

MARKSCHEME

May 2001

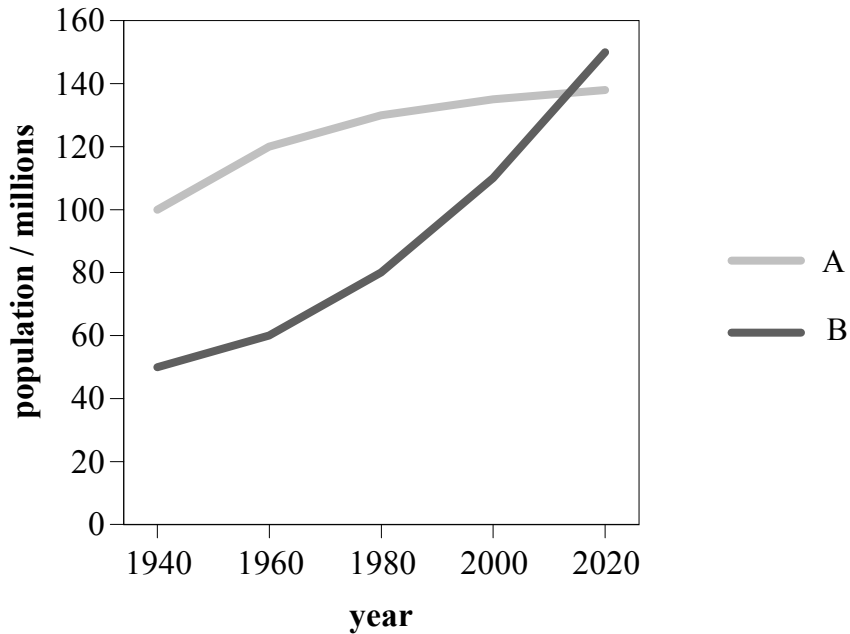
Environmental Systems

Standard Level

Paper 2

SECTION A

1. (a) (i) population plotted on y-axis and time on x-axis, at a suitable scale, so that lines fill at least half available width and height [1];
both axes correctly labelled with quantities and units [1];
lines start, finish and intersect at correct position and are labelled or identified by a key [1]; [3 max]



- (ii) Country **B** as rate of population growth is greater / curve gradient steeper / exponential curve [1]. [1 max]

Accept population B not stabilised OWTTE.

Continued...

Question 1 continued

- (b) (i) Developing 1520 million (accept answers in range 1370–1670 million) **[1]**;
 developed 260 million (accept answers in range 230–290 million) **[1]**. **[2 max]**
- (ii) Cohorts that will soon become of childbearing age **[1]** / economically active **[1]** / entering workforce **[1]**. **[1 max]**
- (iii) Allow **[1]** for difference and **[1]** for its significance $\times 2$

Difference	Significance
Higher proportion of people of reproductive age in developing countries [1] Developing age / sex pyramid is triangular, developed is rectangular [1]	Population increase will be greatest in developing countries [1] ; greater pressure on resources from rapidly increasing population [1]
Higher proportion of people live to middle / old age in developing countries than in developed countries [1]	Better health care / living conditions in developed countries [1]
More males than females throughout age ranges in developing countries, less consistent difference in developed [1]	Female infanticide may be higher in developing countries / women die in childbirth more often in developing countries / data may be inaccurate / hard to collect [1]

Credit other valid responses.

[4 max]

2. (a) Methane released as anaerobic respiration occurs [1] / incomplete respiration [1] / waterlogged conditions [1] / less oxygen availability [1]. [1 max]
- (b) Allow [2] for description and [2] for explanations.
Overall, more methane production in tropics [1] / less in temperate regions [1];
as higher temperatures in tropics lead to faster respiration rates [1];
more methane released in northern hemisphere [1];
as more land [1];
most rice grown in tropics [1];
more methane as temperature higher [1];
most wetlands in mid-latitudes and equatorial regions [1];
where precipitation > evaporations [1];
rice paddies grown in natural wetlands in tropics, so fewer natural wetlands [1]; [4 max]
- (c) Increased rice production leads to more methane; leads to increased greenhouse gases; leads to enhanced global warming [2];
global warming leads to climate change [1];
biomes move away from equator [1] / deserts enlarge [1] / temperate biomes shift to higher latitudes [1] / crop growing areas shifted [1]. [4 max]

SECTION B

General Essay Markscheme

Each essay is marked out of 20 of which 3 are for expression and development of ideas (EDI).

- 0 No expression of relevant ideas.
 - 1 Expression and development of relevant ideas is limited.
 - 2 Ideas are relevant, satisfactorily expressed and reasonably well developed.
 - 3 Ideas are relevant, very well expressed and well developed.
3. (a) Effects due to: increased carbon dioxide levels / sulfur oxides / nitrogen oxides / unburned hydrocarbons / particulates / lead / carbon monoxide / mining / pollution of oceans.

Allow up to [2] for more than 3 effects and then up to [2] for each category. Candidates are asked to review so there should be an overview of most effects not emphasis on one or two.

Carbon dioxide increases → global warming → climate change → sea levels rise / disruption of ocean currents (*e.g.* in North Atlantic) / possible negative feedback effects from increased snow fall at poles / coral bleaching / ice caps melt / flooding of low-lying lands / biomes shift / food production changes [2];
sulfur dioxide → acid deposition → Al / cations leaching → tree death / acidifies lakes / limestone buildings eroding [2];
nitrogen oxides → also acid deposition / photochemical smog / CFC breakdown / pollution of oceans / effects of transporting large quantities of oil round the world *e.g.* oil spillages, Exxon Valdez (March 1989), oiling of seabirds [2].

Credit up to one specific health effect correctly attributed to fossil fuel induced pollution *e.g.* asthma.

(Give credit also for review of other impacts.)

[8 max]

- (b) Award marks for up to 5 strategies (*e.g.* carbon taxes / alternative sources of energy / energy efficiencies / liming), provided some relevant detail is given for each example.

[5 max]

continued...

Question 3 continued

- (c) USA uses more **[1]** / larger and less efficient automobiles **[1]**; → more gases released **[1]** / In North America, petrol is cheaper so North Americans use more gasoline *per capita* **[1]**; ecological footprint high **[1]** / new cars – more efficient technology in newer engines – cleaner emissions **[2]** / pollution effects lead to strong campaign for pollution controls **[1]** / more smog and other pollution effects (including lead in environment) **[1]**.

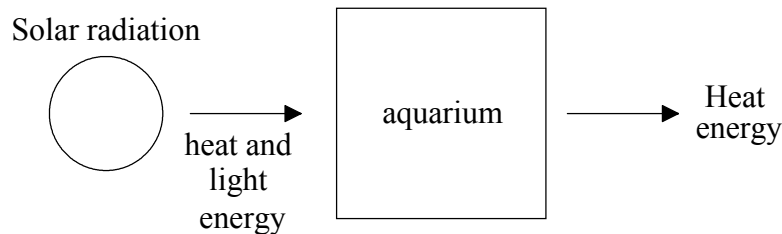
[4 max]

Candidates may approach problem from either European ‘direction’ or North American ‘direction’ e.g. expensive petrol in Europe encourages more use of public transport, leading to less pollution; cheap petrol in USA makes public transport unattractive and use of cars more likely, etc. Credit either approach.

Expression of ideas max [3 marks]

Total [20 marks]

4. (a) Allow [3] for aquarium and [3] for named ecosystem, with [2] for comparisons.
 Aquarium is a closed system [1];
 energy is exchanged with its environmental but matter is not [1];
 matter is recycled in C, water and N cycles [1] / finite amount of matter [1] / most ecosystems are open with exchange of both energy and matter [1].



Flow diagram for aquarium with only energy input and output [1].

Named ecosystem and brief description [1];

e.g. compare to a pond:

open ecosystem [1] /

energy inputs are the same – solar radiation [1] / heat and light [1];

matter input in pond is immigration by animals / plant dispersal / sedimentation of soil particles / precipitation / stream inflow / dissolved substances [1];

matter output in removal of plant material, animal emigration, fishing / stream outflow / evaporation / percolation / sediment and dissolved material [1];

Flow diagram for named ecosystem (e.g. pond):

energy input and output [1];

matter input – oxygen, carbon dioxide, plants, animal migration, sediment [1];

matter output – [1].

[8 max]

- (b) Producers / plants → herbivorous animal → carnivorous animal [1];

(any named organisms in diagram acceptable)

correct direction of arrows [1];

Allow for any reasonable argument [2] and whether positive or negative feedback [1].

e.g. of feedback mechanism – herbivore eats more food → more offspring → overgrazing → starvation → high mortality / disease → population size decreases [2];

negative feedback [1] / or more herbivore offspring → more predation → predator numbers increase → less herbivores [2]; negative feedback [1].

[5 max]

- (c) First law – energy is neither created nor destroyed but converted from one form to another [1] / light energy is converted to chemical energy by photosynthesis [1] / energy moves from one trophic level to the next [1] / but some energy is degraded to a higher entropy form that is unavailable to life – second law [1]; heat is lost from the aquarium and cannot be used by the organisms in the system [1]; but enough light energy is incoming to support the system as it is in stable equilibrium [1] / unless aquarium is in exact balance (unlikely as small size), system tends to run down and entropy increases [1] / organisms die and decompose, gases released and aquarium explodes [1].

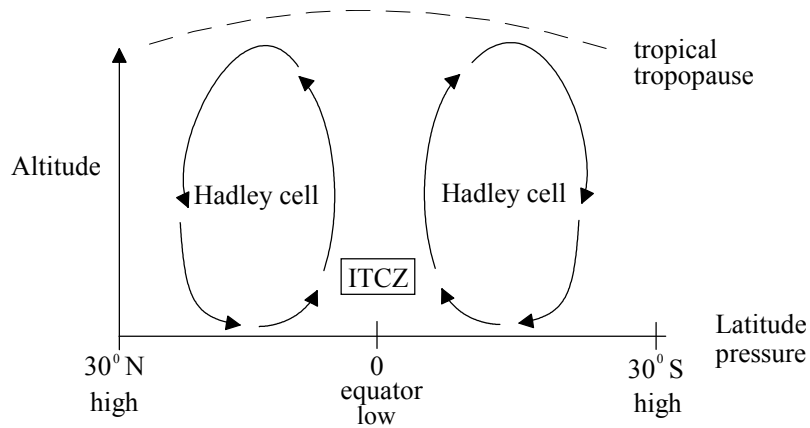
[4 max]

Expression of ideas max [3 marks]

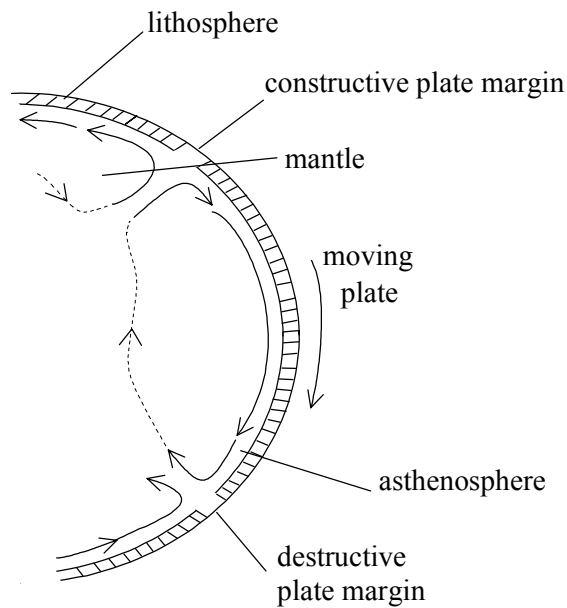
Total [20 marks]

5. (a) *Atmosphere – allow up to [4]*
Hadley cell / tricellular model [1]; redistributes heat energy from equator towards poles [1]; water vapour moves towards poles [1] / carrying latent heat [1]; sources of heat are insolation [1] / and radioactive decay causing heat generation in the Earth [1].

For clear, labelled diagram, up to [2]. (*Candidates may just draw one half of this.*)



- Lithosphere – allow up to [4]*
Asthenosphere convection cells due to hot spots from the interior of the earth [1]; move plates [1]; so causing destructive and constructive plate margins [1]; materials moved [1]; heat from Earth's interior to surface [1].
For clear, labelled diagram, up to [2].



(*Not all labels given here are required.*)

[8 max]

- (b) Both redistribute heat *[1]*;
by convection whereby molecules that gain energy move more and take up more
room *[1]*; density decreased and these molecules rise *[1]* / as they rise they cool and
lose energy so density increases and they fall downwards again *[1]*. *[3 max]*
- (c) Ocean currents transfer energy *[1]*; rivers transfer energy and material down slopes
[1]; warm from equator to poles *[1]*; and cold from poles to equator *[1]*; *e.g.* of
current *[1]*; materials are moved in the currents and by upwellings *[1]*; and
convection of heat through water *[1]*; heat capacity of water greater than rock –
more energy is required to heat water and it loses heat more slowly *[1]*; so
moderating effect on climate *[1]*. *[6 max]*

Expression of ideas max [3]

Total [20 marks]
