M13/4/ENVSO/SP1/ENG/TZ0/XX/M

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MARKSCHEME

May 2013

ENVIRONMENTAL SYSTEMS AND SOCIETIES

Standard Level

Paper 1

12 pages

Subject Details: Environmental Systems and Societies SLP1 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions. Total = ***[45 marks]***.

1. A markscheme often has more marking points than the total allows. This is intentional.

2. Each marking point has a separate line and the end is shown by means of a semicolon (;).

3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are underlined are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by ***OWTTE*** (or words to that effect).

8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script.

10. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

1. (a) A: oxygen/O_2
B: nitrogen/N_2; ***[1 max]***
*Both required to award **[1]**.*
Do not accept N or O.

(b) (i) ultraviolet/UV (light)/shortwave UV radiation; ***[1 max]***
Do not accept infra-red/short wavelengths/high frequencies or numerical values.

(ii) *Award **[1]** for any two listed below.*
air-conditioning;
propellants/aerosols/compressors;
soil sterilants/pesticides;
fire extinguishers/retardants/foam expansion techniques;
production of polystyrene/styrofoam ***[1 max]***
Do not accept DDT.
Do not accept names of ODS such as CFCs as question asks for source of ODS, or refrigerators as they are in the stem.

(iii) *Strengths: **[1 mark]***
signed up to by most states;
inclusive of developing nations as protocol provides support for implementation;
implementation of legislation has been very successful in reducing emissions;
some replacements for ozone-depleting substances (ODS) have been found;
ozone hole is shrinking;

*Limitations: **[1 mark]***
compliance is not yet 100 % / not all nations are involved with the Protocol;
illegal trade still exists;
some ODS are exempt from protocol as alternatives are not yet available;
some replacements for ODS are also ozone depleting (*eg* HCFCs) so unsatisfactory;
need suitable disposal facilities for stockpiled/old ODS as they will leak into atmosphere if no action taken;
disposal is a particular problem in less developed world; ***[2 max]***
Accept other reasonable responses.

2. (a) (i) sulfuric acid and nitric acid; ***[1 max]***

(ii) *transformation process*: ***[1 max]***
eg burning of fossil fuels in power plant/vehicles changes chemical energy to heat/kinetic energy;
eg burning of fossil fuels in power plant/vehicles changes fossil fuels to pollutant gases and ash / formation of acid rain from its precursors (NO_x and SO_x) / oxidation in the atmosphere;
eg condensation of water vapour in clouds changes gas to liquid/ice;

transfer process: ***[1 mark]***
eg rain moves water from clouds to land/river /dry deposition /wet deposition;
eg water and pollutants/acids moved by river;
eg wind moves pollutants from power station chimney/vehicle exhausts to other areas/clouds; ***[2 max]***
Do not accept one word answers.

(iii) acid rain/deposition occurs close to the source;
acid rain/deposition has more local/regional effects than ozone depletion or global warming;
acid rain/deposition is influenced by regional climatic and geographical conditions;
so involves adjacent states/countries in negotiation / many areas of world not affected by acid rain/deposition; ***[2 max]***
Do not award marks for simply repeating "acid deposition is controlled mainly by regional agreements" or the converse.

(b) (i) downward trend in emissions of both SO_x and NO_x / SO_x have reduced at faster rate than NO_x / NO_x have reduced at slower rate than SO_x;
NO_x decline is more consistent/steadier than SO_x / SO_x decline is more fluctuating than NO_x;
NO_x reduced by only 30 % *(accept values between 20–40 %)* in 17 years, but SO_x reduced by 70 % *(accept values between 60–80 %)*
NOx reduced by less than half as much as SO_x / SO_x reduced by more than twice as much as NO_x; ***[2 max]***
Credit appropriate numerical comparison of the data.
Responses must compare and contrast.
Do not award marks for describing trends for only one pollutant.

(ii) *technology*: ***[1 mark]***
catalytic converters fitted to more vehicles;
use of low sulfur diesel;
more efficient designs of vehicles / better vehicle aerodynamic design / engines more efficient;
development of electric/hybrid/hydrogen cars;
Do not accept clean/green technology without transport related example.
Do not accept less polluting fuel without relevant example, or giving some additional detail.

human activity: ***[1 mark]***
higher fuel prices;
more use of public transport;
changes in vehicle taxes deterring vehicle use;
government policy encouraging public transport/decreasing travel;
increased public awareness;
car pooling;
more cycling / walking; ***[2 max]***
Accept other reasonable responses.

3. (a) (i) renewable, non-renewable, replenishable; ***[1 max]***
*All three required to award **[1 mark]**.*

(ii) *eg* nut trees could be exploited for their timber;
but if left to grow provide an income of nuts;
that can be harvested throughout life of tree without liquidating capital; ***[2 max]***
Accept any other reasonable response.
Do not accept timber as an example.

(b) (i) the maximum load/number of a species/biomass/individual that can be sustainably supported by a given environment/ecosystem/habitat/area /*OWTTE*; ***[1 max]***

(ii) the increase in natural capital/forest biomass/production/net productivity (per unit time) that can be exploited without depleting/damaging original stock /*OWTTE*; ***[1 max]***

(iii) (k/2 =) 150 tonnes/t ***[1 max]***

(iv) rate of growth may vary with fluctuations in biotic/abiotic factors / specific examples of these *eg* low rainfall in some years, that depletes stock below previous rates / depletion of soil nutrients/minerals / disease depleting resources/reducing population; ***[1 max]***

(c) construct stone lines/bunds across area/dams on slopes / use contour ploughing / mulching / afforestation /plant cover; ***[1 max]***
Accept other reasonable responses

4. (a) (i) *Four appropriately named organisms, in the correct order and including relevant named producer organism*;
*Arrows leading **from low to high** trophic levels*;
Do not credit food webs. ***[2 max]***

(ii) because there are fewer foxes eating snakes / removal of predator allows prey numbers to increase; ***[1 max]***

(b) in desert, water is limiting so lower productivity;
in desert, soil nutrients are low due to limited decomposition of organic matter so lower productivity;
greater competition for resources in a desert (in contrast to lower competition in higher productivity of a tropical rain forest);
in desert fewer ecological niches so fewer species;
in desert lower productivity reduces length of food chains; ***[2 max]***
Accept responses in the converse.
Accept other reasonable responses.

5. (a) (i) sun/sunlight/light/solar radiation/insolation; ***[1 max]***

(ii) respiration; ***[1 max]***

(iii) decomposers/detritivores / invertebrates and bacteria / invertebrates and fungi / bacteria and fungi; ***[1 max]***

(b) (because) most energy entering is lost to the environment as heat/ respiration/waste as it moves from lower to higher trophic levels in the food chain; ***[1 max]***
Response must explain how energy is lost. Do not credit responses which only give the 10 % or converse 90 % rule, without explanation.

(c) entropy is a measure of the degree of disorder/chaos or randomness in a system; the greater the disorder the higher the level of entropy;
in metabolic processes/respiration, a high proportion of energy is always changed to heat;
heat is a more disordered form of energy than stored chemical energy/lower grade energy/cannot do useful work (so entropy increases); ***[2 max]***

6. (a) (i) log/logarithmic; ***[1 max]***

(ii) species A has fewer deaths at a young age than species B (which could indicate more parental care for young);
species A lives to a greater age than species B and *k*-strategists tend to be longer lived; ***[2 max]***
Allow responses in the converse.

(b) (i) *Award **[1]** for a suitable density-dependent factor. Must give name of animal eg rabbit or tiger*
eg competition/availability/supply of food/mating partners/nesting sites / predation /disease; ***[1 max]***
Do not accept plant example.

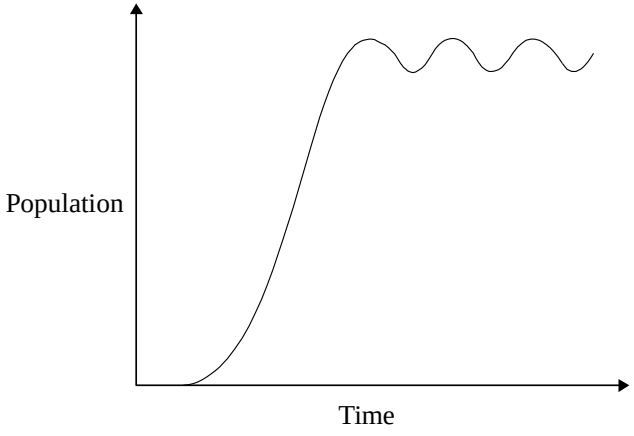
(ii) *Explanation*: ***[2 marks]***

large populations maybe affected by food shortages/disease/predation so population falls (below equilibrium/carrying capacity);

smaller populations allows more food per animal, so population rises (overshoots equilibrium level/carrying capacity) / reduction in prey will limit the predator population allowing prey population to grow/recover (negative feedback);

cycle repeats again in subsequent years;

Accept either S-curve or relevant part of S-curve.
*Award **[1 mark]** for a suitable sketch graph.* ***[3 max]***
eg



7. (a) (i) $\left(\text{natural increase rate} = \frac{\text{crude birth rate} - \text{crude death rate}}{10} = \frac{(19.15 - 8.12)}{10}\right)$

$= 1.103 / 1.1\ \%$ ***[1 max]***

Units are not required.

(ii) $\left(\text{doubling time} = \frac{70 \text{ years}}{(\%\text{ natural increase rate})} = 70 / 1.3\%\right)$

$= 53.8/54 \text{ years};$ ***[1 max]***

Units are not required.

(b) *Birth rates have decreased for reasons such as*: ***[1 mark]***
better access to contraception;
education/career opportunities for women;
urbanization and change in need for large families;
increased affluence so fewer children;
decline in influence of religious prohibitions on birth control in some cultures;
national strategies such as China's one child policy;

Death rates have decreased for reasons such as: ***[1 mark]***
improved health care/sanitation;
better diet/greater affluence;
improved antenatal and postnatal care; ***[2 max]***
Accept other reasonable responses.

(c) larger population uses more energy/fossil fuels, so produces extra carbon dioxide/greenhouse gases;
larger population uses more land for growing food *eg* rice / keeps more livestock, so produces extra methane/greenhouse gases;
more people results in more respiration increasing CO_2 and contributing to global warming ***[1 max]***
Accept other reasonable suggestions.