Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

November 2021

Environmental systems and societies

Standard level

Paper 1

10 pages

Subject details: Environmental systems and societies SLP1 markscheme

Mark allocation

Candidates are required to answer **ALL** questions. Total = **[35]**.

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) grassland/meadow/ marshland/wetland / pond/lake / river / urban / (temperate/deciduous/temperate deciduous) forest / woodland / garden / (city) park/parkland; **[1]**

***Note**: Do not accept only 'terrestrial/freshwater ecosystem'.*

(b) cold temperatures in the winter months (4°C in January) could inhibit photosynthesis/plant growth;
seasons/limited insolation in the winter could reduce photosynthesis/plant growth;
air pollution limits photosynthesis/plant growth; **[1 max]**

***Notes**: Do not credit 'limits variety of vegetation/lowers primary productivity'.*
For credit, response must link to photosynthesis/plant growth, not just productivity.
Do not credit 'low precipitation/rainfall'.

(c)

i. fragmented/scattered/dispersed;
ii. more open land in the southwest;
iii. forested/wild areas/green belt on the border/outskirts/edges of the city;
iv. more forested/wild areas in the southeast;
v. corridor of green space following the River Thames; **[1 max]**

***Notes:** For credit response must relate to the distribution of green spaces.*
Do not accept 'uneven / found in the South'.

(d)

i. remove air pollutants providing cleaner air (improving health/reducing health care costs);
ii. provide areas for education/tourism/leisure and physical activity (reducing obesity/stress);
iii. increase economic value of homes nearby;
iv. increase biodiversity of species (insects, small animals, plants) / provides a habitat for animals/pollinating bees;
v. act as flood mitigation/reduces flood risk (by absorbing precipitation/increase infiltration);
vi. filters (and cleans) water entering river/aquifers;
vii. rivers/lakes provide a source of water;
viii. cool temperatures/reduce urban heat island/reduce heating-cooling costs for homes;
ix. absorb CO_2/carbon sink / release O_2/oxygen source;
x. provides a source of food/timber/fertile soil for agriculture; **[3 max]**

2. (a) *correct identification of features **[2 max]** such as:*

i. antlers: horns with one point/multiple points;
ii. antlers: palmate/multiprong/branching;
iii. markings: spots on fur / black markings on face / black markings on tail;

***Notes**: Do not accept questions relating to bigger/smaller or specific size of deer (which could be dependent on age of deer).*
Do not credit suggestion that Reeves muntjac has no antlers.
Do not credit just 'skin pattern/pattern on body'.

iv. correct format of key; ***[1 max]*** **[3 max]**

***Notes**: Accept a dichotomous key with clear yes/no questions and two branches from each question, leading to the correct deer at each end point or clear question statements with "go-to" links.*
Mark can be achieved for correct format of key even if inappropriate identification features are chosen.

(b)

i. deer population will continue to grow/exceed carrying capacity/would lead to overpopulation;
ii. overgrazing the vegetation / deer would run out of food;
iii. leading to soil erosion in the park / loss of plant biodiversity / death of trees (due to bark stripping);
iv. this will lead to starvation/disease and a population crash; **[2 max]**

***Note**: Do not accept only 'causes instability / causes positive feedback / causes ecosystem to collapse / causes land degradation / competition for food / food hard to get / resources are depleted'.*

3. (a) *Strengths of model:* ***[1 max]***

i. good visualising tool/easily understood by non-specialists;
ii. environmental indicator / hazard warning indicator;
iii. (widespread use so) easy to compare with other areas;
iv. highlights problem areas / identifies necessary changes in lifestyle;
v. iconic symbol for raising awareness;
vi. information can be used to inform policy by governments;

Notes*: Do not credit a definition of EF eg. 'provides an estimate of land/resources required to sustain lifestyle'.*
Do not accept 'EF shows if a country is sustainable or not'.
Do not accept 'it is a simple tool/method'.

Weaknesses of model: ***[1 max]***

vii. calculations are complex/all models are simplifications;
viii. needs huge amounts of data/uses proxy data/estimates;
ix. land has more than one function;
x. less reliable at local level / not everyone in the region has the same lifestyle;
xi. can be interpreted differently by cultures;
xii. does not show types of resources used;
xiii. does not include all factors that contribute to sustainability; **[2 max]**

Notes*: Do not accept only 'it is inaccurate / does not use outliers'.*
Do not accept 'does not account for changes over time'.

(b) importing resources/food;
exporting waste products; **[1 max]**

(c)

i. increases food resources, (which increases carrying capacity);
ii. decreases water use, (which increases carrying capacity);
iii. no pesticides, so less water pollution/does not harm/pollute environment / no pesticides used so fewer inputs/resources needed, (which increases carrying capacity);
iv. vertical farming uses less land area, (so more land area is available for housing);
v. farming on roofs and in abandoned buildings means more land area is available (for housing/population growth);
vi. bees result in more pollination, so more primary productivity, (increasing carbon sink); **[3 max]**

Notes*: Do not accept only 'bees increase resources available' without reference to increasing food.*
Do not accept 'bees provide healthier food'.
Do not accept only 'no pesticides used / provides goods / produces agricultural items / pesticides cause eutrophication'.

4. (a)

i. burning/combustion of fossil fuels releases NOx;
ii. hence higher number of cars produces more NO_x;
iii. greater use of public transport/buses generates more NOx / use of diesel engines in buses produce more NO_x;
iv. traffic congestion means that cars generate more NOx;
v. tall buildings trap pollutants due to lack of air flow, resulting in higher levels of pollutants/NOx;
vi. large number of buildings/offices so more delivery trucks bringing supplies producing more NOx;
vii. there are fewer trees in central London that would trap NOx and help lower NOx levels; **[3 max]**

***Notes**: Figure 2a states electricity is generated outside the city.*
Do not accept there are more industry/factories in central London that generate NOx.
Do not accept only 'there are few green spaces/trees', link needs to be made to trapping air pollutants/cleaning the air.

(b) Examples of strategies include (N.B. no marks for stating strategy): *use of congestion charges/higher tax for using cars, increase/shift to hybrid/electric cars, use of catalytic converters, increase public transportation / increase bicycles/free bicycle scheme, carpooling, shift to cleaner fuel sources for public transportation, stricter emissions controls on car exhaust, shift to solar powered cars/vehicles.*

***Example 1:** congestion charges/higher taxes to decrease number of cars entering the city:*	
Advantages [2 max] i. reduction in cars reduces NO_x; ii. reduction in street parking/congestion iii. reduction in noise; iv. can use revenues to further invest in NOx reduction *eg*. through education campaigns/creation of bus lanes;	*Disadvantages [2 max]* v. richer people can still drive/only impacts poor; vi. need to develop a monitoring system which works/is not likely to be undermined by corruption; vii. need to provide alternative methods such as public transport, which can be expensive;
***Example 2**: shift to hybrid/electric cars:*	
Advantages [2 max] i. reduction in burning fossil fuels reduces NOx emissions; ii. does not require change in lifestyle/behaviour;	*Disadvantages [2 max]* iii. expensive; iv. requires more charge up stations/ development of infrastructure for charging points; v. takes more time to charge up electric car than car that uses fossil fuels; vi. takes time to make the switch from traditional cars to electric/hybrid cars; vii. requires incentive *eg*. legislation/education campaign;
***Example 3**: use of catalytic converters:*	
Advantages [2 max] i. controls release of pollutants/NOx from exhaust pipe, therefore reduces NOx emissions / NOx are converted to nitrogen gas emissions;	*Disadvantages [2 max]* iii. expensive; iv. contributes to increase in carbon dioxide released; v. requires incentive *eg*. legislation/education campaign;

(*continued*)

ii. also reduces emissions of carbon monoxide /hydrocarbons;	vi. reduces fuel mileage/ increases fuel consumption; vii. requires use of metals (platinum/palladium/rhodium) that are finite resources; viii. mining/extraction/processing of metals required (platinum/palladium/rhodium) causes pollution; ix. metals used in catalytic converters are valuable and prone to theft;
***Example 4**: Encourage use/improve provision of public transport*	
Advantages [2 marks] i. reduction in car use that generates NOx / increase use of transport that generates less NOx; ii. can use revenues to further invest in NOx reduction *eg*. through education campaigns/creation of bus lanes / generates revenues for government; iii. can be less stressful to use than driving/can provide time to relax;	*Disadvantages [2marks]* iv. can be expensive to set-up/run; v. difficult to change behaviour; vi. can be very crowded/lack comfort; vii. may be long waiting times between services / journey may take a longer time period;

*Conclusion **[1 max]** needs to consider both sides of the argument for credit. For Example 1, above, "while higher taxes may decrease the number of cars entering the city, this simply moves the problem into other zones around the centre, and therefore it is not an effective strategy."* **[3 max]**

***Notes**: Conclusion is not mandatory and [3] marks can be achieved through consideration of both advantages and disadvantages.*
Do not award a mark for stating only strategy.
Accept other reasonable responses.

(c)

i. reduction in number of deaths due to air pollution / increase in life expectancy;
ii. reduction in asthma/chronic bronchitis/respiratory ailments/lung disease/reduction in heart disease;
iii. reduction in eye irritation/eye disease;
iv. reduction in health care costs;
v. reduced heat island effect;
vi. reduced damage to buildings/monuments;
vii. reduced costs due to damage to monuments;
viii. reduction in damage to plant tissue / increase in photosynthesis/plant growth/primary productivity;
ix. increase in species diversity as high pollution levels have a detrimental effect on some species;
x. improves visibility in absence of smog/particulate pollution; **[2 max]**

***Notes**: Doesn't need to be one impact for London and one for population.*
Do not credit only 'improved health/reduction in diseases / reduction in photochemical smog / affects plants / better vegetation'.
Do not credit 'less pollution would lead to greater tourism and increased revenues'.

5. (a)

i. difficult to access recycling points / fewer recycling bins;
ii. cost of collection too high due to population in London;
iii. lack of political action / lack of incentive to recycle;
iv. London produces a greater proportion of non-recyclables in its waste than the rest of the country;
v. London is multicultural and not all cultures place the same emphasis on recycling;
vi. lack of awareness / not sufficient education campaigns to promote recycling; **[1 max]**

***Note**: Do not accept only 'London has a large population / people refuse to recycle / harder for people in London to recycle / London produces a lot of waste'.*

(b)

*Effective **[2 max]**:*

i. reduces waste going to landfill / reduces need for more land for landfill;
ii. reduction in GHG/methane from landfill;
iii. reduces need for incineration which adds to London's air pollution;
iv. reduces demand for extraction of new resources/reduces EF;
v. can contribute to green markets and create jobs;

***Note:** Do not accept only 'reduces waste / less waste going into the environment (eg. rivers/oceans)'.*

*Ineffective **[2 max]**:*

vi. currently a relatively low rate of recycling / not everyone is recycling effectively / requires change in lifestyle/behaviour / difficult to change behaviour;
vii. recycling schemes can be quite expensive;
viii. there may be a lack of recycling companies;
ix. not all waste can be recycled;
x. recycling centres may need to be located outside the city (due to lack of available land), thereby increasing traffic/transport costs / recycling centres need infrastructure which may take up land (green space);
xi. recycling (is end of pipe measure that) does not tackle problem of high waste production/over-exploitation of resources/over-consumption/consumerism;

*Conclusion **[1 max]** needs to be balanced considering both sides of the argument for credit* **[3 max]**

***Note:** Conclusion is not mandatory and [3] marks can be achieved through consideration of both pros and cons.*

6.

*Sustainable **[4 max]**:*

i. recycling of SDW will reduce CO_2 from decomposition, reducing EF;
ii. recycling of SDW will reduce space required for landfill, reducing EF;
iii. vertical farming increases biocapacity / repurposing brownfield sites/empty industrial buildings means land does not need to be cleared for agriculture (increasing sustainability)/increases productive land area;
iv. urban agriculture reduces importation of food which reduces carbon dioxide emissions from transportation;
v. no pesticides means a reduction in toxification of soil/water, increasing sustainability;
vi. bee-keeping helps protect/raise healthy bees which are needed for biodiversity of plants;
vii. reduction in water use for vertical farming increases sustainability;
viii. air pollution control measures will reduce negative impact on human health and vegetation;
ix. large amount of green space/habitat for biodiversity;
x. aiming to produce 15% of energy from renewable, local sources, which increases sustainability/reduces EF;
xi. deer are managed to ensure environment remains healthy;
xii. money raised from selling deer meat goes to conservation increasing sustainability/protection of habitat;
xiii. there are over 8 million trees/47% is classified as green space, providing oxygen/ acting as a carbon sink/trees clean air of pollutants, which increases sustainability;

*Not sustainable **[4 max]**:*

xiv. EF is larger than biocapacity, which means it is not sustainable;
xv. recycling requires energy and produces air pollution, which increases EF;
xvi. low recycling rates (compared to rest of UK)/lower than 35%, so not sustainable / only paper and glass have more than 50% recycled;
xvii. growth in population will increase demand for land (housing) and energy, so improvements may be counteracted by increased population;
xviii. green spaces are fragmented / green spaces are divided by urban barriers, so wildlife cannot move freely between habitats;
xix. central London suffers from high levels of air pollution, which is not sustainable;
xx. deer numbers rise rapidly and then crash, suggesting numbers are exceeding carrying capacity, which is not sustainable/habitat is being damaged;
xxi. only aiming for 15% energy from renewables, which isn't using resources wisely;

*Conclusion **[1 max]**:* While many aspects of the urban management of London contribute to its sustainability such as use of vertical farming that helps to conserve water, the vast population in a relatively small area means that its environmental footprint far exceeds the area of the city. **[6 max]**

***Notes**: Do not credit 'EF of London is greater than world average EF'.*
A valid conclusion should be credited if it is explicit, balanced (addresses both sides of the argument), supported by evidence and makes a clear value judgement.
Do not credit the conclusion if only one side of the argument has been considered within the overall response.
*Award **[5 max]** for both sustainable and non-sustainable reasons.*