



General Certificate of Education

Environmental Science 6441

**ESC5 Pollution and Physical Resource
Management**

Mark Scheme

2008 examination – June series

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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) $0.0006 \text{ g in } 1 \text{ kg; } / 1667 \text{ kg} = 1667 \text{ kg} \times 2 / 1666.66 \times 2;$
= 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/NO_x/named primary pollutants;
ozone/PANs/named secondary pollutant;
temperature inversion/low wind speeds increase concentration;
named effect on humans;
- oxidation of SO₂;
ozone;
SO₃;
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) | Tinnitus
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
 - CO₂
 - carbon sequestration, efficiency, energy conservation
 - CO
 - catalytic converter, platinum, conversion to CO₂
 - 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) Ionising 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.