



**General Certificate of Education (A-level)**  
**January 2013**

**Environmental Studies**

**ENVS2**

**(Specification 2440)**

**Unit 2: The Physical Environment**

**Final**

***Mark Scheme***

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**Environmental Studies**

**January 2013**

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

**Question 1**

	Answers	Mark																
1	<table><tr><th>Treatment Process</th><th>Feature of Process</th></tr><tr><td><u>Activated</u> carbon/ <u>activated</u> charcoal (filter)</td><td>Removal of organic chemicals as they adsorb onto the particle surfaces ;</td></tr><tr><td>(Primary) sedimentation/settling</td><td>Removal of suspended solids when water is static ;</td></tr><tr><td>Ozonation</td><td><b>Killing/removal of pathogens/ microorganisms/ bacteria/sterilisation</b> ;</td></tr><tr><td><b>Fluoridation</b> [A fluoride/fluorine]</td><td>Reduction of tooth decay in people that drink the water ;</td></tr><tr><td>Flocculation</td><td>Aggregation of clay and fine particles by attraction of static electrical charges</td></tr><tr><td>Filtration</td><td>Removal of suspended solids as water flows through material with small pore spaces</td></tr><tr><td><b>Desalination/(reverse) osmosis</b></td><td>Production of potable water by forcing water through a partially permeable membrane under high pressure ;</td></tr></table>	Treatment Process	Feature of Process	<u>Activated</u> carbon/ <u>activated</u> charcoal (filter)	Removal of organic chemicals as they adsorb onto the particle surfaces ;	(Primary) sedimentation/settling	Removal of suspended solids when water is static ;	Ozonation	<b>Killing/removal of pathogens/ microorganisms/ bacteria/sterilisation</b> ;	<b>Fluoridation</b> [A fluoride/fluorine]	Reduction of tooth decay in people that drink the water ;	Flocculation	Aggregation of clay and fine particles by attraction of static electrical charges	Filtration	Removal of suspended solids as water flows through material with small pore spaces	<b>Desalination/(reverse) osmosis</b>	Production of potable water by forcing water through a partially permeable membrane under high pressure ;	5
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Total	5																	

**Question 2**

	<b>Answers</b>	<b>Mark</b>
<b>2(a)(i)</b>	<p><b>Groundwater</b>  changed process;  resultant change in amount in groundwater;  eg  less interception  more in groundwater  more infiltration  more in groundwater  less transpiration  more in groundwater  less plant/root uptake  more in groundwater  more runoff  less in groundwater</p>	2
<b>2(a)(ii)</b>	<p><b>The atmosphere</b>  changed process;  resultant change in amount in atmosphere;  eg  reduced transpiration  less in atmosphere  reduced interception  less in atmosphere  increased infiltration  less in atmosphere  less evaporation  less in atmosphere</p>	2
<b>2(b)</b>	<p><b>Abstractive</b> : removal from source for <u>named</u> example;  eg drinking, irrigation, chemical industry, cooling water, swimming pools  <b>Non-abstractive</b> : non-removal from source for <u>named</u> example;  eg shipping, HEP, boating, sailing, fishing  [R unqualified agriculture, aquaculture, energy production]</p>	2

**question 2 continued ...**

	<b>Answers</b>	<b>Mark</b>
<b>2(c)</b>	<p>Water qualities (linked to a use);;;  use(s) of water (correctly linked to quality);;;</p> <p>eg  any quality, but no large solids  power station cooling water  soft/low calcium content  textile washing  no bad taste/smell/poor appearance  food/drinking/potable  no dissolved materials  power station steam water boiler  low salinity  irrigation [<b>R</b> unqualified agriculture]  grey water  toilet flushing</p> <p>[<b>R</b> totally pure, drinking water, organic matter as water quality issue]  [<b>A</b> vague quality description eg high and low for <b>1</b> mark]</p>	<b>MAX 4</b>
<b>Total</b>		<b>10</b>

**Question 3**

	<b>Answers</b>	<b>Mark</b>
<b>3(a)</b>	Hot water/steam; dissolved minerals; different solubility (of different metal minerals); movement (of solution along fissure/vent/fault); cooling (of solution); deposition/crystallisation/coming out of solution/precipitation; order (of deposition)/separation;	MAX 4
<b>3(b)(i)</b>	Ore purity; chemical form; ore body area; ore body shape; total mass/quantity; effect of feature on viability; [R unqualified economics]	MAX 3
<b>3(b)(ii)</b>	Overburden hardness (for removal); overburden stability (for landslip risk); depth/overburden thickness; drainage; faulting; shape of structure/anticline/syncline/dome/dip/named example; designated/protected geological feature; effect of feature on viability; [R unqualified economics]	MAX 3
<b>Total</b>		<b>10</b>

#### Question 4

	Answers	Mark
4(a)(i)	(Lowest price so) greater purity (needed to be profitable/economic);	1
4(a)(ii)	Previously uneconomic resource/lower grade ore becomes economic;	1
4(b)	<p>Advantages;;  eg  large area surveyed rapidly  surveys of inaccessible areas  cost effective/less labour intensive  lower habitat impact</p> <p>Disadvantages;;  eg  high initial cost  less detailed information  less sub-surface information  clouds obscure surface  no physical samples (for analysis)</p>	4
4(c)	<p>Named method;  detail of how it works;  eg  leachate/solution  electrolysis</p> <p>bacteria/ <i>Thiobacillus</i>  acid/leaching</p> <p>(large scale) mechanisation  reduce unit extraction costs</p> <p>plant absorption/phytomining/phytoremediation/brassicas  harvest/incineration</p> <p>streaming  waste washed away</p> <p>floatation/oil-water separation  density</p>	2

**question 4 continued ...**

	<b>Answers</b>	<b>Mark</b>
<b>4(d)</b>	Named material and use; named alternative material for that use;  eg copper (telecoms) cables plastic  copper pipes plastic  copper (electricity) cables aluminium  steel/aluminium car panels plastic/carbon fibre/composite material	2
<b>Total</b>		<b>10</b>



**Question 5**

	<b>Answers</b>	<b>Mark</b>
<b>5(a)(i)</b>	<b>B;</b>	<b>1</b>
<b>5(a)(ii)</b>	<b>B;</b>	<b>1</b>
<b>5(b)</b>	<p>Systematic/random sampling;  <b>[R transect]</b>                      named method of systematic/random sampling;                      multiple samples;                      reduce effect of variability between samples taken at same site;                      allows use of statistics test;                      use of auger;                      same depth;                      sealed;                      cool storage;                      similar size/similar mass/large enough size of samples;                      detail of timing of sampling (simultaneous or repeated); <b>[A same day]</b>  <b>[R same time of day]</b>                      to remove effect of weather/seasons;</p>	<b>MAX 5</b>
<b>5(c)</b>	<p>Dry/crush/grind/separate particles;                      sieves with different mesh sizes;                      reference to correct positions of sand/silt/clay/particle sizes described;                      weigh;                      percentage calculation;</p> <p><b>OR</b></p> <p>add water (to soil) and shake;                      allow to settle;                      reference to correct positions of sand/silt/clay/particle sizes described;                      measure layers;                      percentage calculation;</p>	<b>MAX 3</b>
<b>Total</b>		<b>10</b>

**Question 6**

	<b>Answers</b>	<b>Mark</b>
<b>6(a)</b>	Increased UV/shortwave radiation; sunburn/DNA damage/cancer/melanoma/retina damage/cataracts/ leaf damage/fish egg/plankton damage;	2
<b>6(b)</b>	<p>Absorption of UV by CFC/CFC broken down by UV;  release of chlorine (Cl) from CFC/  <math>\text{CCl}_2\text{F}_2 \rightarrow \text{CClF}_2\cdot + \text{Cl}\cdot</math>;  reaction of chlorine (Cl) with monatomic oxygen (O)/  <math>\text{Cl}\cdot + \text{O}\cdot \rightarrow \text{ClO}\cdot</math>;  reaction of chlorine monoxide (ClO) with monatomic oxygen (O)/  <math>\text{ClO}\cdot + \text{O}\cdot \rightarrow \text{ClO}_2\cdot</math>;  release of chlorine (Cl) from chlorine dioxide (ClO<sub>2</sub>)/  <math>\text{ClO}_2 \rightarrow \text{Cl}\cdot + \text{O}_2</math>;</p> <p><b>OR</b></p> <p>Absorption of UV by CFC/CFC broken down by UV;  release of chlorine (Cl) from CFC/  <math>\text{CCl}_2\text{F}_2 \rightarrow \text{CClF}_2\cdot + \text{Cl}\cdot</math>;  reaction of chlorine (Cl) with ozone (O<sub>3</sub>)/  <math>\text{Cl}\cdot + \text{O}_3 \rightarrow \text{ClO}\cdot + \text{O}_2</math>;</p> <p>[R ozone dynamic equilibrium equation]</p>	MAX 3
<b>6(c)</b>	Chemical stability/persistence of CFCs; continued use of CFCs manufactured before Montreal Protocol; [R long time to reform ozone]	MAX 1

**question 6 continued ...**

	<b>Answers</b>	<b>Mark</b>
<b>6(d)(i)</b>	Named CFC waste/old fridges/aerosols; incineration;	2
<b>6(d)(ii)</b>	Named use; replacement material;  eg aerosols/propellant hydrocarbons/propane/butane/stick (deodorant) [ <b>A</b> HCFCs]  solvents alcohols  refrigerants HCFCs HFCs  expanded plastics propane/pentane	2
<b>Total</b>		<b>10</b>

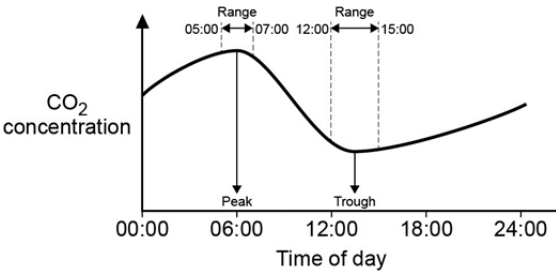
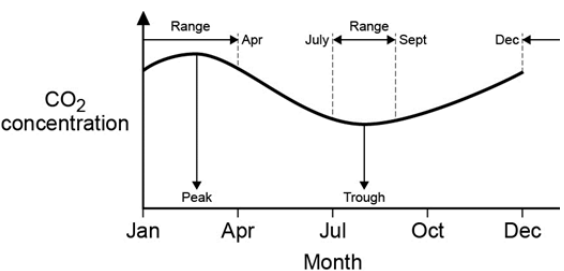
**Question 7**

	<b>Answers</b>	<b>Mark</b>
<b>7(a)(i)</b>	(Excess) held back/in reservoir (at times of high flow); reduced flow downstream/reference to flow rates above <b>and</b> below;	2
<b>7(a)(ii)</b>	<u>Previous</u> surplus stored; released to maintain flow; reference to flow rates above <b>and</b> below;	MAX 2
<b>7(b)(i)</b>	Reduced temperature in summer/sunny weather; increased winter temperature/cloudy weather; reduced seasonal range; high thermal capacity/heat storage/slow change/more constant flow; deep water not heated by sun;	MAX 2
<b>7(b)(ii)</b>	Aeration on outflow; increased DO; <b>OR</b> organic matter decay in reservoir; lowered DO; <b>OR</b> lower temperature; higher DO; <b>OR</b> higher temperature; lower DO; <b>OR</b> less turbulent (in reservoir); lower DO; [R change with no explanation]	MAX 2
<b>7(c)</b>	(Land use with) more permeable surfaces/less impermeable; named more permeable/less impermeable surface; reduced runoff/overland flow/increased infiltration; [R reduced flooding]	MAX 2
<b>Total</b>		<b>10</b>

**Question 8**

	<b>Answers</b>				<b>Mark</b>
<b>8(a)</b>	<b>Gas</b>	<b>Mean proportion of gas in dried air / %</b>	<b>One natural process that releases the gas</b>	<b>One human activity that causes release of the gas</b>	;;  ; ; ;
	<b>Nitrogen</b>	78	<b>Denitrification (of nitrates)</b>	Use as a low temperature refrigerant	
	Oxygen	21	Photosynthesis	Hospital breathing gases	
	<b>Carbon Dioxide</b>	0.038	Aerobic respiration	Combustion of fossil fuels	
	Methane	0.00017	<b><u>Anaerobic respiration/ anaerobic decomposition/ anaerobic decay/ anaerobic breakdown</u></b>	Coal mine ventilation	
	<b>Water (vapour)</b>	0 (removed when air is dried)	Evapotranspiration	Power station cooling towers	
					5

question 8 continued ...

	Answers	Mark
8(b)(i)	<p>Peak between 05.00 and 07.00; trough between 12.00 and 15.00; eg</p> 	2
8(b)(ii)	<p>Peak between December and April; trough between July and September; eg</p> 	2
8(c)	<p>Preliminary study to find fluctuation rate; frequent enough to pick up fluctuations; [R same time of day/year]</p>	MAX 1
Total		10

**Question 9**

	Answers	Mark								
9(a)	Uncertainty over:  inaccurate/incomplete (climate) data; changes in/unpredictability of emission rates/control; incomplete understanding of natural climate; natural fluctuations/changes; interconnected systems; different rates of change/cause-effect lag; negative feedback mechanisms; positive feedback mechanisms;  [A feedback mechanisms for 1 mark]	MAX 3								
9(b)	(Tropospheric) ozone; oxides of nitrogen; water (vapour); [R Stratospheric ozone]  [A SF <sub>6</sub> /sulfur hexafluoride]	MAX 2								
9(c)	Change in named abiotic factor/habitat feature and specific impact on wildlife;;;;;;; one named taxa illustrating specific impact;;;  eg of impact: competition for named resource habitat loss displacement of wildlife rate of colonisation lack of biological corridor changes in migration patterns interspecies relationships  <i>Quality of Written Communication</i> <table><tr><th>Mark</th><th>Descriptor</th></tr><tr><td>2</td><td>All material is logically presented in clear, scientific English and continuous prose. Spelling, punctuation and grammar are almost always correct. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.</td></tr><tr><td>1</td><td>Account is logical and generally presented in clear, scientific English and continuous prose. Minor errors occur in spelling, punctuation and grammar. Technical terminology has been used effectively, and is usually accurate. At least half a page of material is presented.</td></tr><tr><td>0</td><td>The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas. Spelling, punctuation and grammar contain many errors.</td></tr></table>	Mark	Descriptor	2	All material is logically presented in clear, scientific English and continuous prose. Spelling, punctuation and grammar are almost always correct. 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 and continuous prose. Minor errors occur in spelling, punctuation and grammar. Technical terminology has been used effectively, and is usually accurate. 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. Spelling, punctuation and grammar contain many errors.	MAX 8   <
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