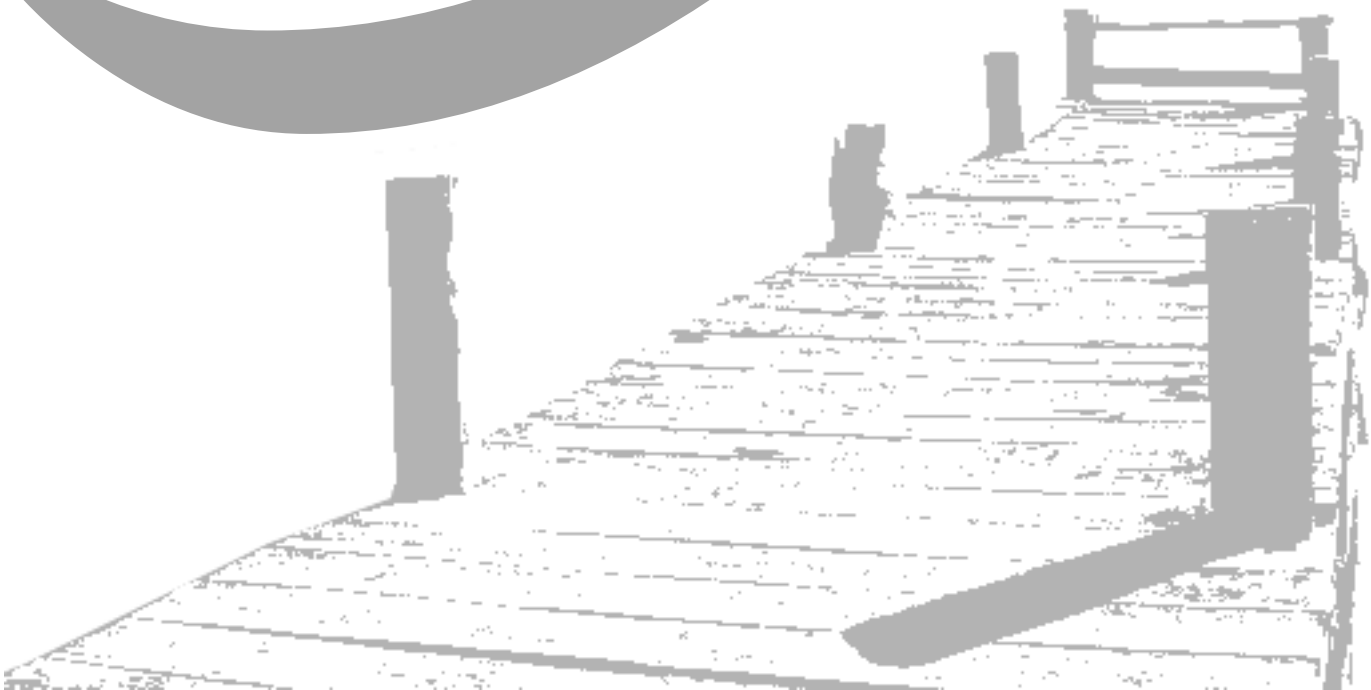
GCE
AS and A Level

Environmental Studies

AS exams 2009 onwards
A2 exams 2010 onwards

Unit 2: ENVS2
Specimen mark scheme

Version 1.1



ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Environmental Studies

The Physical Environment ENVS2

Specimen Mark Scheme

for 2009 examination

The specimen assessment materials are provided to give centres a reasonable idea of the general shape and character of the planned question papers and mark schemes in advance of the first operational exams.

For operational papers, mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. The mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis on one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Dr Michael Cresswell Director General

Environmental Studies

Specimen Unit
Mark Scheme **ENVS2**

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

Question 1

Term	Definition	
Metamorphic (rock)		;
	Minerals in hot solutions deposited as water cools	;
Evaporite		;
	The lowest purity (of ore) that can be exploited economically	;
Reserve		;

5

Total marks = 5

Question 2

2 (a) Negative gradient; 1

2 (b) Any 2 suitable changes;;
plus explanatory details;;
eg
increased affluence/standard of living
increased use of water-using appliances
example of appliance
OR
increased use in agriculture
irrigation
OR
increased industrial use
example of industry/use
OR
climate change
increased use (not previously used) eg washing/irrigation
OR
lifestyle/social changes
increased hygiene/health/recreational uses
[**R** non per-capita changes eg population increase] MAX 4

2 (c) (i) Balance of inputs and outputs; 1

2 (c) (ii) Up to 3 changes to aquifer;;;
Up to 2 consequences of the changes;;

eg
reduced support of water in pores
collapse of aquifer structure
subsidence at surface

lowered water table
reduced spring/river/baseflow
vegetation/habitat change
drying of wetlands

reduced water pressure
salt water incursion/salinisation
denser saltwater flows under freshwater

reduced volume
increased pollutant concentration
eg nitrates/pesticides MAX 4

Total marks = 10

Question 3

3 (a) Nitrogen
20 – 21%
0.025 – 0.04%
[**A** ppm equivalents]
O_3
2 correct for 1 mark;
4 correct for 2 marks;; 2

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

3 (c) Chlorofluorocarbons/CFCs/HCFCs/halogenated hydrocarbons/freons;
mobility/persistence/insolubility;
details of chemical reactions;
chemical breakdown due to UV/chlorine released/chemical reactions between C1 and O/O_3;
less ozone formed/ozone destroyed/damage to ozone layer;

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 5

Total marks = 10

Question 4

4 (a) Emissions would vary over year;
would need to get average values;
reservoir emissions affected by temperature;
oxygen affects aerobic/anaerobic conditions and hence CO_2/CH_4 release;
reservoir emissions affected by air pressure;
temperature affects rate of decomposition;
temperature affects solubility;
amount/type of submerged vegetation affects rate of decay;
wind speed affects dispersal;
power station emissions affected by fuel type;
need to standardise by unit of electricity output to make fair comparison;
easier to measure emissions from chimney/sampling required in reservoir; MAX 4

4 (b) (i) Named change at start and end;
details of two processes;;

eg
change:
increased temperature plus eventual temperature reduction
process:
increased evaporation
increased cloud cover
increased albedo/sunlight reflection

change:
increased carbon dioxide concentration plus eventual decline
process:
increased photosynthesis
increased tree growth
[**R** plant]
[**A** reference to carbon sequestration] MAX 3

[credit other suitable examples]

4 (b) (ii) Named change at start and end;
details of two processes;;

eg
change:
increased temperature with eventual further increase
process:
reduced snow/ice cover/other named cause of albedo reduction
increased light absorption MAX 3

[credit other suitable examples]

Total marks = 10

Question 5

5 (a) Human costs
labour/land;

Geological problems affecting costs
depth/overburden hardness/drainage problems/faulting/fracturing;
dispersal/thin/low quantity deposit;
low purity/wrong chemical form;

Land use conflicts
urban area/designated protected area/wildlife/agriculture;

Infrastructure
transport/support industries/energy costs;

Economics
market demand/market price/cut off ore grade; MAX 3

5 (b) (i) Aesthetic pollution/loss of amenity;
habitat loss;
loss of topsoil/reduced fertility/damage to soil structure;
impact on water table/ground H_2O/aquifer;
dust;
subsidence;
noise pollution;
turbid drainage water; MAX 2
[**R** air pollution, 'traffic']

5 (b) (ii) Landscaping to reduce aesthetic problems;
revegatation to improve surface stability;
revegetation to mitigate habitat loss;
sedimentation (lagoons) to reduce drainage turbidity;
lime/neutralisation to reduce pH/heavy metal solubility;
watersprays to reduce dust;
leachate collection to reduce water pollution; MAX 3

5 (c) Name of method;
detail of method;

eg
exploitation in previously unexplored area
reason for not being explored/ice covered/isolated/protected
named area/Antarctica/deep ocean/national park
OR
named better explanatory techniques
how technique works
material that would be found

eg
satellite surveys
large scale visible/IR scanning/low/polar orbit

seismic surveys
vibration echoes/details of depth/density/angle/thickness/faults

gravimetry
information on strength of gravity/density

magnetometry
information on strength of magnetism/locate magnetic oves

scintillometry/geiger counters
information on ionising radiation
OR
mechanisation/larger excavators
enable deeper extraction
OR
use of low grade ores
leachate electrolysis/biotechnology/bacterial recovery/phytoextraction/
hyperaccumulations
OR
recycling
reduce demand for virgin ores
OR
substitution
reduce demand for scarce material/transfer demand to more abundant material
eg copper cable to fibre optics/copper pipes to plastic/chrome plating to plastic

MAX 2

Total marks = 10

Question 6

6 (a) (i) Removal of (suspended) solids/particles; 1
[**R** reference to filtration]

(a) (ii) Removal/kill pathogens/bacteria/microorganisms; 1

6 (b) Addition of flocculant/coagulant/example of flocculant/alum/polyelectrolytes;
neutralisation of surface charges/particles coalesce/join/aggregate to form floc/larger solids;
sedimentation/settling/deposition/clarification; MAX 2

6 (c) Any suitable method;;;
how it works;;;

eg
maintenance/leak control/explanation of reduced use
repair of leaking water mains
repair of dripping taps

lower volume alternative technology/explanation of reduced use
low pressure supply
hippo bag/cistern brick/dual flush toilet
automatic taps
low water washing machine/dishwasher

behaviour choices/explanation of reduced use
turn off tap when brushing teeth
shower vs bath
full load washes
mulch garden to reduce watering

use waste water/grey water/recycle
eg of $1^{st}/2^{nd}$ use/washing water for toilet

use restrictions/rationing/bans/pricing mechanism
encourage awareness/conservation
named banned activity/hosepipe/sprinkler/car washing
installation of meter

public information/education/explanation of reduced use
named example of publicity medium eg newspaper/TV/leaflet
named example of campaign/turn it off MAX 4

6 (d) (i) Level of dissolved oxygen level with explanation/effect on rivers/groundwater

turbulence/named aeration process/mixing air/O_2 into water/
rivers more turbulent/named aeration process/mixing;
photosynthesis/plants produce O_2/more photosynthesis/plants in rivers;
oxidation of inorganic minerals/organic matter removes O_2/
more inorganic minerals/organic matter in rivers;
exposure to air allows O_2 to dissolve/rivers more exposed to air; MAX 1

6 (d) (ii) Level of turbidity with explanation/effect on rivers/groundwater

filtration by rocks removes suspended solids;
filtration by rocks/reduced turbidity in groundwater;
turbulence in/erosion by/kinetic energy/movement of moving water increases turbidity;
turbulence in/erosion by/kinetic energy/movement of moving greatest in rivers;
MAX 1

Total marks = 10

Question 7

7 (a) (i) Volume of water collected in non-forested area; 1

7 (a) (ii) Named precaution;;
how precaution result in fair test;;

eg
sampling on same day/time period
avoid fluctuations in weather
OR
at same time of year/over whole year
ref to seasonal fluctuations in precipitation/evaporation
OR
identical equipment
equal effectiveness at collecting water
OR
sampling at ground level
water collected beneath total canopy cover
OR
repetitions
ref to reliability/significance/result variability MAX 4

7 (b) Measure of spread/variability of results; 1

7 (c) Named standardised soil collection method/auger/borer;
soil dried;
weighed;
heated at 200-500 °C;
to constant mass;
reweighed;
ref to % calculation; MAX 4

Total marks = 10

Question 8

8 (a) Climate change threatens our economies/way of life;
example of threat/flooding/drought/agricultural losses/infrastructural problems/forest damage/storm damage;
link between threat and greenhouse gas;
need to set emissions targets now;
because it takes a long time to reduce emissions; MAX 2

8 (b) Named difficulty;;;
detail of uncertainty;;;

eg
processes naturally fluctuate
eg solar activity/ice ages

limited historical date
eg temperature data/data inferred from other sources eg ice cores

feedback mechanisms
processes may combine to increase/reduce effect in ways not understood
changes slow
difficult to determine trend

poor understanding of processes/reservoirs
eg ocean currents/biomes/methane in permafrost/methane hydrate MAX 4

8 (c) Named method;;;
detail of how it works;;

eg
(sign) Kyoto Protocol
commitment to greenhouse gas emission reduction

carbon trading
limit to total releases/surpluses can be sold

vehicle taxation
discourage energy inefficient vehicles

carbon taxes
discourage use of carbon-based fuels

congestion charges
discourage use of cars

substitute public transport
encourage energy-efficient transport

landfill tax
reduce methane release

Agenda 21
commitment to sustainable development

(increased) recycling targets
reduced energy use (from processing virgin materials)

public information
example of campaign/organisation/Turn it off/Carbon Trust

restrictions on oil performance assessment
encourage insulation/conservation MAX 4

Total marks = 10

Question 9

9 (a) No gaseous form reduces availability;
low solubility reduces uptake; 2

9 (b) Increase plant growth/algae;
Macrophytes shaded, die, food chains broken;
bacterial decomposition of algae/microphytes;
deoxygenation causes death of named taxon;
blue-green algae release toxins; MAX 3

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

Features of C, P, N cycles related to fertility MAX 4 per cycle
farming activities releated to fertility MAX 4
[credit definition of soil fertility]

Carbon cycle
- dead organic matter
  - improves structure;
  - reduces leaching;
  - nutrient reservoir/nutrients released during decay;
  - increases aeration;
  - increases drainage;

Phosphorous cycle
- low solubility;
- low natural availability;

Nitrogen cycle
- high solubility;
- increases leaching risk;
- nitrifying bacteria are anaerobic;
- denitrifying bacteria are anaerobic;
- root nodule bacteria;

Agricultural practices
- fertiliser application for nutrients;
- timing of fertiliser application (to reduce leaching);
- use of low solubility fertiliser/area (to reduce leaching);
- manure/compost for dead organic matter;
- ploughing for aeration;
- drainage for aeration;
- legumes for root nodule bacteria; MAX 8

Quality of Written Communication

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

ENVS2

Assessment grids

Specification Section	Question number									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
3.4.1			10	10				10		**30**
3.4.2		10				10	10			**30**
3.4.3	5				10				13	**28**
Total	**5**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**13+2 QWC**	**88+2 = 90**

Specification Section	Question number									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
AO1 Knowledge with understanding	5	5	5		5	4			8	**32**
AO2 Application, analysis and evaluation		4	5	6	5	6		4	5	**35**
AO3 Experiment and investigation		1		4			10	6		**21**
Total	**5**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**13+2 QWC**	**88 + 2 = 90**