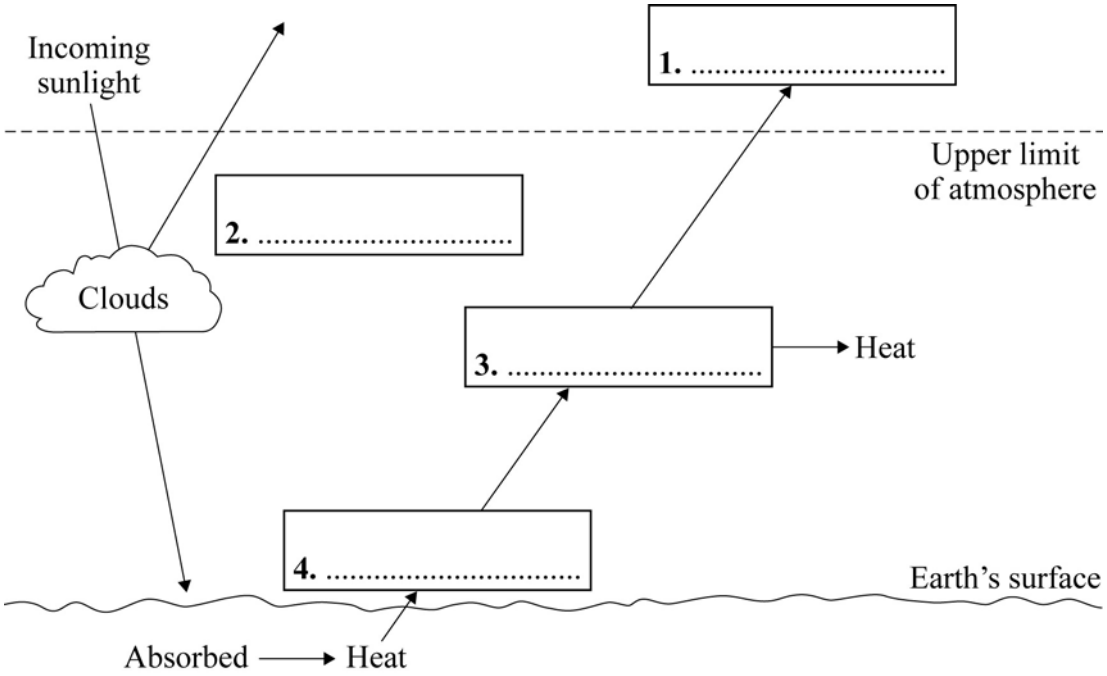
Topic 2: Global Climate Change

1 (a) Label the boxes **1** to **4** in the diagram to show the processes associated with the Greenhouse Effect.



(2 marks)

1 (b) Name **two** gases released by human activities which may increase the Greenhouse Effect and cause Global Climate Change.

1 .....

2 .....

(2 marks)

1 (c) Outline how a *negative feedback mechanism* may reduce the impact of Global Climate Change.

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(2 marks)

6

2 (a) Explain how a change in the composition of the atmosphere may lead to more heat being retained by the atmosphere.

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(2 marks)

2 (b) Name **two** greenhouse gases which do **not** contain carbon.
For each gas, outline how human activity causes its release.

1 Gas .....

Human activity.....

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(2 marks)

2 Gas .....

Human activity.....

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(2 marks)

2 (c) Explain how an increase in the heat retained by the atmosphere may:

2 (c) (i) lead to a rise in sea level

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(3 marks)

2 (c) (ii) change the amount of rainfall which an area receives.

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(4 marks)

13

3 (a) Name **one** greenhouse gas which is thought to cause global climate change.

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(1 mark)

3 (b) Give **two** different human activities which cause the atmospheric concentration of this gas to increase.

1.....

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(1 mark)

2.....

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(1 mark)

3 (c) Describe how emissions of this gas may be reduced.

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(3 marks)

6

4 Many scientists believe that the global climate is changing because of atmospheric pollution.

4 (a) Name **two** pollutants which are thought to contribute to global climate change.

1 .....

2 .....

(2 marks)

4 (b) Explain how such pollutants may cause atmospheric warming.

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(2 marks)

4 (c) Explain the ways in which Global Climate Change may affect the amounts of water in different water stores and the rates of water movement in the water cycle.

Quality of Written Communication will be assessed in this answer.

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(8 marks)

12

5 Describe the likely consequences of global climate change.

Quality of Written Communication will be assessed in this answer.

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(9 marks)

9

6 The table shows some human activities which release gases that cause global climate change.

6 (a) Complete the table.

Gas	Human activities
Carbon dioxide	Combustion of fossil fuels, deforestation
	Livestock and rice production, landfill sites, coal mine ventilation
Oxides of nitrogen	
Chlorofluorocarbons	Aerosol propellants, fire extinguishers, refrigerants
Tropospheric ozone	Chemical reactions involving NO_2 and unburnt fuel vapours

(2 marks)

6 (b) Explain how greenhouse gases control the temperature of the atmosphere.

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(2 marks)

6 (c) Explain how global climate change is likely to affect:

6 (c) (i) aquifers through sea level rise

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(1 mark)

6 (c) (ii) precipitation through altered evaporation rates.

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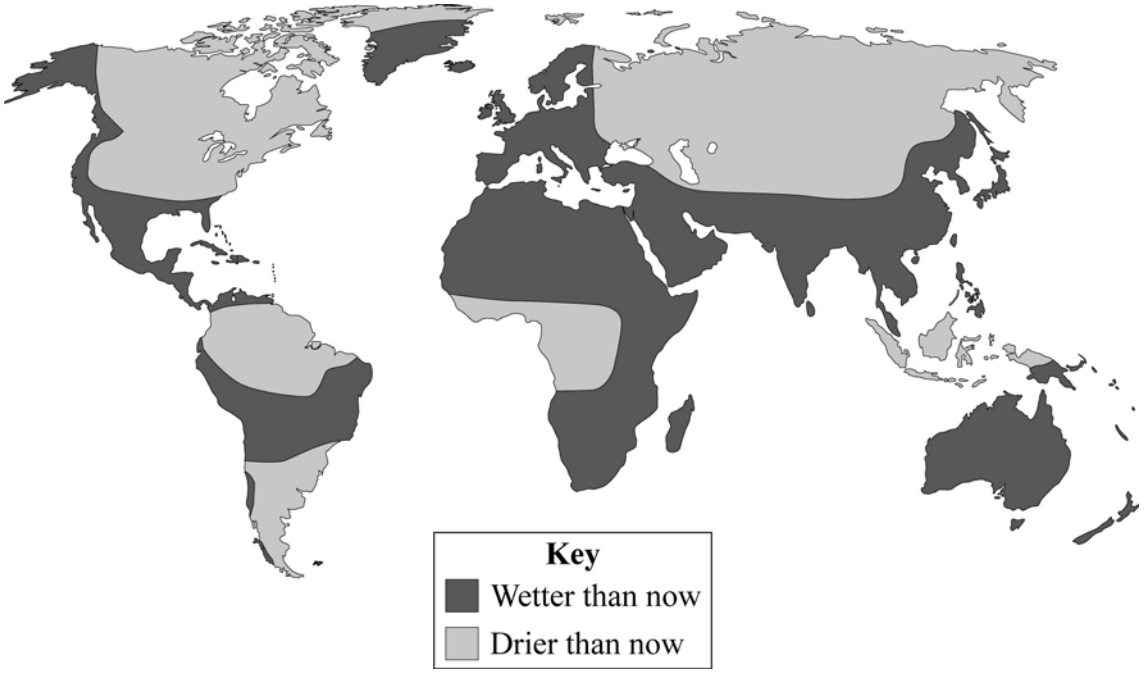
(1 mark)

6

7 The map shows one possible scenario for the effect of global climate change on weather.

Projected changes in precipitation patterns in this century as a result of global warming



7 (a) Explain how global climate change may:

7 (a) (i) **increase** the rainfall which an area receives

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(2 marks)

7 (a) (ii) **reduce** the rainfall which an area receives.

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(2 marks)

7 (b) Explain why global climate change may cause:

7 (b) (i) species extinction

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(1 mark)

7 (b) (ii) changes in species distribution

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(1 mark)

7 (b) (iii) sea level rise.

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(1 mark)

7 (c) Suggest how a change in albedo, caused by a reaction in the area covered by ice, may upset the temperature balance of the Earth.

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(3 marks)

10

8 (a) Complete the table which links the gases involved in global climate change to the human activity causing their release.

Name of gas	Molecular formula	Human activity causing release
Carbon dioxide	CO_2	Burning fossil fuels
	Various, eg CCI_3F	Scrapping old refrigerators
Oxides of nitrogen	NO, N_2O, NO_2 (NO_x)	
Methane	CH_4	

(3 marks)

8 (b) Describe how plants and animals are likely to be affected by global climate change.

Quality of Written Communication will be assessed in this answer.

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(10 marks)

13

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Mark scheme – Topic 2: Global Climate Change

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

1	(a)	**1** Radiated/transmitted**;** [**A** infra red/longwave radiation for **one** of 1,3 or 4] **2** reflected/albedo**;** [**R** absorbed/scattered] **3** absorbed/converted to heat**;** **4** radiated/re-radiated *1 mark for 2 correct* *2 marks for 4 correct*	MAX 2
1	(b)	Carbon dioxide**;** CFCs/HCFCs/halogenated hydrocarbons**;** NO_x**;** ozone**;** methane/hydrocarbons**;** water vapour**;**	MAX 2
1	(c)	More cloud cover/snow cover**;** leading to increased albedo/reflection/cooling effect**;** **OR** faster plant growth/increased photosynthesis**;** leading to reduced carbon dioxide (in atmosphere)**;**	MAX 2

Total marks = 6

Question 2

2 (a) Example of change**;**
[**A** increased cloud cover]
IR/re-radiated energy (is absorbed)**;** MAX 2

2 (b) NO_x**;**
combustion of fuels/high temperature/N and O from air react/
car exhausts/fertiliser use/industrial effluent**;**
OR
ozone**;**
reaction of oxygen and breakdown product of vehicle exhausts/NO_x/
aerosols**;**
OR
water vapour**;**
evapotranspiration from forests/evaporation from irrigated land/
combustion of fuels/cooling towers/evaporation from reservoirs**;**

1 mark for name of gas max 2
1 mark for process max 2
Allow process mark for correct process producing a greenhouse
gas containing carbon MAX 4

2 (c) (i) Melting of land ice/glaciers/south polar ice/named ice cap**;**
water flows into sea**;**
increasing sea temperatures**;**
thermal expansion of sea**;** MAX 3

2 (c) (ii) Increased temperatures of water bodies**;**
reference to kinetic theory of behaviour of water molecules**;**
causing increased evaporation/increased ability of atmosphere
to hold water vapour**;**
increased windspeeds/increased condensation leading to
precipitation**;**
causing increased evaporation as water vapour carried away**;**
water vapour carried further inland before precipitation occurs**;**
changes in area of low and high air pressure**;**
changes in wind direction**;**
reference to dew point**;**
changes in ocean currents**;** MAX 4

Total marks = 13

Question 3

3

(a) Gas**;**	(b) Activity**;;**	(c) Emission reduction**;;;**
Carbon dioxide**;**	Combustion of fossil fuels/first example**;** second example of fossil fuel use**;** (only one example from each of industrial or domestic or transport use of fossil fuels) combustion of wood/biomass**;** increased decomposition**;** (reduced photosynthesis with cause) eg deforestation**;**	Appropriate processes and descriptions**;** non FF use/use of renewables**;** increased efficiency of use/better combustion efficiency/energy conversion efficiency**;** reduced unnecessary use**;**
Ozone**;**	Use of ozone in water treatment**;** NO_x breakdown**;**	Use of Cl_2**;** control of hydrocarbons**;** control of NO_x**;** catalytic converters**;** eg of reaction in catalytic converter**;**
Oxides of nitrogen**;**	Combustion of fuel/in vehicle engines**;** use of nitrate fertilisers**;** deforestation by burning/stubble burning**;**	Organic fertilisers**;** slow release inorganic fertiliser**;** catalytic converters**;** eg of reaction in catalytic converter**;** low temperature combustion**;**
Methane**;**	Landfill sites**;** paddy fields fossil fuel extraction**;** herbivores/ruminants/ livestock**;**	Name of alternative disposal technique**;** description of process**;** ref to organic matter**;** alternative crops**;** collection of methane**;** reduced livestock rearing**;**
CFCs**;**	Aerosol cans**;** expanded plastics**;** solvents**;** refrigerants/air conditioning**;**	Alternative propellants**;** alternative gases for expanded plastics**;** alternative solvents**;** alternative regfrigerants**;**
Water vapour**;**	Named process increasing evaporation**;** named process increasing transpiration**;**	Process/activity to control temperature**;** details of mechanism**;** control of vegetation**;**
1	MAX 2	MAX 3

Total marks = 6

Question 4

4 (a) Carbon dioxide
methane**;**
CFCs**;**
ozone**;**
oxides of nitrogen**;** MAX 2
[**A** formulae]

4 (b) Absorb terrestrial/infra red radiation/longwave radiation**;**
convert to heat**;**
does not escape to space/reduced rate of escape**;** MAX 2
[**R** ozone depletion answers]

4 (c) *Quality of Written Communication is assessed in this answer*

Changes in up to 3 named processes**:**
melting/evaporation/transpiration/infiltration/percolation/precipitation/
atmospheric transport/condensation/other named process**;;;**

changes in up to 3 named storage reservoirs**;;;**

changed residence time**;**
changes transfer/movement rates**;**
dynamic equilibrium**;**
kinetic theory**;**
hydrogen bonding**;** MAX 6

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 12

Question 5

Quality of Written Communication is assessed in this answer

Suitable expansion of following points**:**

temperature change**;**
species' range of tolerance**;**
species distribution**;**
change in (species) survival/extinction**;**
changes in rainfall distribution**;**
changes in amount of rainfall**;**
sea level rise**;**
changes in wind strength**;**
changes in wind direction**;**
changes in ocean current strength**;**
changes in ocean current direction**;**

Up to 2 marks for expansion of each process/effect/alternative valid point MAX 7

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 9

Question 6

6 (a) Methane**;** 1

named human activity/industry
combustion eg vehicle engine/exhaust/power station/furnace/
specific fossil fuel use/specific agricultural activity/use of nitrates/
fertiliser use/ploughing**;** 1

6 (b) Atmosphere is transparent to visible light/short wave light**;**
absorb infra red light/long wavelength radiation**;**
[**R** heat/UV]
converted to heat**;**
delay escape of energy to space**;** MAX 2
[**A** prevent]

6 (c) (i) Salinisation/increased salt content/salinity/raised water table / increased volume**;** 1

(ii) Increased/unreliable**;** 1

Total marks = 6

Question 7

7 (a) (i) (Increased temperature causes) increased evaporation/transpiration**;**
increased water vapour/ condensation/clouds**;**
OR
change in wind patterns**;**
bringing more rain/humid air/cloud**;** 2

(ii) Increased temperatures/heat**;**
water vapour fails to condense/lower relative humidity**;**
OR
change in wind pattern**;**
takes rain/humid air**;**
OR
specific reason for reduced evapotranspiration/reduced vegetation**;**
reduced evapotranspiration**;** 2

7 (b) (i) Ref to range of tolerance/lack of adaptation/specific habitat change/specific physiological problem/
changed species interrelationships – food/pollination/
seed dispersal/evolution too slow**;** 1

(ii) Ref to migration/colonisation with changed distribution of suitable conditions**;** 1

(iii) Thermal expansion of seas/melting of land ice/glaciers/ice sheets/melting ice goes into sea/isostatic changes**;** 1

7 (c) Land/water has lower albedo than ice/albedo reduced when ice melts**;**
less sunlight reflected/more sunlight absorbed/reaching the ground (since ice is not in the way)**;**
[**R** UV]
more heat produced/increased temperature (from absorbed light)**;**
more ice melts**;**
positive feedback/change in ocean currents**;** MAX 3

Total marks = 10

Question 8

8 (a) Chlorofluorcarbons/CFCs**;**
nitrate fertiliser use/named high temperature combustion process/ use of named equipment**;**
landfill sites/padi fields/coalmine ventilation/natural gas use (leakage)/livestock farming**;** 3

8 (b) *Quality of Written Communication is assessed in this answer*

Impact of changed factors**;;;;**
- extinction/changed geographical range
- migration patterns
- range of tolerance
- enzyme inhibition
- named adaptations/lack of adaptation/speed of adaptation

max 4

Factors changed by GCC
- named abiotic factor**;;**
  - eg water supply, fires, temperature extremes, increased storm damage, flooding, erosion, melting of ice/ permafrost/salinity/nutrients max 2
- named biotic factors**;;**
  - changed food supply
  - changed habitat
  - changed breeding sites
  - changed competition
  - changed inter-species relationship
    - eg pollination, seed dispersal, decomposition/ nutrient release max 2

Taxa**;;;;**
- Appropriate named taxonomic examples used to illustrate

max 4 MAX 8

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 13

Topic 3: Ozone Depletion

1 (a) In which layer of the atmosphere does most ozone occur naturally?

.....

(1 mark)

1 (b) Explain why the ozone layer is important to life on the surface of the Earth.

.....

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(1 mark)

1 (c) Name the International Agreement which has banned the manufacture of the chlorofluorocarbons (CFCs) which damage the ozone layer.

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(1 mark)

1 (d) Explain why, even if this agreement is kept, it will be many years before damage to the ozone layer stops.

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(1 mark)

4

2 (a) Describe how the atmosphere naturally prevents most ultraviolet light (UV) from the sun from reaching the Earth's surface.

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(3 marks)

2 (b) (i) Describe how a pollutant released by human activities may result in more UV light reaching the Earth's surface.

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(3 marks)

2 (b) (ii) Give an international agreement intended to limit this damage to the atmosphere.

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(1 mark)

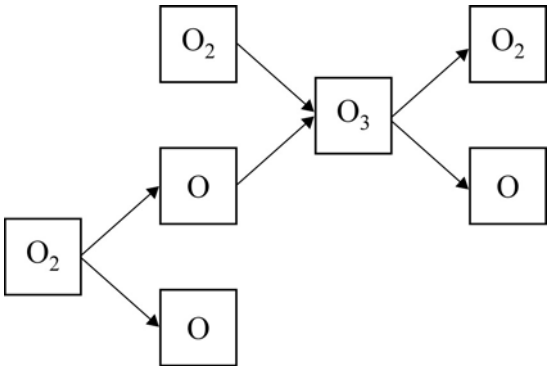
2 (c) State **one** industrial use of UV light.

.....

(1 mark)

8

3 The diagram shows some of the reactions which occur in the ozone layer.



3 (a) Outline the role of ultraviolet light (UV) in these reactions in the stratosphere.

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(3 marks)

3 (b) Describe the significance of the ozone layer for life on Earth.

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(2 marks)

3 (c) Describe how reactions involving chlorofluorocarbons (CFCs) affect the amount of ozone in the stratosphere.

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(3 marks)

8

4 (a) Describe how human activities have reduced the amount of ozone in the stratosphere.

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(3 marks)

4 (b) Explain why this reduction in stratospheric ozone is harmful to life on Earth.

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(2 marks)

4 (c) Name the international agreement which aims to reduce this damage.

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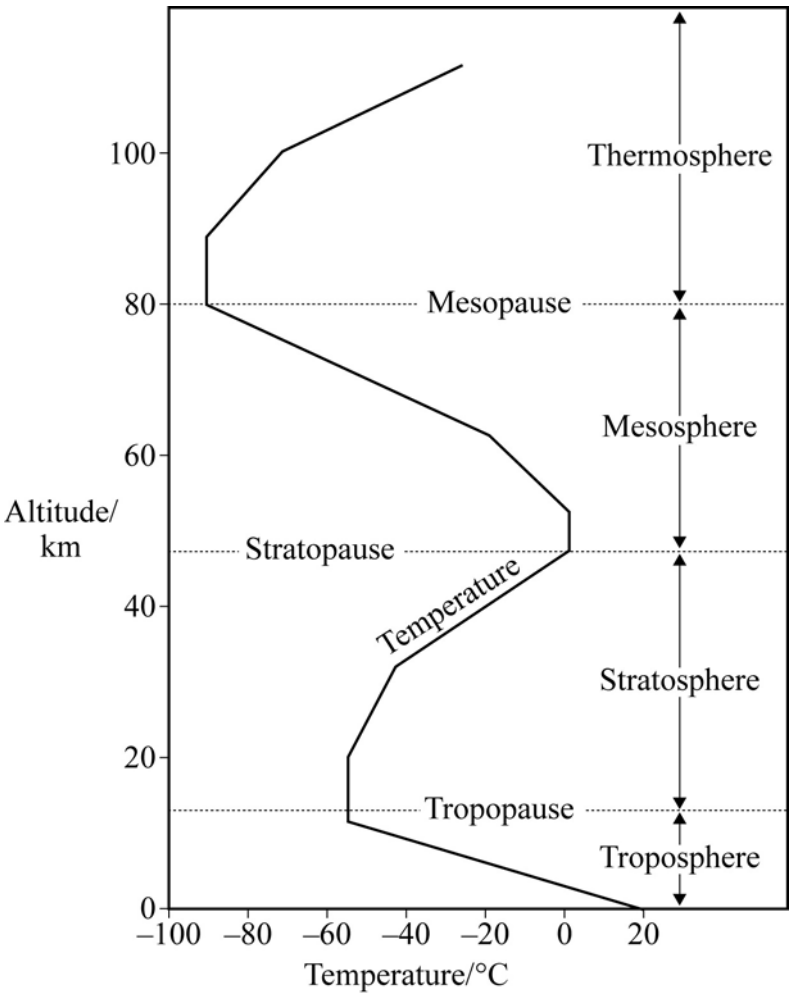
(1 mark)

6

5 The diagram shows the structure of the atmosphere.



5 (a) (i) Which layer absorbs ultraviolet light from the sun?

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(1 mark)

5 (a) (ii) Which gas absorbs ultraviolet light?

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(1 mark)

5 (b) Describe how human activities have increased the amount of ultraviolet radiation reaching the Earth's surface.

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(3 marks)

5 (c) In which layer does carbon dioxide absorb the infra red radiation emitted by the Earth?

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(1 mark)

5 (d) By reference to the natural processes which control atmospheric carbon dioxide, explain the term 'dynamic equilibrium'.

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(2 marks)

5 (e) Explain why burning biofuels such as straw may be described as being 'greenhouse neutral', despite the fact that burning them releases carbon dioxide.

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(2 marks)

10

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Mark scheme – Topic 3: Ozone Depletion

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

1	(a)	Stratosphere/ozonosphere**;**	1
1	(b)	Stops/absorbs UV light**;** prevents DNA damage/sunburn/skin (disease) cancer/ eye damage**;**	MAX 1
1	(c)	Montreal Protocol/agreement/convention**;**	1
1	(d)	CFCs long-lived in atmosphere/ CFCs in troposphere may reach stratosphere in the future/ CFCs currently in use may be released in the future**;** other damaging chemicals still released**;** [**R** long time taken to recover 'reaction homeostasis']	MAX 1

Total marks = 4

Question 2

2 (a) Ozone/O_3**;**
UV absorbed/filtered**;**
[**R** Reflection]
description of chemical reactions**:**
$O_3 \rightarrow O_2 + O/O_2 + O \rightarrow O_3$/word equation 3

2 (b) (i) Chloroflurocarbons/CFCs/HCFCs/halogenated hydrocarbons**;**
mobility/persistence/insolubility**;**
details of chemical reaction**:**
chemical breakdown due to UV/chlorine released/
chemical reactions between C1 and O/O_3**;**
less ozone formed/ozone destroyed/damage to ozone layer**;**
OR
oxides of nitrogen released in stratosphere/by aircraft**;**
details of reactions producing NO_x**;**
reaction between NO_x and O/O_3**;**
less ozone formed/ozone destroyed/damage to ozone layer**;**
MAX 3

2 (b) (ii) Montreal Protocol/agreement/treaty/convention
(for CFCs in (b)(i))**;** 1

2 (c) Disinfection/sterilisation/killing microbes/setting epoxy
resins/identifying fluorescing agents**;** 1

Total marks = 8

Question 3

3 (a) UV absorbed**;**
energy converted to chemical energy**;**
breaks up/splitting of diatomic oxygen**;**
splitting/destruction of ozone**;**
reversible reaction/dynamic equilibrium/cycle repeated**;** MAX 3

3 (b) Less/no UV reaches Earth's surface/absorbs UV/barrier to UV/
UV filtered out**;**
prevents all/tissue damage/example of effect**;**
DNA damage/(skin) cancer/eye problems**;** 2

3 (c) CFCs absorb UV/short W/L radiation**;**
chlorine released**;**
chlorine reacts with monatomic oxygen**;**
chlorine released again**;**
reduced levels of O/increased levels of O_2**;**
ozone level reduced/less ozone formed/ozone hole/
thinner ozone layer**;** MAX 3
[**R** radiation on own]
[**R** CFCs break down ozone]
[**R** properties of CFCs eg persistence]

Total marks = 8

Question 4

4 (a) CFCs/NO_x/(gaseous) Br compounds**;**
1 example of use/source**;**
(eg aerosols/refrigerators/solvent/plastic blowing/fire extinguishers)
residence time OWTTE**;**

up to 3 examples of reactions/processes**;;;**
CFCs – C1 released/C1 free radical
$C1 + O \rightarrow C1O$
$C1O + O \rightarrow C1O_2$
$C1O_2 \rightarrow C1 + O_2$
$CFC + O_3 \rightarrow C1O + O_2$ (partial reaction) 3

4 (b) More UV reaches surface**;**
tissue damage/skin cancer/skin damage/mutations/eye damage**;** 2

4 (c) Montreal protocol/agreement**;** 1

Total marks = 6

Question 5

5	(a)	(i)	Stratosphere/ozone layer**;**	1
5	(a)	(ii)	Ozone/O_3/triatomic oxygen**;** [**A** specific CFC]	1
5	(b)		Use of aerosols/fridges/AC/jet aircraft/ use of/ release of chloroflurocarbons/CFCs/halons/freons/NO_x in stratosphere/other suitable example**;** persistence/mobility of chemical**;** release of halogen/Cl/F/Br (in stratosphere)**;** ozone depletion/reduced concentration/amount**;** described reaction/equation/ reaction of Cl with O/O_3**;** reduced absorption of UV**;**	MAX 3
5	(c)		Troposphere**;**	1
5	(d)		Named (counter-balancing) processes eg photosynthesis-respiration/combustion-photosynthesis/ dissolving – coming out of solution**;** [**R** human activities] balance/counteracting effect/negative feedback/ (global) homeostasis**;**	2
5	(e)		Balance of growth/photosynthesis/absorption (with combustion/respiration/release)**;** timescale of reactions/release of the same C/CO_2**;** [**A** CO_2 would have been released by decomposition]	2

Total marks = 10

Topic 4: The Hydrosphere

1 Explain how a water collection reservoir may affect:

1 (a) suspended solids carried by the river downstream

.....

.....

.....

.....

.....

.....

(3 marks)

1 (b) the climate of the area.

.....

.....

.....

.....

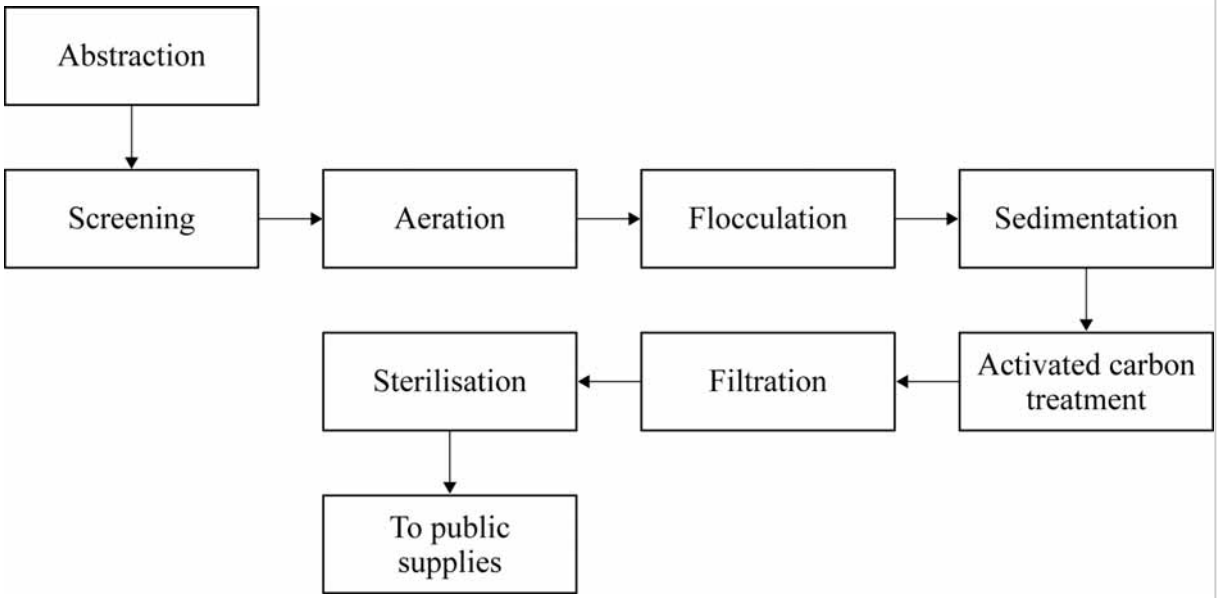
.....

.....

(3 marks)

6

2 The diagram shows some of the main processes carried out in a water treatment works.



State the purpose of and outline the following processes.

2 (a) Flocculation

Purpose.....

.....

.....

Process .....

.....

.....

(2 marks)

2 (b) Sterilisation

Purpose.....

.....

.....

Process .....

.....

.....

(2 marks)

2 (c) Aeration

Purpose .....

.....

.....

Process .....

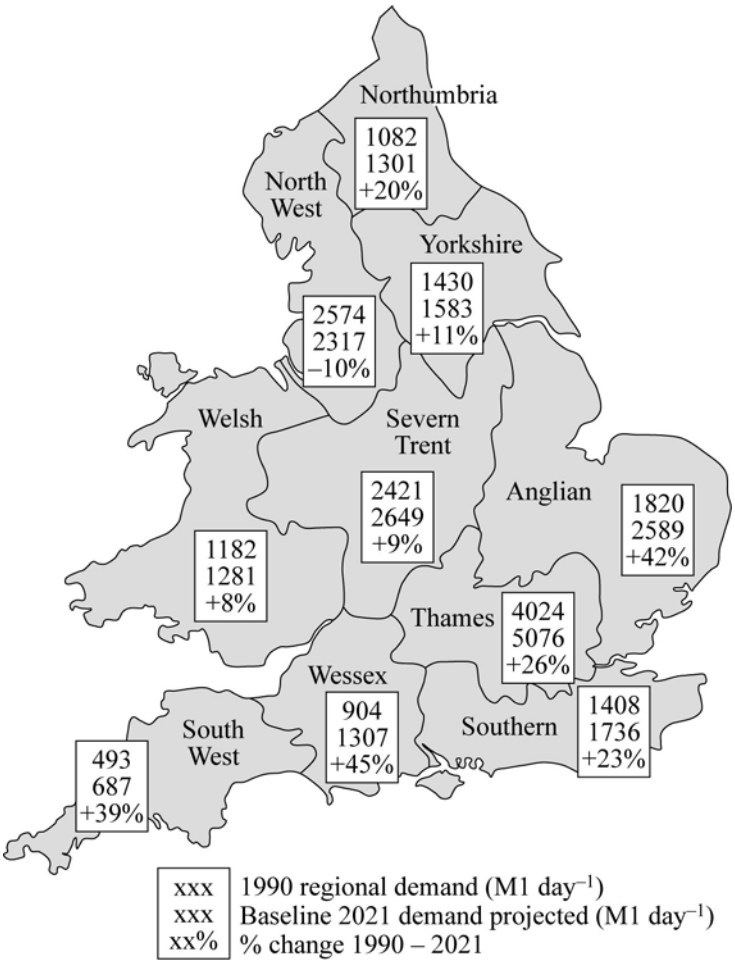
.....

.....

(2 marks)

6

3 The map shows the demand for water in England and Wales in 1990 and projections for 2021.



3 (a) (i) In which area is there the greatest predicted percentage change in demand for water?

.....

(1 mark)

3 (a) (ii) In which area is there the greatest predicted volume increase in demand for water?

.....

(1 mark)

3 (b) Outline how **three** named factors may explain the changes in demand for water in England and Wales.

1 .....

.....

.....

.....

(2 marks)

2 .....

.....

.....

.....

(2 marks)

3 .....

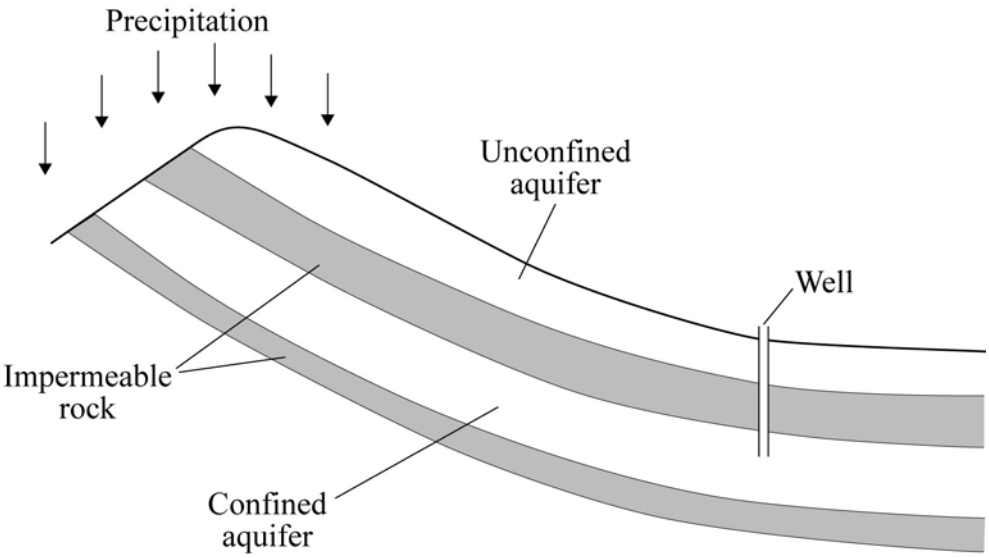
.....

.....

.....

(2 marks)

The diagram shows part of an artesian well.



3 (c) In some parts of Britain much of the water for public supply is extracted from aquifers.

Name a rock which:

3 (c) (i) **often** forms aquifers

.....

(1 mark)

3 (c) (ii) **never** forms aquifers.

.....

(1 mark)

3 (d) With reference to aquifers, explain what is meant by:

3 (d) (i) porosity .....

.....

.....

.....

(2 marks)

3 (d) (ii) permeability.....

.....

.....

.....

(2 marks)

3 (e) Outline **two** advantages of using an aquifer for water supply rather than using reservoirs.

1 .....

.....

.....

.....

(2 marks)

2 .....

.....

.....

.....

(2 marks)

3 (f) The over exploitation of an aquifer may lead to its depletion.

Describe **one** way in which the amount of water supplied by an aquifer can be increased.

.....

.....

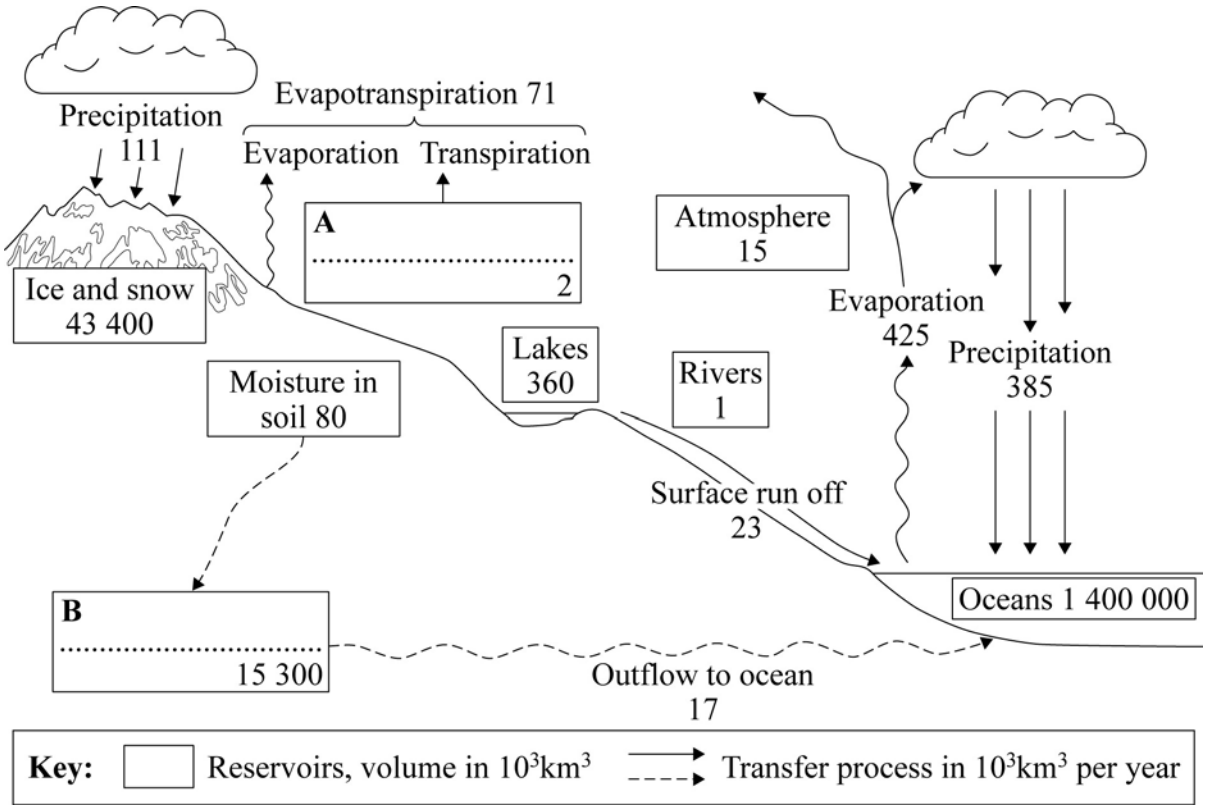
.....

.....

(2 marks)

20

4 The diagram shows the main reservoirs and processes involved in the hydrological cycle.



4 (a) Outline **one** way in which solar energy drives the hydrological cycle.

.....

.....

.....

.....

(2 marks)

4 (b) Complete the diagram by adding the names of the missing reservoirs, **A** and **B**.

(2 marks)

4 (c) The average length of time that water remains in a reservoir before moving to another reservoir is known as the *residence time*.
Use the formula below to calculate the average residence time of water in the atmosphere. Show your working.

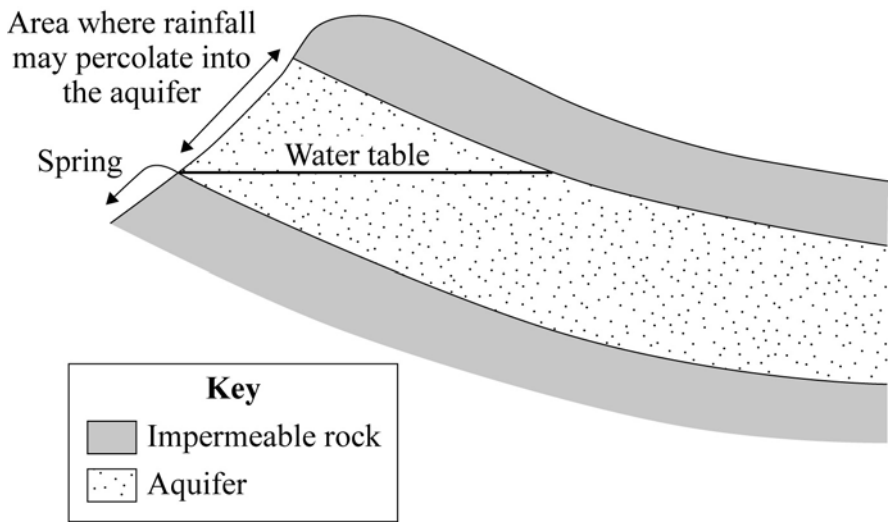
$$\text{Residence time} = \frac{\text{volume in the reservoir}}{\text{rate of transfer in or out of the reservoir}}$$

Average residence time of water in the atmosphere = ...

(2 marks)

6

5 The diagram shows an aquifer and related features.



5 (a) Name the area of land over which rainfall may percolate into the ground and fill an aquifer.

.....

(1 mark)

5 (b) Name a type of rock which often forms aquifers.

.....

(1 mark)

5 (c) Outline why it is important to restrict the maximum amount of water which is extracted from an aquifer.

.....

.....

(1 mark)

5 (d) Explain why summer rain is less effective at refilling an aquifer than winter rain.

.....

.....

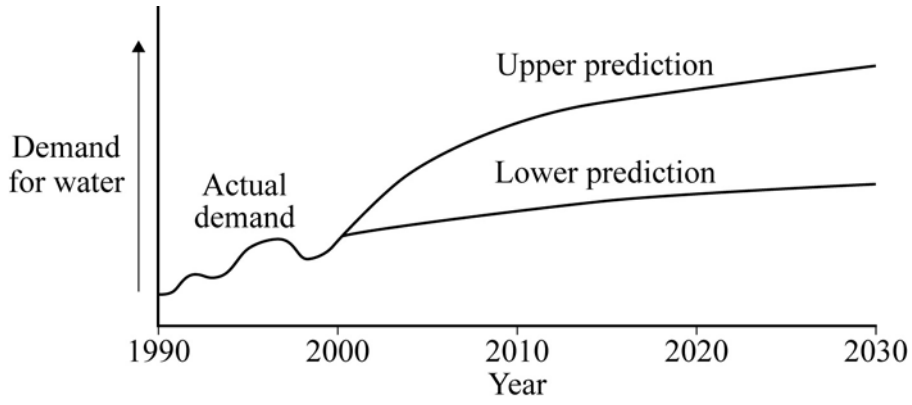
.....

.....

(2 marks)

5

6 The graph shows the actual demand for water up to 2001 and predictions of future demand for an area of the UK.



Outline **two** factors which water companies must consider when making predictions of future demand for water.

1.....

.....

.....

.....

(2 marks)

2.....

.....

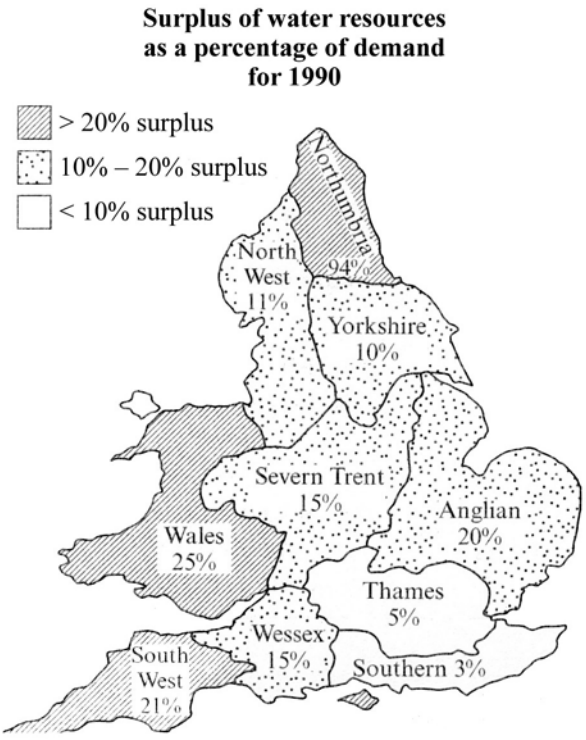
.....

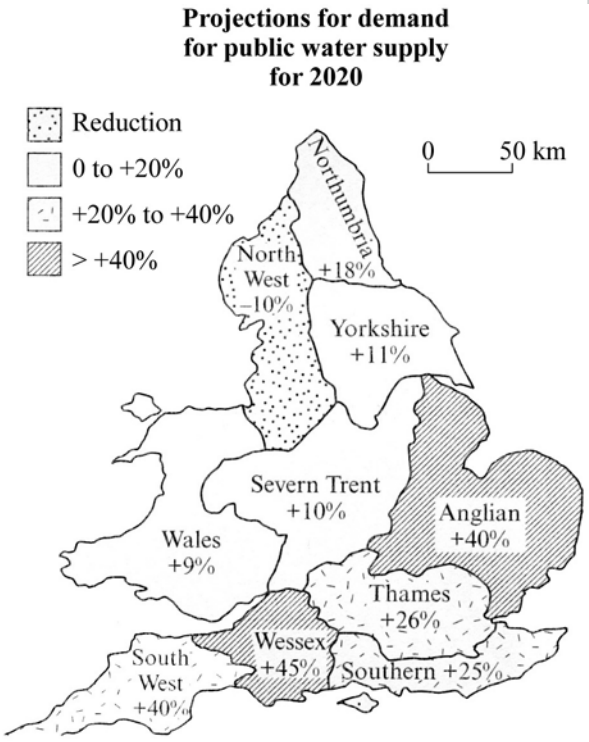
.....

(2 marks)

4

7 The maps of England and Wales show the surplus of water in different regions in 1990 and projections of the change in demand for water in 2020.





7 (a) Suggest **one** reason to account for each of the following:

7 (a) (i) the relatively small surpluses of water in south east England

.....

.....

(1 mark)

7 (a) (ii) the projected reduction in demand for water in north west England;

.....

.....

(1 mark)

7 (a) (iii) the large projected increase in demand for water in south west England.

.....

.....

(1 mark)

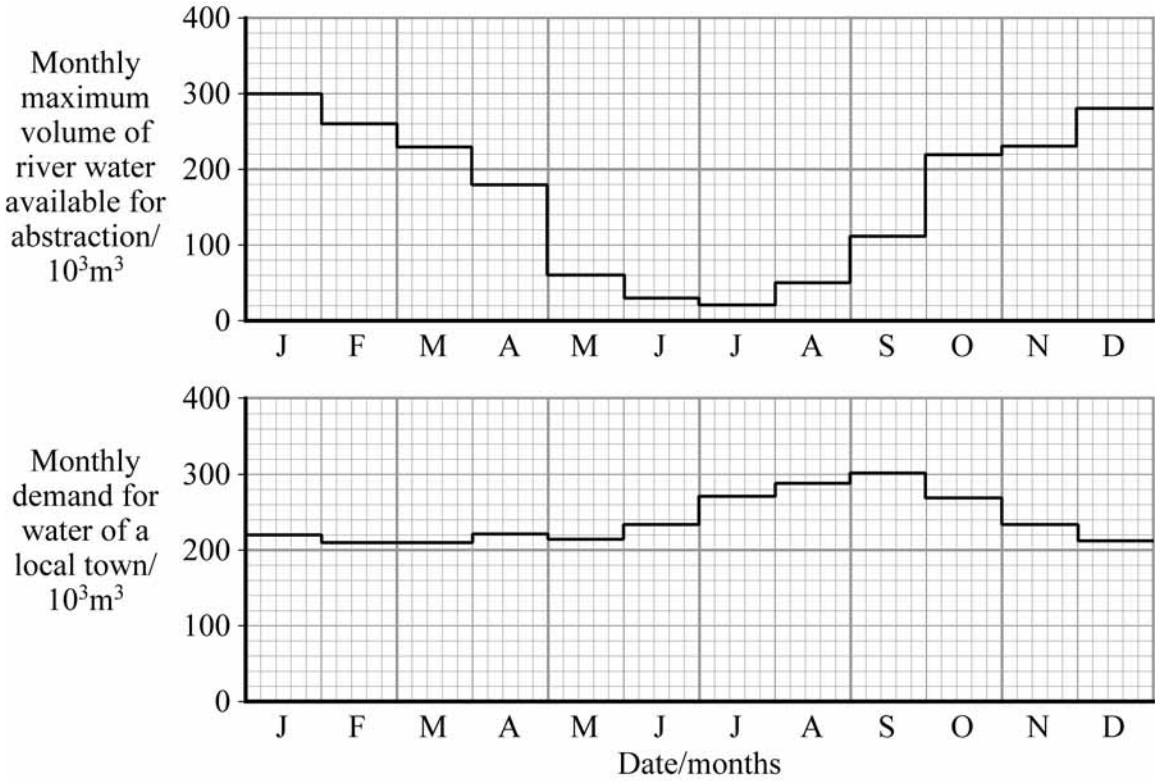
7 (b) Suggest how the shortfall in future supplies in south east England might be met.

.....

.....

(1 mark)

7 (c) The graphs show water availability from a river and the demand for water in an area in the UK.



7 (c) (i) Use information from the graph to explain why this area may have temporary water shortages.

.....

.....

(1 mark)

7 (c) (ii) Suggest how a reservoir could be used to prevent these water shortages from occurring.

.....

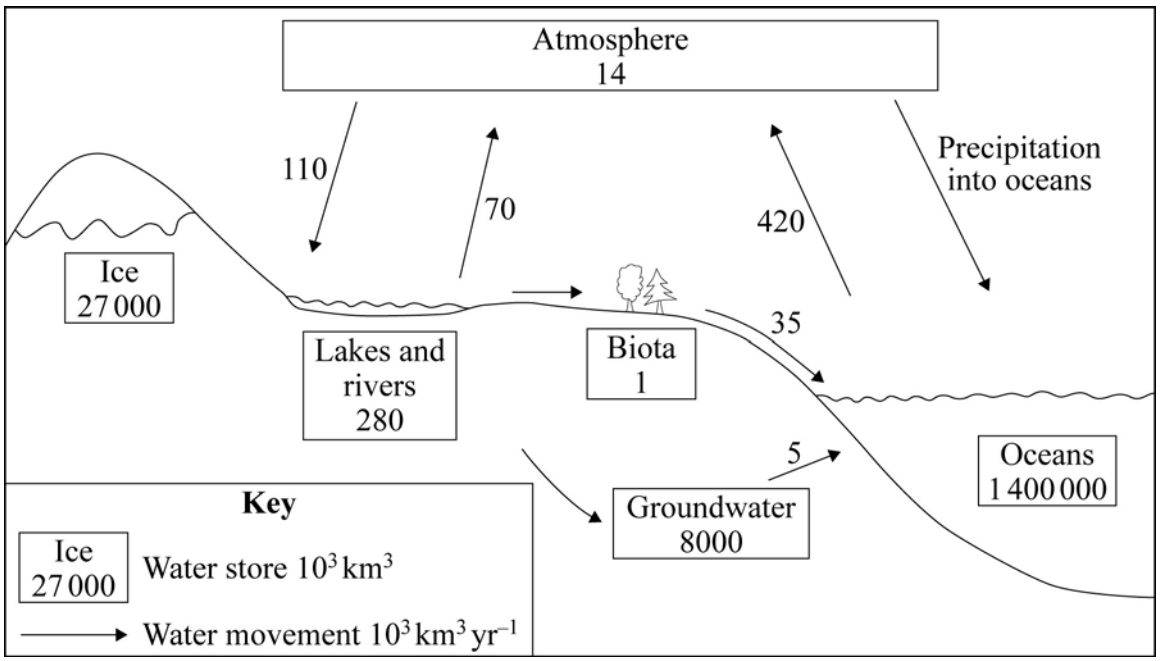
.....

.....

(2 marks)

7

8 The diagram shows dynamic equilibrium in the water cycle.



8 (a) Use the information from the diagram to calculate the annual water movement of precipitation into the oceans.

Show your working.

Answer..... 10^3km^3
(1 mark)

8 (b) Use the formula to calculate the average residence time of water in oceans.

$$\text{Residence time} = \frac{\text{quantity of water in a water store}}{\text{flow out of (or into) the store per year}}$$

Show your working.

Answer.....
(1 mark)

8 (c) Name a rock which often forms aquifers.

.....

(1 mark)

8 (d) Outline **one** problem that may make groundwater unsuitable for irrigation of crops.

.....

.....

.....

.....

(2 marks)

8 (e) Suggest how large-scale irrigation may alter the dynamic equilibrium of the water cycle.

.....

.....

(1 mark)

6

9 Before water can be used it must be treated to remove contaminants.

9 (a) Name and describe a process which is used to remove:

9 (a) (i) large floating objects, such as branches and plastic bags

process .....

description .....

.....

(2 marks)

9 (a) (ii) suspended colloidal particles, such as clay

process .....

description .....

.....

(2 marks)

9 (a) (iii) bacteria.

process .....

description .....

.....

(2 marks)

9 (b) Explain why such processes are usually more important when treating river water than when treating reservoir water.

.....

.....

.....

.....

(2 marks)

8

10 The diagram shows some of the processes used to make water suitable for drinking.

Abstraction
↓
Screening
↓
Sedimentation
↓
Aeration
↓
Flocculation
↓
Chlorination
↓
Fluoridation
↓
Distribution

10 (a) State the purposes of the following processes.

10 (a) (i) Sedimentation

.....

.....

(1 mark)

10 (a) (ii) Flocculation

.....

.....

(1 mark)

10 (b) Chlorine is often added to water to kill pathogenic bacteria.

Name another method that is used to sterilise water for public supply.

.....

(1 mark)

10 (c) The level of chemical contamination is an important factor in the selection of water sources for agriculture.

Outline a problem which would be caused by the use of irrigation water containing dissolved salts.

.....

.....

.....

.....

(2 marks)

10 (d) Describe a technique which can be used to produce fresh water from salt water.

.....

.....

.....

.....

(2 marks)

10 (e) Describe how the quality of water may affect its use in industry.

.....

.....

.....

.....

.....

.....

(3 marks)

10

11 (a) The table shows some of the processes involved in the water cycle.

Complete the table by adding appropriate names or descriptions of processes.

Name of process	Description of process
Infiltration	
	Water molecules pass out of the stomata of leaves
Interception	
Evaporation	Hydrogen bonds between water molecules break and individual molecules escape in gaseous form

(3 marks)

11 (b) Rocks which form aquifers must be both permeable and porous.

Explain the difference between permeability and porosity.

.....

.....

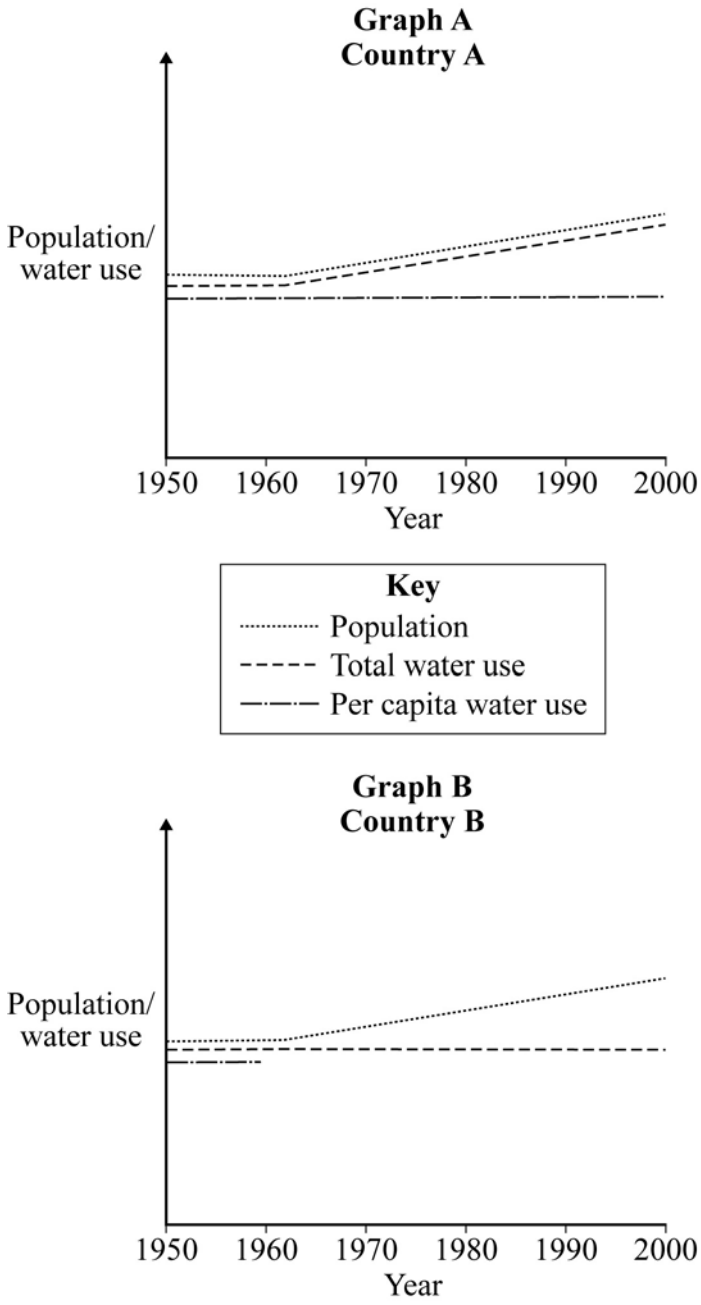
.....

.....

(2 marks)

5

12 The graphs show some features of population, total water use and per capita (per person) water use in two countries.



12 (a) Continue the line on **Graph B** to show per capita water use between 1960 and 2000.

(1 mark)

12 (b) Outline **two** reasons why the per capita water use in a country may increase.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

(4 marks)

12 (c) (i) What is an aquifer?

.....

.....

(1 mark)

12 (c) (ii) By reference to the amount of water in an aquifer, explain the principles of a dynamic equilibrium.

.....

.....

(1 mark)

12 (c) (iii) Describe the likely consequences of the over-exploitation of an aquifer.

.....

.....

.....

.....

.....

.....

(3 marks)

10

13 Tick **one** box in each row to show which water source best fits the feature described. One has been completed as an example.

Feature	Source of water for public supply		
	Upland reservoir water	**Groundwater**	**Lowland river water**
Most likely to be saline			
Least likely to be turbid			
Most likely to be contaminated with pesticides			✓
Least likely to have a high calcium content			
Most likely to contain *E. coli*			
Least likely to have a low dissolved oxygen level			

(5 marks)

5

Mark scheme – Topic 4: The Hydrosphere

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

1 (a) Less suspended sediment/TSS downstream**;**
static water in reservoir/has less kinetic energy/reduced velocity/ speed/stopped by dam**;**
sediments dropped in reservoir/elsewhere/not in river**;** MAX 3

1 (b) Increased surface area of exposed water**;**
increased evaporation**;**
increased humidity**;**
more mist/fog**;**
increased precipitation**;**
less insolation/increased cloud/albedo/more reflection**;**

due to high heat capacity of water/reservoir acts as heat sink**;**
reduced temperature variations**;**

reservoir has large, flat surface**;**
reduces drag/friction with moving air**;**
increased wind speeds**;**

due to high heat capacity**;** *(only credited once)*
onshore/offshore breezes**;**
caused by convection currents/atmospheric pressure differences**;**
(up to 2 for causes)
(up to 2 for effects linked to causes) MAX 3

Total marks = 6

Question 2

2 (a) Purpose**:**
removal of suspended solids/particles/bacteria/
reduce TSS/reduce turbidity**;** 1

Processes**:**
neutralise surface electrical charges/use of alum/ polyelectrolytes/
ionic materials/remove repulsive forces**;** 1

2 (b) Purpose**:**
to kill pathogens/bacteria/microorganisms/prevent disease**;** 1

Processes**:**
use of chlorine/ozone/UV light**;** 1

2 (c) Purpose**:**
to remove tastes/odours/colour/metals/reduce BOD/
remove organic matter**;** 1

Processes**:**
air/oxygen mixed/bubbled through/oxidation of any
of above contaminants/materials**;** 1

(Allow interchange of purposes and processes if meaning is still correct)

Total marks = 6

Question 3

3 (a) (i) Wessex**;** 1

3 (a) (ii) Thames**;** 1

3 (b) Changes in type of industry/type of technology**;**
new industry types require more/less water**;**

changes in amount of industry**;**
increase/reduction in amount of industry increases/reduces demand**;**

change in population size/migration/number of households**;**
increase in population/households increases demand/
reduction in population/households reduces demand**;**

affluence-related consumption/state of development/standard of living**;**
more consumer-goods require more water in manufacture/use/
greater use of such devices**;**

climate change**;**
changing need for specified use**;** 3 × 2 = 6
1 mark for each reason
1 mark for description of reason

3 (c) (i) Sandstone/chalk/limestone/gravel**;** 1

3 (c) (ii) Granite/clay/basalt/marble/slate**;** 1

3 (d) Porosity**:**
capacity to/potential to hold water**;**
percentage/proportion of volume**:**
which is space/pores**;** MAX 2

Permeability**:**
connected pores/fissures/degree of fracturing**;**
capacity to transmit water/allow water to flow**;**
measure of flow rate/ease of movement**;** MAX 2

3 (e) Reduced costs of collection/construction**;**
no construction of dam/reservoir**;**
OR
reduced costs of purification/fewer chemicals/higher quality/cleaner**;**
natural filtration/contaminants removed before reaching aquifer**;**
OR
reduced environmental impact/lower surface land-use conflicts**;**
reference to negative impact of reservoir**;**
OR
reduced evaporation**;**
lower losses**;**
(1 for each advantage) MAX 2
(1 for explanation) MAX 2

3 (f) Artificial recharge**;**
Water pumped underground/use of artificially increased infiltration/river diversion**;** MAX 2

Total marks = 20

Question 4

4 (a) Absorption of solar energy causes**:**
heating
expansion
convection currents
photosynthesis and opening of stomata**;** 1

And hence the process**:**
evaporation
transpiration
winds
ocean currents**;** 1

2nd process must be correctly linked with 1st process to gain 2nd mark

4 (b) **A** vegetation/plants/example of vegetation**;**
B groundwater/aquifer**;** 2

4 (c) Residence time = $\frac{15\times10^3}{496\times10^3}$ 10^3 may be omitted from both parts of this calculation 1

= 0.03 years or 11 days 1
Allow one mark for correct calculation if incorrect rate of transfer is used

Total marks = 6

Question 5

5	(a)	Recharge/catchment area**;**	1
5	(b)	Chalk/limestone/sandstone**;**	1
5	(c)	To avoid extraction exceeding the recharge rate/subsidence/ saltwater incursion/pumping may be required/problem associated with fall in water table**;** [credit relevant example]	1
5	(d)	Higher temperatures**;** more evaporation/transpiration/evapotranspiration/interception**;** less residual precipitation to refill aquifer**;** reduced permeability of soil**;**	MAX 2

Total marks = 5

Question 6

Agricultural change**;**
change in water required for irrigation**;**
OR
increased use of water appliances**;**
specific example of appliance**;**
OR
changes in type of industry**;**
light industry uses less water than heavy industry**;**
OR
change in amount of industry/industrial output**;**
increased industry/industrial output will increase demand**;**
OR
change in efficiency of water use/metered usage**;**
increased efficiency would reduce demand**;**
OR
change in population size**;**
increased populace would increase demand**;**
OR
change in per capita domestic consumption/living standard/affluence/
increased number of homes**;**
increased per capita domestic consumption would increase demand**;**
OR
climate change**;**
increased temperature/reduced precipitate would increase demand**;** MAX 4

1 mark for factor
2nd mark for suggestion of how factor might affect demand
Any two examples

Total marks = 4

Question 7

7	(a)	(i)	High population/high level of industry/lower rainfall/lack of source with justification eg lack of reservoirs + topography/land use/ lack of aquifers + geology/contamination**;**	1
7	(a)	(ii)	population decrease/reduced industry/change in type of industry**;**	1
7	(a)	(iii)	increase in population/per-capita consumption/tourism/ industry/irrigation as climate changes**;**	1
7	(b)		Suggestion of possible source**:** new aquifers/aquifer recharge/river abstraction/desalination/ inter-basin transfer/transport/reservoirs/reuse/ repair leaky pipes**;**	1
7	(c)	(i)	Reference to time period when availability is lower than demand/April to October demand is high, availability is low**;**	1
7	(c)	(ii)	Storage during winter months/times of surplus water/ low demand/high availability**;** for later use**;**	2

Total marks = 7

Question 8

8 (a) 380 = (420 + 70) – 110**;**

OR

380 = 420 – (35 + 5)**;** 1
[calculation not required for mark to be awarded]

8 (b) $\frac{140000}{420}$ = 3333 years/3.333×10^3 years**;** 1
[**A** alternative stated time periods]
[**A** answer without years]

8 (c) Limestone/chalk/sandstone**;** 1

8 (d) (Dissolved) salts/chemicals/pollutants**;**
(osmotic) dehydration/salinization/specific eg of damage**;**
access problems – depth**;** drilling/pumping costs
hardrock**;** drilling/pumping costs
aquifer non recharge**;**
depletion**;** 2
[**A** seawater (in groundwater)]
[**R** not sterile/clean/pH/lack nutrients]

8 (e) Change in**:**
evaporation/runoff/transpiration/percolation/infiltration/
other process**;**
linked to change in**:**
water table/soil moisture/river water/atmospheric water
vapour/biota/other reservoir**;** MAX 1

Total marks = 6

Question 9

9 (a) (i) Screening/sieving/using meshes/filtration**;**
separation from fluids/smaller objects**;** 2

9 (a) (ii) Flocculation/coagulation**;**
repulsive charges neutralised/allow sedimentation/
named flocculant**;**
eg alum/polyelectrolytes/potato starch/feral/Al-Fe salts/floc mat formation/particles stick together**;** 2

9 (a) (iii) Sterilisation/disinfection/reservoir storage**;**
chlorine/UV light/ozone/sunlight**;**
toxic to/kills bacteria**;**
OR
filtration**;**
name of filter type/material**;**
traps due to size**;**
OR
flocculation**;**
named flocculant**;**
stick together and settle**;** MAX 2

9 (b) Greater risk of contamination**;**
reason for greater risk/source of contamination**;**
example of likely contaminant**;**
natural purification in reservoir**;**
example of purification process**;** MAX 2

Total marks = 8

Question 10

10 (a) (i) Sedimentation – settling/removal of suspended solids**;** 1
[**R** large debris/particles]

10 (a) (ii) Flocculation – coagulation/joining/aggregation of charged/ clay/small particles**;** 1
[**R** dissolved solids]

10 (b) Ozone/UV treatment**;** 1

10 (c) Reduced yield/growth/plant death/reduced soil fertility**;**
[**A** pH change if problem stated]
salinisation/increased concentration of salts in soil/water stores**;**
osmosis/(osmotic) dehydration/damage/physiological drought/ water loss/high water potential in plant/lower in soil**;** MAX 2

10 (d) Reverse osmosis**;**
high pressure filtration/semi-permeable membrane/molecular filter/ water movement from low to high water potential**;**
OR
distillation**;**
high temperature/low pressure boiling/evaporation then condensation**;**
OR
electrodialysis**;**
electric charge/ion separation**;** MAX 2

10 (e) Up to two specific industrial uses of water**:**
boiler water/solvent/washing/coolant/radiation absorption/irrigation/ food ingredient**;;**
up to two specific quality-related issues or problems**:**
limescale/dissolved minerals/hardness/corrosion/turbidity/gross solids/ acidity/toxins/taste**;;** MAX 3

Total marks = 10

Question 11

11 (a) (Water soaking) into the ground/soil/rock/entering interstitial spaces**;**
(evapo) transpiration/diffusion**;**
water landing on leaves/vegetation**;** 3
[**R** taken up by plant]

11 (b) Porosity: proportion of volume which is space/presence of spaces**;**
permeability: (rate of) fluid flow through**;** 2

Total marks = 5

Question 12

12 (a) Line goes down**;** 1

12 (b) Any suitable change**;**
plus expansion**;**
eg
increased affluence/standard of living**;**
increased use of water-using appliances**;**
example of appliance**;**

increased use in agriculture**;**
irrigation**;**

increased industrial use**;**
example of industry/use**;**

climate change**;**
increased use (not previously used) eg washing/irrigation**;**

lifestyle/social changes**;**
increased hygiene/health/recreational uses**;** MAX 2+2 MAX 4
[**R** non per-capita changes eg population increase]

12 (c) (i) Water-bearing rock (used as a source)**;** 1

12 (c) (ii) Balance of in/out**;** 1

12 (c) (iii) Reduced support of water in pores**;**
subsidence**;**
lowered water table**;**
reduced river flow**;**
reduced springflow/baseflow/dry upstream**;**
vegetation/habitat change**;**
saltwater incursion/saltwater flows in/salination/
increased salt concentration**;**
due to pressure change**;**
denser saltwater flows under freshwater**;**
increased pollution concentration**;** MAX 3

Total marks = 10

Question 13

Feature	**Source of water for public supply**			
	Upland reservoir water	**Groundwater**	**Lowland river water**	
Most likely to be saline		✓		**;**
Least likely to be turbid		✓		**;**
			✖	
Least likely to have a high calcium content	✓			**;**
Most likely to contain *E. coli*			✓	**;**
Least likely to have a low dissolved oxygen level	✓			**;**

Total marks = 5

Topic 5: Mineral Resources

1 Explain how each of the following environmental consequences of mining and quarrying can be treated or reduced:

1 (a) slow recolonisation by plants due to the high carbon:nitrogen ratio of the waste

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(1 mark)

1 (b) high noise levels from active quarries.

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(1 mark)

2

2 (a) Explain why land that is suspected of heavy metal contamination may be regarded as unsuitable for:

2 (a) (i) recreation

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(1 mark)

2 (a) (ii) food production.

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(1 mark)

2 (b) Suggest why land previously used for deep mining may not be suitable for housing.

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(1 mark)

2 (c) Explain the term *toxic leachate*.

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(2 marks)

5

3 Complete the table by adding the appropriate land reclamation technique or reason.

Land reclamation technique	Reason
	Increase pH to increase nutrient availability
	Increase aeration and decrease compaction
Planting legumes	
Reducing gradient of slopes to less than 20°	
Spraying grass seeds in a liquid slurry of treated manure (hydro-seeding)	

(5 marks)

5

4 (a) The extraction of rocks used for roadstone causes environmental damage.

4 (a) (i) Name **two** rocks used for roadstone.

1.....

2.....

(2 marks)

4 (a) (ii) State **two** properties of rocks that make them suitable for roadstone.

1.....

2.....

(2 marks)

4 (b) Discuss why mineral extraction in National Parks causes many environmental problems.

Quality of Written Communication will be assessed in this answer

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(11 marks)

15

5 (a) Using **two** named examples, explain how the properties of non-metallic minerals are related to their uses.

1 Example .....

Properties .....

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2 Example .....

Properties .....

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(6 marks)

5 (b) Discuss the factors which affect the viability of exploiting mineral deposits.

Quality of Written Communication will be assessed in this answer.

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(9 marks)

15

Mark scheme – Topic 5: Mineral Resources

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

1	(a)	Addition of nitrogen fertiliser/planting of legumes/soil biota**;** [**R** organic waste]	1
1	(b)	Walls/fencing/embankments/tree screens/method of blasting/ baffling on machinery**;** [**R** resiting quarry]	1

Total marks = 2

Question 2

2	(a)	(i)	Ingestion of soil/inhalation/swallowing/skin problems/ cost of clean up**;**	1
2	(a)	(ii)	Reference to uptake by plants/roots**;**	1
2	(b)		Subsidence/explosion/unstable land**;**	1
2	(c)		Toxin is poisonous/harmful to biota**;** dissolved/soluble substance which moves through soil/rock**;**	2

Total marks = 5

Question 3

Land reclamation technique	Reason	
Liming/calcium carbonate ($CaCO_3$) [**R** neutralise/fertilise]		;
Ploughing/ripping/tilling [**R** add worms]		;
	Fix/add nitrogen/NO_3^-/NH_3/NH_4^+/OM	;
	Reduce risk of landslip/erosion/run-off/ easier reclamation/construction [**R** leaching ref]	;
	Encourage growth/add increase OM/ provide ground cover/revegetate/ stabilise slopes/decrease erosion [**R** increase nutrients]	;

Total marks = 5

Question 4

4 (a) (i) Basalt**;**
granite**;**
gabbro**;**
sandstone (used in levelling)/greywacke**;**
limestone/dolomite**;**
dolerite**;**
diorite**;**
syenite**;** MAX 2

4 (a) (ii) Hard/resistant to wear/abrasion/durable**;**
impermeable/waterproof/non porous**;**
low solubility/inert**;**
limestone bonds with bitumen**;**
minerals weathering at different rates improve grip**;** MAX 2

4 (b) *Quality of Written Communication will be assessed in this answer*

Parks meant for (quiet) recreation**;**
landscape conservation/land take/amenity**;**
habitat loss/disrupts wildlife**;**
scarring/loss of visual amenity/aesthetic problems/dereliction**;**
noise**;**
accidents/congestion**;**
dust**;**
fumes/air pollution from traffic/lorries/named gases**;**
vibration**;**
sedimentation/turbidity/qualified water pollution/silt**;**
toxic leachate/mine drainage**;**
spoil stability/landslides**;**
subsidence**;**
flooding/ref to water table moving**;**
explosions/blasting**;**
access**;** MAX 9

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 15

Question 5

5 (a) Granite**;**
hard/resistant/durable/strong/road grip**;**
roadstone/kerbs/cladding/building/statues**;**
[**R** tough]

limestone**;**
kali/chem. reactive/can be ground finely/easy to cut/carve/shape/sculpt/attractive**;**
cement/glass/agric use/smelting/neutralising agent/building**;**

sand**;**
inert/compound of silica**;**
filler/concrete/mortar/glass**;**

gravel**;**
inert**;**
filler/construction/concrete**;**

clay**;**
hard when baked/non-porous/poor conductor of heat**;**
bricks/pottery**;**

china clay/kaolin**;**
inert/non-toxic**;**
waterproof/non-porous**;**
forms hard/smooth surface/fine/can be polished/pure white**;**
pottery/paper/named pharmaceuticals/paint/cosmetics/plastics/filler**;**

coal**;**
high calorific value**;**
fuel/power stations**;**
uranium**;**
radioactive/fissile**;**
power stations**;**

slate**;**
fissile non-porous**;**
roofs**;**

sandstone**;**
easily crushed/graded**;**
road filler**;** max 3 + max 3 MAX 6

5 (b) *Quality of Written Communication is assessed in this answer*

Mining costs/depth of veins/seams/thickness of overburden**;**
size of deposit**;**
dispersal of veins/seams**;**
nature of overburden eg granite v clay/exploitable overburden**;**
drainage problems**;**
folding/faulting/seismic activity**;**
land costs**;**
cost of reclamation/pollution prevention/CH_4 pockets**;**
infrastructure/roads/transport costs/site accessibility**;**
processing costs/purity of ore/grade of ore/
level of technology available**;**
[**R** quality]
chemical form**;**
(market) demand/cut-off grade**;**
labour costs**;**
public opposition/NIMBY**;**
designations eg NP/SSSI**;**
political instability**;** MAX 7

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 15

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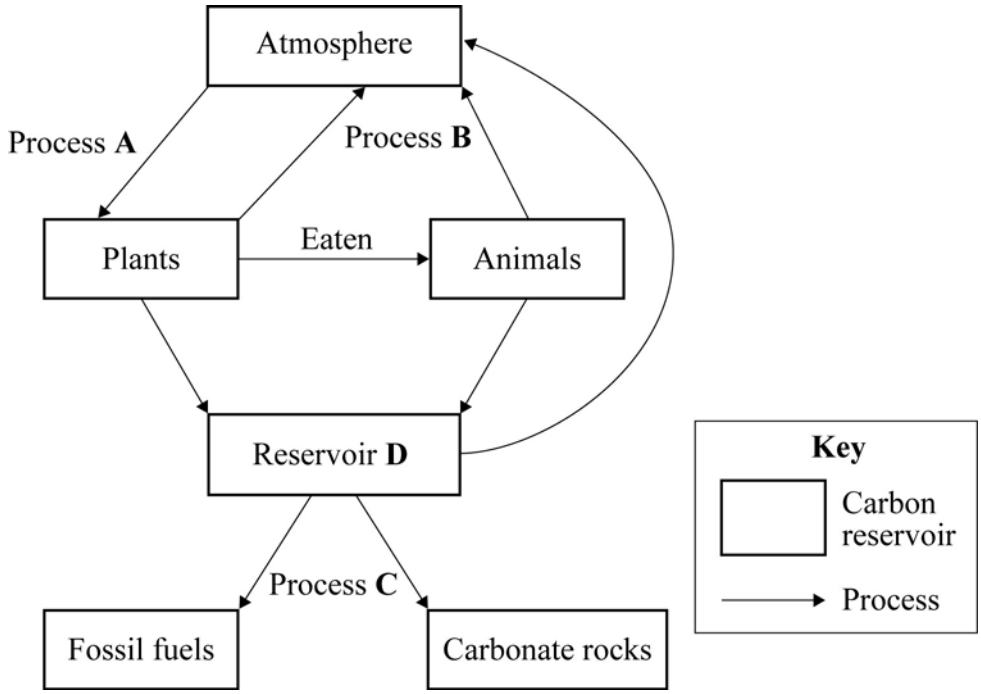
Topic 6: Carbon Cycle

1 The diagram shows part of the carbon cycle.



1 (a) Give the name of the processes and reservoir shown in the diagram.

Process **A** .....

Process **B** .....

Process **C** .....

Reservoir **D** .....

(2 marks)

1 (b) Give an example of a carbonate rock.

.....

(1 mark)

1 (c) Use the carbon cycle to explain what is meant by the term global homeostasis.

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(2 marks)

1 (d) Suggest how the large-scale planting of trees affects the movement of carbon in the carbon cycle.

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(2 marks)

7

2 (a) The table shows details of some of the processes in the carbon cycle.

Add the names of the missing processes to the table.

Name of process	Description of process
	Fixation of carbon dioxide in plants using energy from sunlight
Carbonate rock formation	Sedimentary rocks formed by the laying down of shells of marine organisms or by chemical precipitation
	Production of carbon dioxide from organic matter at high temperatures
Respiration	Release of carbon dioxide from living organisms to produce energy for metabolic processes
	Production of methane or alcohol from the incomplete decay of organic matter

(3 marks)

2 (b) Use the carbon cycle to explain the principle of a dynamic equilibrium.

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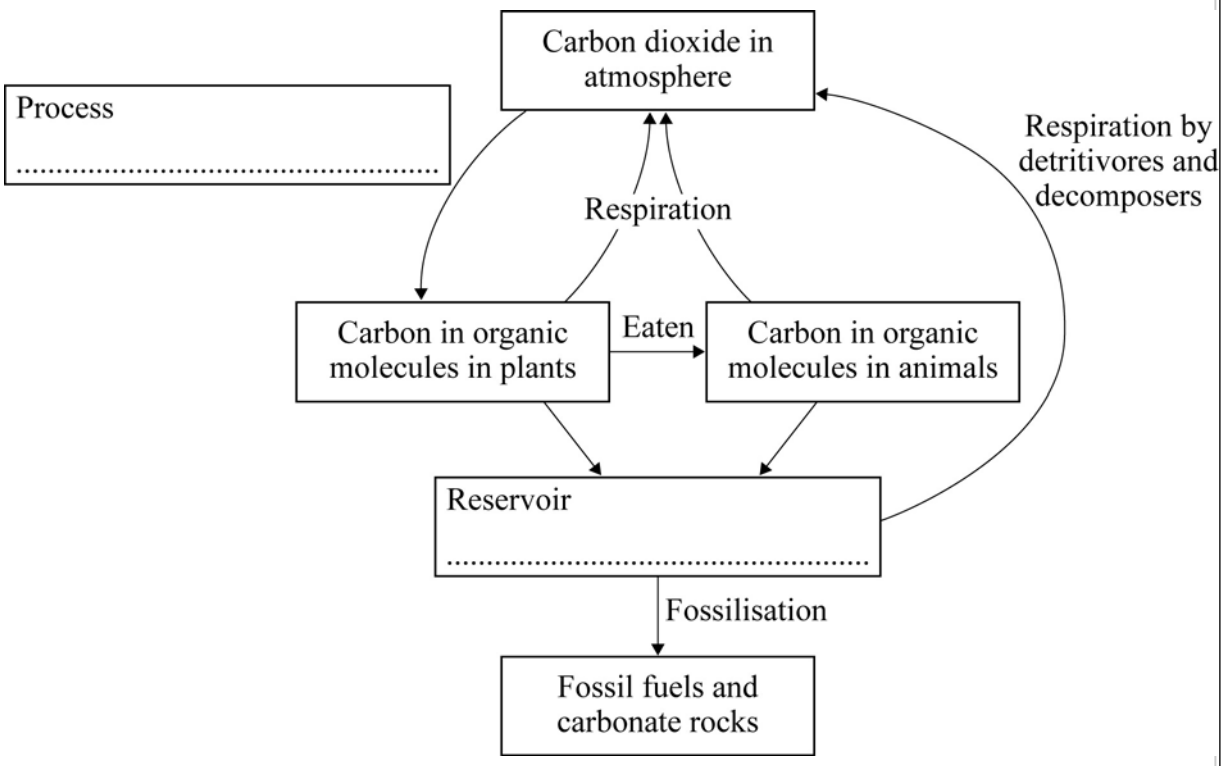
(2 marks)

5

3 The diagram illustrates the carbon cycle.



3 (a) Complete the diagram.

(2 marks)

3 (b) In which reservoir does carbon have the longest residence time?

.....

(1 mark)

3 (c) Use the carbon cycle to explain how negative feedback can produce a dynamic equilibrium.

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(3 marks)

3 (d) Outline how human activities change the rate of movement of carbon in the carbon cycle.

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(3 marks)

3 (e) Suggest why it may be difficult to estimate accurately the global amount of carbon present in biomass.

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(1 mark)

10

4 Describe the ways in which human activities alter amounts of carbon present in the major carbon reservoirs and the rates at which it moves between reservoirs.

Quality of Written Communication will be assessed in this answer

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(9 marks)

9

Mark scheme – Topic 6: Carbon Cycle

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

1	(a)	Process **A** – photosynthesis**;** Process **B** – respiration**;** Process **C** – fossilisation/sedimentation/burial/compaction/ partial decay/chemical change**;** Reservoir **D** – dead organic matter/decaying organic matter/DOM**;** 1 mark for two correct, two marks for four correct	MAX 2
1	(b)	Chalk/limestone/marble/calcite/dolomite/magensite/siderite/malachite/ ankerite/rhodocrosite/smithsonite/aragonite/witherite/strontianite/ cerussite/alstonite/baryto-calcite/asurite/carbobatite/ calci-rudite/calcarenite/calci-lutite**;**	1
1	(c)	Effects cancel out/balancing reactions/dynamic equilibrium/ negative feedback/maintenance of stable conditions**;** examples of opposing reactions using Carbon cycle eg photosynthesis:respiration**;**	MAX 2
1	(d)	More trees → more animals; more animals → more respiration**;** more photosynthetic cells**;** increased rate of photosynthesis/more photosynthesis**;** more carbon stored as biomass/carbon reservoir/in trees**;** reduced carbon levels in atmosphere**;** release of carbon on death/decay of trees**;**	MAX 2

Total marks = 7

Question 2

2	(a)	Photosynthesis**;**	1
		combustion/burning/incineration**;**	1
		anaerobic digestion/decay/decomposition (of organic matter)/ methanogenesis/anaerobic bacteria/archaebacteria/fermentation/ action of yeast**;**	1
		[**A** respiration instead of digestion/decay]	
2	(b)	Names of two opposing processes/materials involved eg photosynthesis and respiration**;**	
		processes/rates (counter) balance/equal each other/cancel each other/ steady state/homeostasis**;**	2

Total marks = 5

Question 3

3	(a)	Photosynthesis**;** DOM/dead organic matter**;**	2
3	(b)	Fossil fuels/carbonate rocks**;** [**A** lithosphere/sediments] [**R** underground/in soil]	1
3	(c)	Change in named process**;** change in second named process**;** rebalance**;**	3
3	(d)	Named activity with effect on carbon movement/amount in reservoir/ named material**;;;** eg fossil fuel combustion**;** named activity using fossil fuel**;** deforestation**;** increased soil decomposition**;** marine pollution killing phytoplankton**;** global warming increasing rate of named process**;** change in vegetation type**;**	MAX 3
3	(e)	Any suitable difficulty**;** population size estimates**;** DOM estimates**;** deep oceans/soil organisms/other hard to find organisms**;** area estimates**;** different carbon contents of different types/sizes of organism**;** speed of change/residence times**;**	MAX 1

Total marks = 10

Question 4

Descriptions of processes or changed rates of movement of carbon**:**
deforestation**;**
afforestation/reforestation**;**
fuel combustion**;**
cement manufacture**;**
soil disturbance/increased soil decomposition**;**
forest fires/stubble burning**;**
methanogenic bacteria/anaerobic decay**;**
up to 2 marks for details of each (named process,
specific named C-containing substance)
eg carbohydrate not wood/hydrocarbon not fossil fuel

Secondary effects of global climate change**:**
reduced CO_2 solubility**;**
increased rate of decomposition**;**
melting permafrost releasing methane**;**
methane hydrate liberation**;** MAX 7

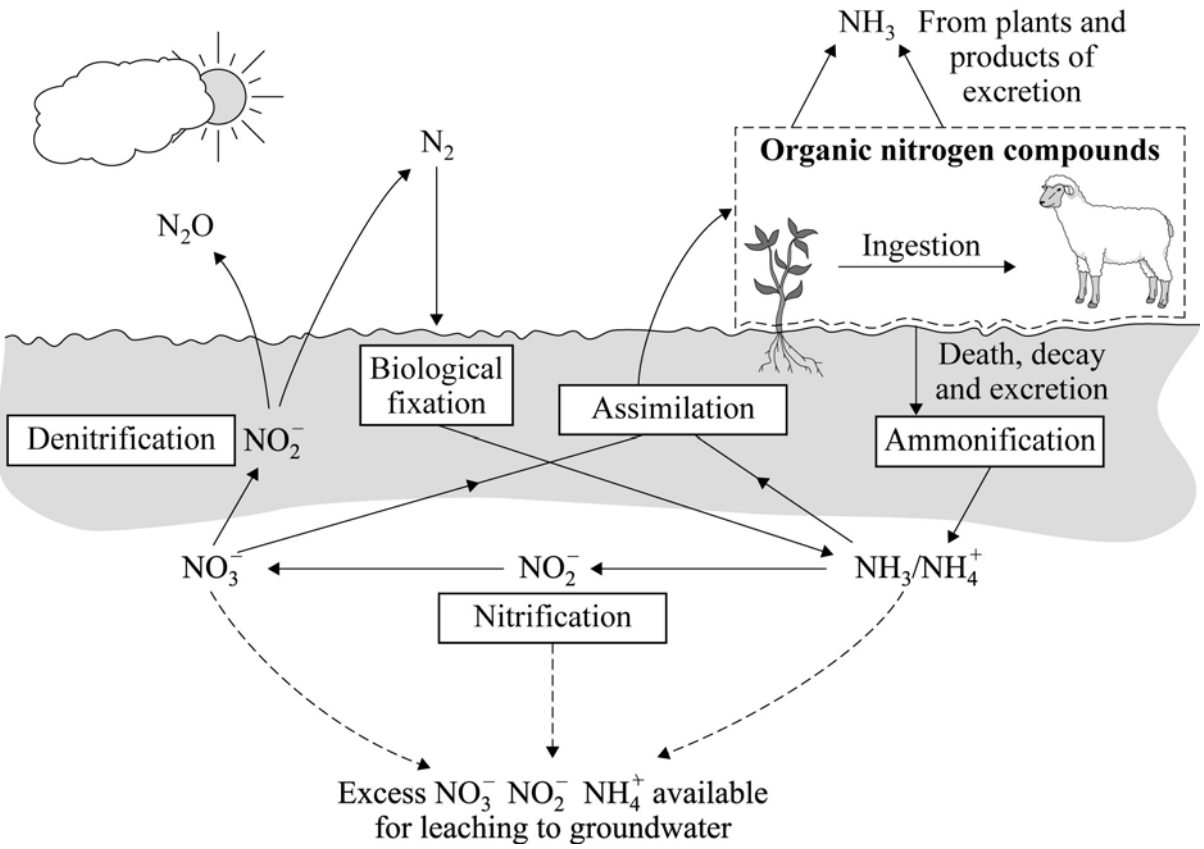
Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 9

Topic 7: Nitrogen cycle

1 The diagram shows the terrestrial part of the natural nitrogen cycle.



1 (a) Describe a process of natural nitrogen fixation.

.....

(1 mark)

1 (b) Outline how nitrifying bacteria increase soil fertility.

.....

.....

(2 marks)

1 (c) Explain how solar energy drives the nitrogen cycle.

.....

.....

.....

(2 marks)

The tables show some of the active and storage pools within the nitrogen cycle.

Active Pool		Size of Pool (10^6 tonnes)
Organic	Land organisms	31.1
	Marine organisms	2.5
	Decaying organic matter	4286.7
Inorganic	Soils	357.1
	Ocean sediments	253.6

Storage Pool	Size of Pool (10^6 tonnes)
As N_2 in atmosphere	964 285
As N_2 in oceans	50 000
Sedimentary rocks	1 035 714
Crushed rocks	35 714 286

1 (d) Calculate the percentage of organic nitrogen which is contained in living matter. Show your working.

(2 marks)

1 (e) Describe **two** ways in which humans affect the atmospheric pool of nitrogen.

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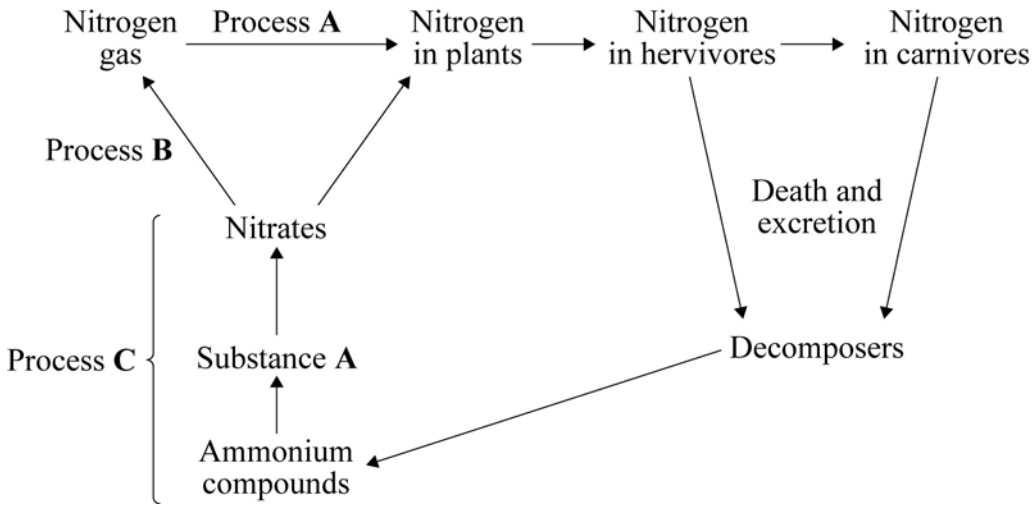
(4 marks)

11

2 The diagram shows the nitrogen cycle.



Name:

Process **A** .....

Process **B** .....

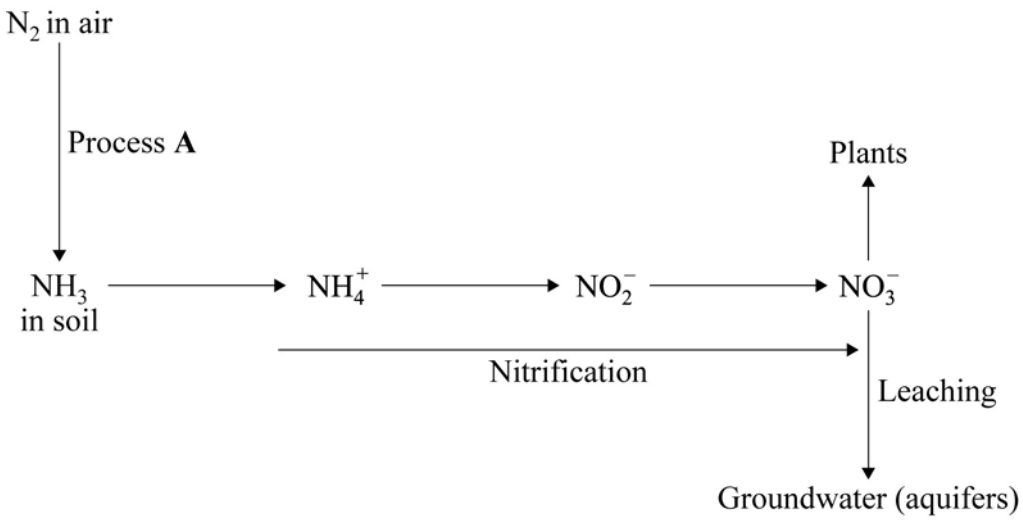
Process **C** .....

Substance **A** .....

(4 marks)

4

3 The diagram shows part of the nitrogen cycle.



3 (a) Name process **A**.

.....

(1 mark)

3 (b) Outline the biotic significance of:

3 (b) (i) process **A**

.....

.....

.....

(2 marks)

3 (b) (ii) nitrification

.....

.....

.....

(2 marks)

3 (b) (iii) leaching.

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(2 marks)

3 (c) Explain why, despite process **A**, the percentage of nitrogen in the atmosphere stays approximately constant.

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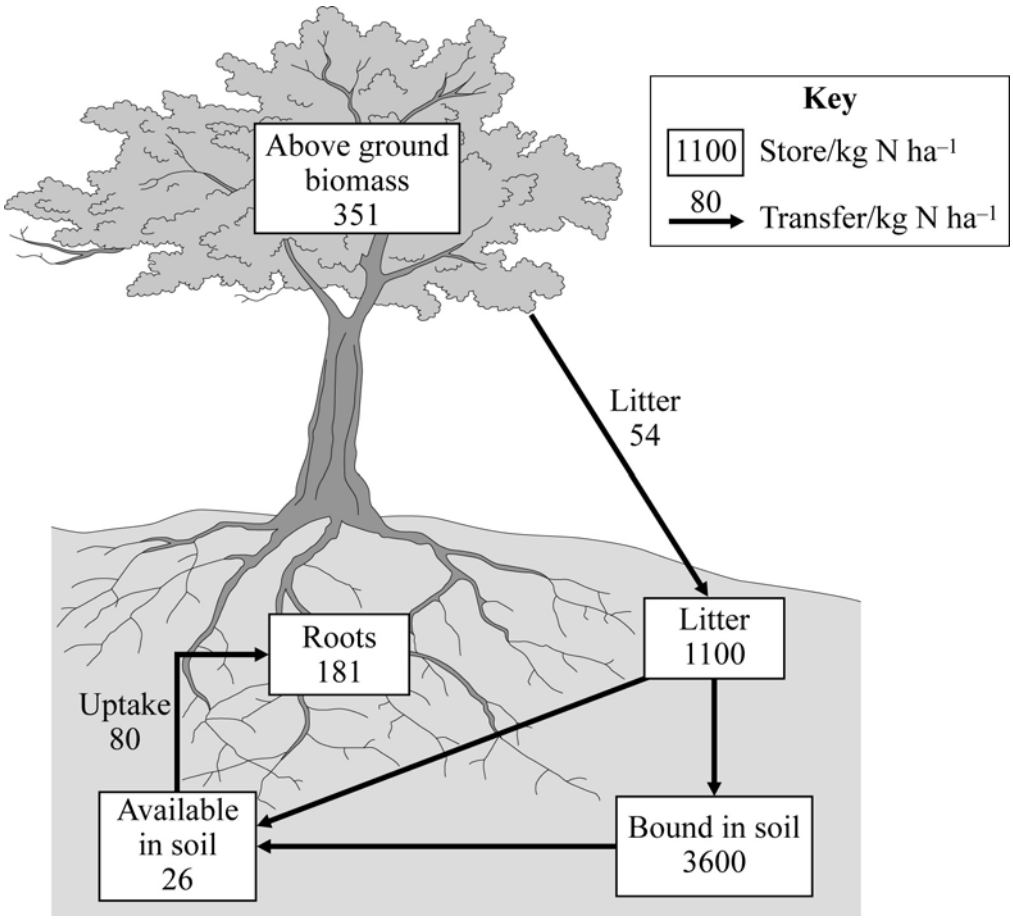
(3 marks)

10

4 The diagram shows part of the nitrogen cycle.



4 (a) In what form do plants absorb nitrogen?

.....

(1 mark)

4 (b) State **three** ways, not shown in the diagram, by which the amount of nitrogen compounds in the soil may increase.

1.....

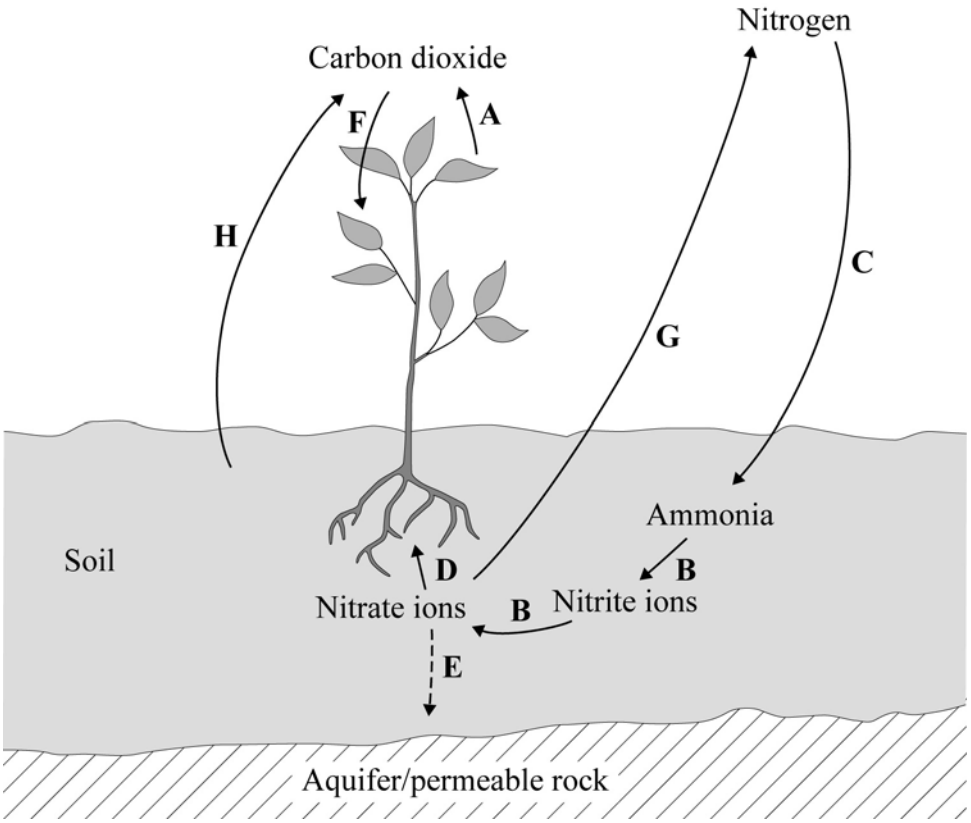
2.....

3.....

(3 marks)

4

5 The diagram shows part of the carbon and nitrogen cycles.



Complete the table by selecting the appropriate letter from the diagram. The first line has been completed as an example.

Description	**Letter**
Plant respiration	**A**
Nitrogen fixation	
Leaching	
Nitrification	
Photosynthesis	
Dentrification	

(5 marks)

5

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Mark scheme – Topic 7: Nitrogen Cycle

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

1	(a)	Conversion of N_2 into NH_3 by bacteria**;** conversion of N_2 into oxide of N by lightning**;**	1
1	(b)	Convert NH_3/NH_4^+ into NO_2^-, or NO_2^- into NO_3^-**;** NO_3^- important nutrients/needed for protein synthesis**;**	2
1	(c)	Solar energy needed for plant growth/photosynthesis**;** plants absorb nitrates**;** plants provide source of nitrogen for heterotrophs/ decomposers**;**	MAX 2
1	(d)	$31.1 + 2.5 \frac{33.6}{4320.3}; \times 100 = 0.77 – 0.78\ (0.8)$**;**	2
1	(e)	Industrial fixation/Haber process – link to decrease**;** excess fertilisers denitrified – link to increase**;** planting of legumes – link to decrease**;** combustion of fossil fuels – link to increase**;** ploughing of soils – increase or decrease, but correctly qualified**;** creation of anaerobic soils eg paddy – increase or decrease, but correctly qualified**;** linked correctly to increase or decrease for two ways	MAX 4

Total marks = 11

Question 2

Process **A** –	Nitrogen fixation**;**	1
Process **B** –	Denitrification**;** [**A** denitrifying bacteria]	1
Process **C** –	Nitrification**;** [**A** nitrifying bacteria]	1
Substance **A** –	NO_2^-/nitrite**;**	1

Total marks = 4

Question 3

3	(a)		Nitrogen fixation**;** [**R** Haber Process]	1
3	(b)	(i)	Makes available N/NO_3 source for plants/animals**;** increases N/NO_3 in soil**;** N needed for proteins/DNA/nucleic acids**;** named/rhyzobium bacteria are able to convert it**;**	MAX 2
3	(b)	(ii)	Ammonium/NH_4^+ ions difficult to absorb**;** nitrates can be absorbed/makes N available to plants**;** increases fertility**;**	2
3	(b)	(iii)	Loss of nitrogen/nitrates/nutrients**;** reduces fertility/growth**;** economic loss/pollutant/ref eutrophication/ blue baby syndrome/replace via fossil fuels/ Haber Process**;**	MAX 2
3	(c)		Ref dynamic equilibrium**;** death/decay/decomposition**;** denitrification/NO_x/NH_3 converted to N_2**;** burning of fossil fuels/industrial processes**;** release of ammonia (eg swamps/anaerobic decomposition)**;** NO_x/NH_3 converted to N_2**;** volcanic eruptions**;**	MAX 3

Total marks = 10

Question 4

4 (a) Nitrate (ions)/NO_3^-/ammonium/NH_4^+**;** 1
[**R** ammonia]

4 (b) Faeces/urine/animal waste/excretion/decomposition of animals**;**
rain**;**
lightning**;**
dust/Aeolian deposition**;**
fixation/named legumes/nitrogen fixing bacteria/rhizobium**;**
[**R** nitrifying bacteria]
fertilisers**;**
weathering**;** MAX 3

Total marks = 4

Question 5

Description	**Letter**	
Plant respiration		
Nitrogen fixation	C	**;**
Leaching	E	**;**
Nitrification	B	**;**
Photosynthesis	F	**;**
Dentrification	G	**;**

Total marks = 5

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Topic 8: Phosphorus Cycle

1 Phosphorus is an essential plant nutrient.

1 (a) In what form do plants take up phosphorus?

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(1 mark)

1 (b) Outline how phosphorus is transferred from the ocean to the land.

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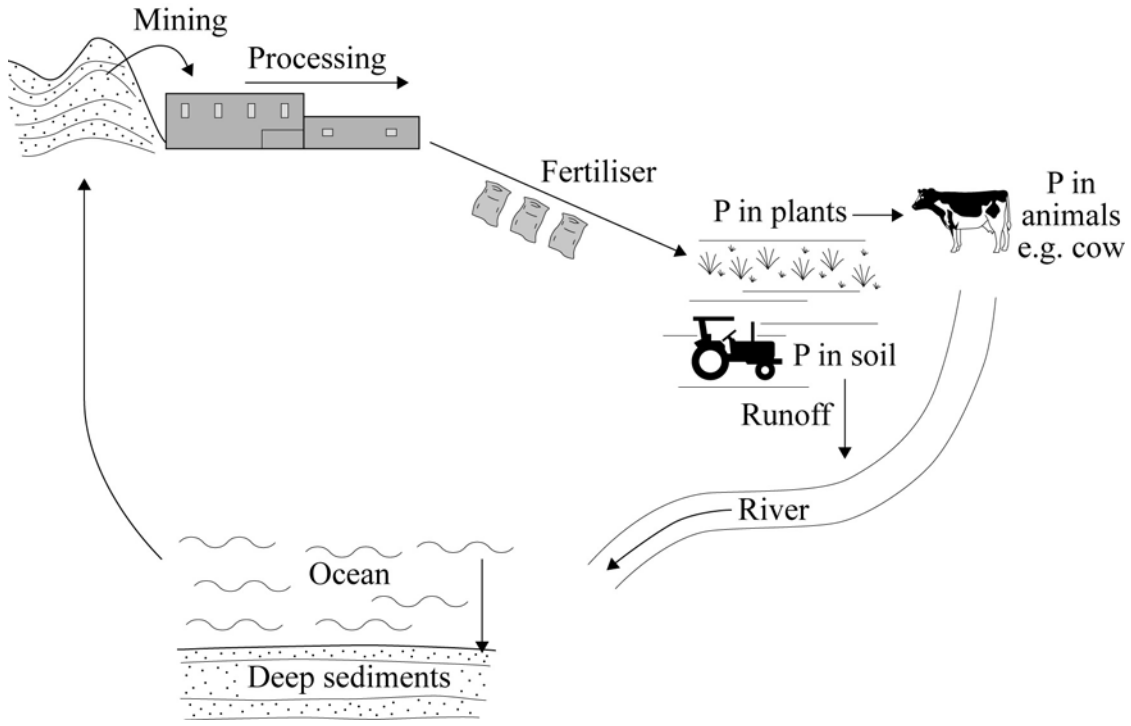
(3 marks)

4

2 The diagram shows part of the phosphorus cycle.



2 (a) State **one** use of phosphorus in living organisms.

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(1 mark)

2 (b) Suggest **two** reasons why the cycling of phosphorus is slower than the cycling of carbon or nitrogen.

1.....

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2.....

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(2 marks)

2 (c) Suggest **three** ways, not shown in the diagram, by which the amount of phosphorus compounds in the soil may increase.

1 .....

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2 .....

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3 .....

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(3 marks)

6

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Mark scheme – Topic 8: Phosphorus Cycle

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

1	(a)	Phosphate (ion)/PO_4^{3-}**;** [**A** PO_4^{2-}] [**R** in solution]	1
1	(b)	Algae/phytoplankton absorb PO_4^{3-}**;** fish eats phytoplankton**;** bird eats fish/fish converted to fertiliser**;** guano/death and decomposition of bird/fertiliser applied to land**;** **OR** ref: lithification (of phosphate-rich sediments)**;** uplift/sea level falling**;** weathering/erosion**;** mining/quarrying**;**	MAX 3

Total marks = 4

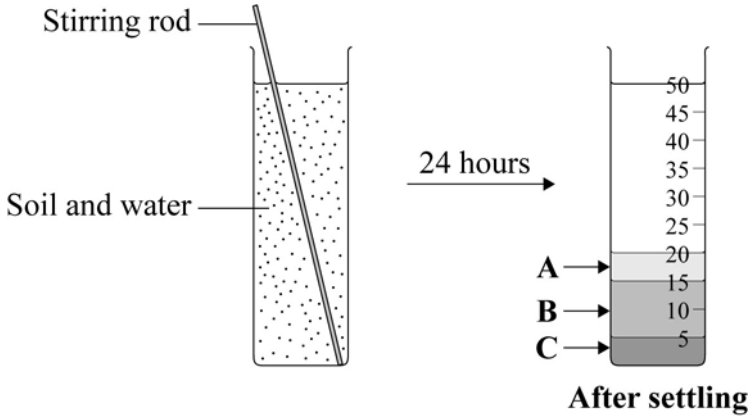
Question 2

2	(a)	Proteins/bones/DNA/RNA/nucleic acids/ATP/ADP/phosphorylation/ phospholipids/(plasma) membrane**;**	1
2	(b)	No gaseous stage**;** low solubility**;**	2
2	(c)	Weathering**;** dust/rain/sea spray**;** death/decay/decomposition**;** excretion/urine**;** egestion/guano/manure/faeces/organic fertiliser**;** volcanic eruption**;**	MAX 3

Total marks = 6

Topic 9: Soil

1 A student used the apparatus below to try to determine the texture of a soil sample, which has been sieved to remove the gravel.



1 (a) Identify components **A**, **B** and **C**.

A .....

B.....

C .....

(3 marks)

1 (b) Calculate the percentage of component **B** in the soil sample.
Show your working.

(2 marks)

1 (c) Describe a method to determine the water content of a soil sample.

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(4 marks)

9

2 (a) Explain why the nutrient content of soils may increase and decrease.

Increase .....

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(2 marks)

Decrease .....

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(2 marks)

2 (b) Explain how soil texture affects soil fertility.

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(2 marks)

2 (c) Suggest how the action of frost on the soil may increase plant growth.

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(2 marks)

2 (d) Outline **one** way in which soil biota may improve soil structure.

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(2 marks)

10

3 The table shows the sources of fixed nitrogen.

Source	Quantity/10^6 tonnes	as share of total nitrogen fixed/percentage
Natural sources of nitrogen fixation		
Lightning	<10	3
Microbes	90–140	34
Human sources of nitrogen fixation		
Nitrogen fertiliser	80	24
Leguminous crops	32–53	12
Release of previously fixed nitrogen		
Burning fossil fuels	20	6
Clearing land, draining wetlands	70	21
Total human fixation and release	213	63

Using information in the table, explain how humans increase soil fertility.

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(4 marks)

4

4 The table shows the size fractions of soil particles.

Fraction name	Diameter/mm
Sand	0.05 to 2.00
Silt	0.002 to 0.049
Clay	<0.002

4 (a) Suggest why chemical reactions occur faster in clay soils.

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(2 marks)

4 (b) Outline a technique which could be used to measure the proportions of different sized particles in a soil sample.

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(2 marks)

4 (c) Suggest **two** advantages and two disadvantages to a farmer of a soil with a very high percentage of clay.

Advantages.....

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(2 marks)

Disadvantages .....

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(2 marks)

4 (d) State **three** factors which influence a soil's thermal capacity.

1.....

2.....

3.....

(3 marks)

4 (e) Explain why soil thermal capacity may influence soil fertility.

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(2 marks)

4 (f) Outline a method which could be used to determine the organic matter content of a soil.

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(4 marks)

17

5 A student investigated how the organic matter content of a soil affected the infiltration rate. At each of three sites, the student took a soil sample. In the laboratory, the student then measured soil moisture content, organic matter content and the rate of infiltration of 50 cm^3 of water.

5 (a) (i) Explain how soil organic matter forms.

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(2 marks)

5 (a) (ii) Other than soil moisture and organic matter content, state **four** factors which could affect infiltration rate.

1 .....

2 .....

3 .....

4 .....

(4 marks)

5 (b) Explain why an increase in the infiltration rate of a soil may:

5 (b) (i) increase its fertility

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(2 marks)

5 (b) (ii) decrease its fertility.

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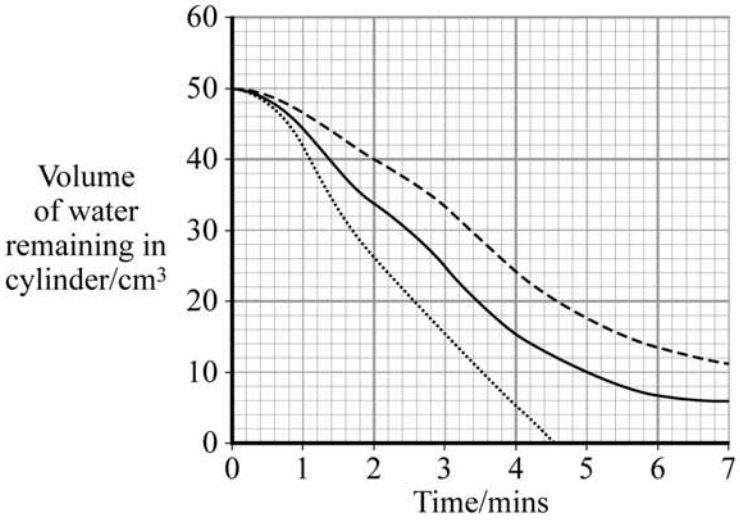
(2 marks)

5 (c) The student's record of the rate of infiltration is shown below.



Sample	Key	Organic matter content/%
A	------	14
B	———	29
C	.....	38

Describe and suggest an explanation for the relationship shown in the student's graph.

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(3 marks)

5 (d) In order to ensure a fair test:

5 (d) (i) outline **two** precautions the student should have taken in obtaining the soil samples

1.....

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2.....

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(2 marks)

5 (d) (ii) outline **two** precautions the student should have taken in conducting the infiltration investigation.

1 .....

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2 .....

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(2 marks)

17

6 Outline a method which could be used to determine the organic matter content of a soil.

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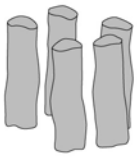
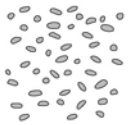
(4 marks)

4

7 (a) The diagram shows various forms of a particular soil property.

Columnar  (prismatic)	Allows free vertical movement of soil water	Platy 	Can hinder root development and vertical water movement
Blocky 	Allows soil water movements but can hinder plant growth if tightly packed	Granular  (crumb)	Allows good seed development and early plant growth

Name the property illustrated.

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(1 mark)

7 (b) Explain what is meant by soil aggregation.

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(1 mark)

7 (c) Outline how soil fertility is affected by soil pH.

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(4 marks)

6

8 Outline the effects of soil texture on the following soil properties:

8 (a) drainage

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(2 marks)

8 (b) nutrient levels

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(2 marks)

8 (c) temperature.

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(1 mark)

5

9 (a) Why is soil considered a finite resource?

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(1 mark)

9 (b) Discuss the factors which influence soil fertility.

Quality of Written Communication will be assessed in this answer.

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(10 marks)

11

Mark scheme – Topic 9: Soil

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

1	(a)	**A** – Clay**;**	1
		B – Silt**;**	1
		C – Sand**;**	1
1	(b)	$\frac{15-5}{20}$; or $\frac{10}{20}\times 100$	
		$100 \times \frac{10}{20} = 50\%$**;**	2
1	(c)	Weigh the soil**;** heat soil at 60 – 100°C**;** too high will burn organic matter (and drive off CO_2)**;** reweigh**;** repeat constant mass**;**	
		$\frac{\text{difference in mass}}{\text{original mass}}$ **;** $\times 100$**;**	MAX 4

Total marks = 9

Question 2

2 (a) Increase**:**

nutrients added by: pollution/fertilisers**;**
decomposition/decay/breakdown**;**
root exudates**;**
weathering**;** MAX 2

Decrease**:**

nutrients lost by: leaching/washing away**;**
plant uptake/harvesting**;**
erosion**;**
escape of gases to atmosphere**;** MAX 2

2 (b) Clays hold minerals/nutrients/sands tend to be low in nutrients**;**
texture influences water movement/through soil**;**
affects aeration**;**
may bring or leach nutrients**;** MAX 2

2 (c) Mechanical/physical weathering**;**
exposes/releases minerals/nutrients**;**
reference to seed germination/kills pests/vernalisation**;**
reference to aeration/root penetration**;** MAX 2

2 (d) Decomposition of organic matter to humus**;**
humus binds soil particles/increases water holding capacity**;**

egestion**;**
adds organic matter**;**

burrowing/mixing**;**
reference to aeration/water entry**;** MAX 2

Total marks = 10

Question 3

Humans are increasing the amount of nitrogen available to plants**;**
by Haber Process/adding fertilisers**;**
by draining wetlands/waterlogged soils increases aerobic bacterial activity**;**
land clearance by ploughing increases aerobic bacterial activity**;**
planting legumes increases bacterial activity/to fix nitrogen**;**
burning fossil fuels results in acid rain/increases in N/N compounds**;**
slash and burn releases nutrients**;** MAX 4

Total marks = 4

Question 4

4	(a)	Small particles**;** therefore great surface area/site for reaction**;** catalytic activity**;** cation exchange rate**;** retains more water**;**	MAX 2
4	(b)	Add water and allow to settle**;** measure layers**;** **OR** dry and sieve**;** weigh samples**;**	2
4	(c)	Advantage: contains many nutrients/little leaching**;** holds water**;** less prone to erosion/cohesive**;**	MAX 2
		Disadvantage: difficult to cultivate**;** waterlogging/slow drainage/impermeability**;** shrinkage**;** cold**;**	MAX 2
4	(d)	Amount of radiation absorbed/colour of soil/albedo of soil**;** moisture content/aeration**;** exposure of soil/angle of slope/aspect**;**	3
4	(e)	Soil temperature will affect rate of decomposition/weathering/activity of soil biota**;** nutrient release/nutrient uptake**;** [**A** increased enzyme activity or similar] [**R** freezing]	2
4	(f)	Heat soil between 105° – 120°C/dry soil**;** to constant mass/weigh dry sample**;** heat soil to high temperatures/burn**;** [**R** bake] to constant mass**;** re-weigh**;** <u>loss in weight</u> × 100 = % organic matter/ loss in weight = mass of organic matter**;**	MAX 4

Total marks = 17

Question 5

5	(a)	(i)	Plant/animal/organisms' reference to bacteria/fungi/ decomposers/enzymes/detrivores/decay**;**	2
5	(a)	(ii)	Vegetation cover/amount**;** intensity of precipitation**;** gradient**;** soil texture/pores/high clay reduces infiltration/ high sand increases infiltration/density**;** soil depth**;** soil structure/peds/particles**;**	MAX 4
5	(b)	(i)	Reference to chemical reactions**;** more minerals/nutrients**;**	2
5	(b)	(ii)	May cause/increase leaching/eluviation**;** reduce soil temperature**;** may become anaerobic**;**	MAX 2
5	(c)		The greater the percentage of organic matter, the faster the rate of infiltration**;** organic matter improves structure**;** increase pore space/porosity**;**	3
5	(d)	(i)	Same soil depth**;** maintain horizons/treat each sample the same/wrap carefully**;**	2
5	(d)	(ii)	Same speed/height of pouring/same rate of pouring**;** Use same funnel tec**;** Same mass of soil/same sample size**;**	MAX 2

Total marks = 17

Question 6

Dry soil**;**
weigh (dry) soil**;**
bunsen/burn/bake sample/desiccate/ref suitable temp 130 °C+ – organic matter will be lost**;**
reweigh**;**
to constant mass**;**
EITHER
difference = weight of organic matter**;**
express as %**;**
OR

$$\frac{\text{dry weight} - \text{incinerated weight}}{\text{dry weight}} \times 100;;$$

MAX 4

Total marks = 4

Question 7

7 (a) Structure**;** 1

7 (b) How particles fit/join together/ref to peds**;** 1
[**R** mixing]

7 (c) Determines nutrient solubility/availability/cycling/most available in slightly acid soil/pH6.5**;**
refs to leaching**;**
refs to weathering**;**
ref to ion exchange**;**
influences invertebrates/named invertebrates/detritivores/biota**;**
burrowing/aeration/organic matter**;**
influences decomposition/microbes/named bacteria/attacks humus**;**
[**R** pH6.5 incr soil fertility] MAX 4

Total marks = 6

Question 8

8	(a)	Ref to pore/particle size**;** (sands) well drained**;** (clays) poorly drained/prone to waterlogging/retain water**;** silts intermediate**;**	MAX 2
8	(b)	Clays absorb minerals/have/hold more nutrients**;** may be difficult for roots to absorb**;** loams ideal**;** sands low**;** sands prone to leaching**;**	MAX 2
8	(c)	Clays wetter so cooler/affects specific heat capacity/clay heats up/ absorb more heat/cool more slowly/sands have greater temperature range**;** [**A** converse]	1

Total marks = 5

Question 9

9 (a) Long time period of formation/slower than erosion**;** 1

9 (b) *Quality of Written Communication is assessed in this answer*

1 Texture**;**
2 influences/leaching/eluviation**;**
3 nutrient content**;**
4 sands well drained/few nutrients**;**
5 clays may be waterlogged/hold nutrients**;**
6 structure**;**
7 peds – correct reference to**;**
8 humus/organic matter/faeces**;**
9 biota/soil organisms**;**
10 correct reference to biotic activity**;**
11 shallow soils may not offer sufficient nutrients/support**;**
12 aeration needed to provide O_2**;**
13 for respiration/active uptake/nutrient uptake**;**
14 ploughing can break up pans/improve aeration/reduce compaction**;**
15 pH determines nutrient availability**;**
16 moisture needed for nutrient uptake**;**
17 waterlogging reduces O_2**;**
18 NPK/macro/micronutrients**;**
19 correct reference to Nitrogen fixation/legumes**;**
20 nutrient input from precipitation**;**
21 nutrient input from (weathered) parent material**;** MAX 8

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

MAX 2

Total marks = 11