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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Environmental Science 6441

ESC5 Pollution and Physical Resource Management

Mark Scheme

2008 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This 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.

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Environmental Science

June 2008 **ESC5**

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

Question 1

1 Chronic;
mutagenic;
teratogenic;
bioaccumulation;
biomagnification; 5

Total marks = 5

Question 2

2 (a) (i) Dam/lagoon/bund;
sedimentation/settlement;
time for separation/reduced flow;

filter/named filter material;
particles trapped; MAX 2

[**R** reedbed]

2 (a) (ii) Acidity reduction/increase pH;
addition of lime/named alkali/base;
reduce solubility;

electrolysis/addition of named material;
precipitate (metal);

reedbeds/brassicas/named appropriate organism;
(phyto)accumulation; MAX 2

2 (b) Any two methods;;
with explanatory points;;

drainage
collect toxic leachate

leachate pH neutralisation (credit if not used in (a)(ii))
reduce toxicity/toxin solubility

leachate toxin removal (credit if not used in (a)(ii))
bacterial action/oxidation/named method

remove/treat toxic spoil
pH control/bacterial action

revegetation
soil stability

landscaping/infill
aesthetics

soil/nutrient addition/legumes
increase plant growth/fertility

slope grading
stability/erosion control

sealing shafts/removal of hazardous equipment/buildings;
safety/aesthetics

subsequent land use 2 + 2 4

2	(c)	(i)	Reduced demand for raw materials/reduced spoil/reduced waste (to landfill);	1
2	(c)	(ii)	(Reduces mining because) reduced value of site after mining so fewer mines are profitable/increased viability of recycling so less mining;	1

Total marks = 10

Question 3

3 (a) 600;
500 000; 2

3 (b) 0.0006 g in 1 kg; / 1667 kg = 1667 kg × 2 / 1666.66 × 2;
= 3333.3; 2
[**A** 3333 – 3334]

3 (c) Neurotoxin;
nervous system damage/paralysis;
mutation/embryo deformities;
teratogen;
enzyme inhibition;
liver damage;
kidney damage;
death; MAX 2

3 (d) Persistence/low biodegradability;
not excreted**;**
(lipo)solubility; 2

[**R** bioaccumulation, biomagnification]

3 (e) Feature of water body;
how feature affects severity of pollution;

eg volume/enclosed water body
dilution

currents
dispersal

temperature/oxygenation
rate of reaction/degradation

presence of living organisms
biodegradation

existing pollution
concentration/reactions/synergism

pH
rate of reaction/solubility MAX 2

Total marks = 10

Question 4

4 (a) Visible light/short wavelength light passes through atmosphere;
absorbed at Earth's surface;
converted to heat;
emitted as infra red/long(er) wavelength;
absorbed in atmosphere/by greenhouse gases/named gas; MAX 3

4 (b) Consequence of global climate change;;
Explanatory detail;;

increased rate of decay/respiration
release of carbon dioxide

increased drying of forests/peat
more fires releasing carbon dioxide

increased melting of permafrost
release of methane

increased melting of ice
reduced albedo/increased light absorption

increased ocean temperature
release of methane (hydrate)

reduced carbon dioxide solubility
increased carbon dioxide in atmosphere

increased evaporation/transpiration
increased (low level) cloud cover

[**R** consequence if no mechanism given] 2 + 2 MAX 4

4 (c) Ozone depletion;
stratospheric ozone;
CFCs/other ozone depleting chemical;
details of chemical reactions;
increased ultraviolet light;
skin cancer/eye damage/other biological effect;

photochemical smogs;
hydrocarbons/NOx/named primary pollutants;
ozone/PANs/named secondary pollutant;
temperature inversion/low wind speeds <u>increase concentration</u>;
named effect on humans;

oxidationof $SO_{2;}$
ozone;
SO_3;
acid rain;

photochemical (reaction);
named pollutant;
details of reactions;;

MAX 3

Total marks = 10

Question 5

5	(a)	30	1
5	(b)	Greater sensitivity; nerve damage/auditory nerve; loudest noise produced; frequency of machinery;	MAX 2
5	(c)	C	1
5	(d)	Tinitus stress; nervous disorders; insomnia/behavioural changes; headaches; high blood pressure; increased heart rate; heart attacks explanatory detail;	MAX 2
5	(e)	Slow development of symptoms/chronic; named alternative causes; lack of medical understanding; difficulty measuring/quantifying effects; lack of data;	MAX 2
5	(f)	Shock of loud noise/pressure change; acoustic fatigue; (natural) resonant/harmonic frequency; (stress) cracking/weakening (due to vibrations);	MAX 2
5	(g)	Acoustic/sound insulation/absorption; hearing protection; remote operation; stamping to moulding; named change in industrial procedure;;; worker monitoring; limited period of exposure; noise limits; restricted access to noisy areas; details of method;;;	MAX 5

Total marks = 15

Question 6

Quality of Written Communication is assessed in this answer.

6 (a) Transport systems

- Noise pollution
  - baffle mounds,time restrictions, vehicle design
- CO_2
  - carbon sequestration, efficiency,energy conservation
- CO
  - catalytic converter, platinum,conversion to CO_2
- NO_x
  - catalytic converter, urea/ammonia
- Photochemical smog
  - catalytic converter/vapour collection
- Smoke
  - bag filter, cyclone separator, electrostatic filter, air supply
- SO_x
  - dry/wet FGD, fuel desulphurisation
- lead
  - unleaded fuel, fuel substitution
- fuel leaks
  - maintenance, vapour collection, bunding
- aesthetics
  - landscaping
- infrastructure construction damage

6 (b) Ironising radiation

- details of types, effects, properties of ionising radiation

Environmental monitoring

- Critical Pathway Analysis
- water, grass, milk, soil, vegetables, meat, dust etc
- sampling sites

The public

- Critical Group Monitoring
- features of lifestyle
- medical checks

Workers and workplace

- atmospheric monitors
- contamination checks
- protective clothing
- closed sources
- absorbing materials
- remote handling
- period of exposure

Total marks = 20

Essay Questions

The essay questions are marked using the following marking criteria.

Scientific content
(maximum 14 marks)

Category	Mark	Descriptor
	14	
Good	12	Most of the material of a high standard reflecting a comprehensive understanding of the principles involved and a knowledge of factual detail fully in keeping with a programme of A Level study. Some material, however, may be a little superficial. Material is accurate and free from fundamental errors but there may be minor errors which detract from the overall accuracy.
	10	
	9	
Average	7	A significant amount of the content is of an appropriate depth, reflecting the depth of treatment expected from a programme of A Level study. Generally accurate with few, if any fundamental errors. Shows a sound understanding of most of the principles involved.
	5	
	4	
Poor	2	Material presented is largely superficial and fails to reflect the depth of treatment expected from a programme of A Level study. If greater depth of knowledge is demonstrated, then there are many fundamental errors.
	0	

Breadth of Knowledge
(maximum 2 marks)

Mark	Descriptor
2	A balanced account making reference to most if not all areas that might realistically be covered by an A Level course of study.
1	A number of aspects covered but a lack of balance. Some topics essential to an understanding at this level not covered.
0	Unbalanced account with all or almost all material based on a single aspect.

Relevance

(maximum 2 marks)

Mark	Descriptor
2	All material present is clearly relevant to the title. Allowance should be made for judicious use of introductory material.
1	Material generally selected in support of title but some of the main content of the essay is of only marginal relevance.
0	Some attempt made to relate material to the title but considerable amounts largely irrelevant.

Quality of Written Communication

(maximum 2 marks)

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.