Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

November 2022

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
- The maximum total = **[35]**.

1. Environmental systems and societies uses marking points and markbands to determine the achievement of candidates

When using marking points:

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

ii. Each marking point has a separate line and the end is shown by means of a semi-colon (;)

iii. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded**

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

When using markbands (Only for Section B, part (c) questions):

i. Read the response and determine which band the response fits into

ii. Then re-read the response to determine where the response fits within the band

iii. Annotate the response to indicate your reasoning behind the awarding of the mark
Do not use ticks at this point

iv. Decide on a mark for the response

v. At the end of the response place the required number of ticks to enable RM Assessor to input the correct number of marks for the response.

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

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

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

5. 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).

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

7. 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.

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

1. (a) 27°C / from –4 to (+)23°C; **[1]**
Accept use of dash to indicate 'to'. Units are not required for credit.

(b) temperate forest / (temperate) deciduous forest/ (temperate) coniferous forest / montane forest / boreal forest / taiga / alpine (meadow) / grasslands / wetland; **[1]**
Do not accept only 'forest'.
Only mark the first answer if more than one biome is given.

(c)
a. national parks are mainly found in areas above 500m/1000m in elevation / found mainly in the areas of highest/high elevations;
b. (there is no relationship, as) the national parks are found at all elevations (i.e. Kushiro Marshlands); **[1 max]**

Note: *Must give a reason if they say there is no relationship.*

(d) *Effective **[2 max]***:
a. cover a variety of ecosystems (wetland, coastal, alpine, volcanic, forests, peat moorland) / multiple elevations so provide a variety of habitats;
b. some national parks are round/large to reduce edge effects (Daisetsuzan);
c. one national park/Daisetsuzan is large so it can support more organisms;
d. some national parks are isolated from urban settlements (Shiretoko);

Do not accept 'national parks cannot be reached/disturbed by humans at high altitude.'

*Not effective **[2 max]***:
e. all national parks are located near airports resulting in human influence eg airplanes interfering with birds/causing noise pollution/air pollution / location of national parks near airports can result in more tourists that results in greater human influence eg degradation of habitats;
f. many of the national parks are long and thin (Shikotsu-Toya, Shiretoko, Sarobetsu), increasing edge effects/increasing human impacts eg poaching/hunting (at the boundary);
g. there are no wildlife corridors linking the national parks;
h. some are quite close to large urban areas (Sapporo), increasing human influence;
i. only a small area is dedicated to lowland/wetland habitats;

Do not credit 'degradation due to increased use of hiking trails' or other points that relate to management rather than design (shape, size and positioning).
Do not accept 'areas are fragmented'

*Conclusion **[1 max]***:
needs to be balanced considering both sides of the argument for credit and involves a clear statement about the design of Japan's national parks system, e.g.:
"While the parks cover a multitude of ecosystems, they are too close to human activity to be effective as protected areas".
No marks awarded for an isolated statement such as, "there are both positives and negatives".
Conclusion is not mandatory and 4 marks can be achieved through consideration of both effective and non-effective marking points.

[4 max]

Note: *Accept other relevant answers.*

2. (a) tertiary/third level consumer;
fourth level/levelfour/4; **[1 max]**

Note: *Do not credit 'top predator / top consumer / top of trophic level / tertiary / third'.*
Only mark the first answer if more than one answer is given.

(b)
a. rise in Japanese beetle numbers due to reduced predation;
b. more food available for long-tailed tit (which eats Japanese beetles) so increased population size;
c. reduction in food availability for Red-crowned crane/Hokkaido owl/least weasel resulting in drop in population;
d. increased predation on Hokkaido flying squirrel/Long-tailed tit (from owl/weasel) resulting in reduction in its population size;
e. increased herbivory on willowleaf meadowsweet (by larger numbers of Japanese beetles), reducing its population; **[2 max]**

Note: *Accept any other reasonable answer relating specifically to changes in the feeding patterns in the food web.*
Accept 'reduction in food source for Red-crowned crane could lead to its extinction' as in this simplified food web, the crane is shown with only one food source.
Do not accept only increase/decrease in named population without the cause (eg increase/reduced predation) or vice versa.
Do not accept "food web would collapse/be destroyed."
Do not accept general statements such as, "its predators would have less food". Answers must relate specifically to the food web provided.

(c) (i) 1952: 30 (mature individuals) **AND**
2000: 900 (mature individuals); **[1]**
Note: Correct values for both years are required for credit.

(ii) ((900–30)/(2000–1952)) = (870/48) = 18.125 / 18.13 / 18.1 / 18; **[1]**

Note: Accept ECF (Error Carried Forward) that use the **two** values from (c)(i).
Mark is for final calculated answer (not workings).
Do not accept incorrect rounding of the answer.

(d)
a. loss of habitat / reduction in geographic range;
b. number of mature individuals/population size (still relatively low despite some increase in numbers;
c. decline in quality of habitat;
d. habitat fragmentation;
e. fourth/highest trophic level; **[2 max]**

Note: *For population size accept reasonable numerical value eg 900 or less than 1000 individuals.*
Do not accept at risk of extinction or declining numbers/reduction in population size, as none of these are valid from data of IUCN status in 2000 nor on graph data presented in Fig 6(b).
Do not accept only 'geographic range / not widely dispersed / quality of habitat / trophic level.'

2. (e)

a. small genetic diversity puts them at risk of infectious disease / overcrowding at feeding stations puts them at risk of infectious disease;
b. small genetic diversity puts them at risk of infertility/failed breeding/restricts population growth;
c. currently survive in winter due to feeding programs (if these are discontinued, the red-crowned cranes may not survive);
d. their habitats are still being lost/degraded for agricultural use / their habitat quality has not improved;
e. removal of Endangered status may result in loss of protected areas/loss of funding /reduction in conservation effort;
f. considered a pest species by farmers, who may begin killing them if they lose their Endangered status / with change in status the cranes may be killed for food;
g. efforts to raise them in captivity for later release have been unsuccessful, (so protection is the only way to ensure they continue to survive);
h. over 50% of the population is located in Hokkaido, so if something adverse happens to this population (eg fatal disease), the entire population is at risk; **[3 max]**

Do not accept only 'lower genetic diversity makes them vulnerable to extinction'.
Do not accept 'numbers of cranes are still relatively low'.

3. (a) coniferous forest monocultures are increasing at a faster rate than the natural forests; **[1]**

Do not accept only 'coniferous have a higher forest stock than natural forest'.
Do not accept only 'they grow at different rates.'
Do not accept 'there is an increase in coniferous forest whereas natural forest remains the same/does not change.'

(b)
a. monocultures have low resilience (less adaptable to disturbance) due to lack of biodiversity;
b. low genetic biodiversity increases risk of spread of disease;
c. single tree species increases risk of pest attacks;
d. lack of younger growth increases risk of forest fires;
e. monoculture reduces soil fertility which reduces primary productivity/biodiversity and therefore resilience;
f. reduction in habitat reduces species complexity/food web complexity/ energy flows, making it less adaptable to disturbance;
g. lower species diversity reduces food web complexity, making it more susceptible to collapse if disturbed;
h. these conifer species require large amounts of water and therefore are less resilient to drought conditions; **[3 max]**

4. (a) ((6.21–12.22)/10) = –0.601 / -0.60 / -0.6; **[1]**

Notes: *Must have negative, as there is a natural decrease (birth rate is lower than death rate).*
Units not required.

(b) Stage 5/contracting/declining / Stage 4/stable; **[1]**

Note: *Some older models only have 4 stages*

(c)
a. higher levels of education for women, delaying marriage/first birth/reducing number of children;
b. higher proportion of women in the work force/professional women delaying having children / increase in female emancipation/status (personal freedom) resulting in women choosing to have less/no children;
c. increased access to family planning/use of contraception/sex education (lowering the fertility rate);
d. societal/ cultural expectations, resulting in smaller families;
e. strong pension scheme/support for elderly means Japanese do not require large families for support later in life / economic stability means children are not required as a labour force;
f. healthy lifestyle provides long life expectancy, resulting in a larger proportion of elderly people/women beyond childbearing age;
g. more money spent on healthcare reducing child mortality/increasing survival rates so parents have less children;
h. economic cost of raising children (resulting in a desire for fewer children);
i. anti-natalist laws / government policy/legislation that encourages families to have less children;

[3 max]

Do not credit just a list of terms such as 'education/employment/women empowerment/contraception/aging population/laws.'
Do not accept 'low income from agriculture means they cannot afford to have many children.'
Do not credit 'religious beliefs lowers the fertility rate'.
Do not accept only 'increased/higher level of education reduces fertility rates', response needs to refer to either education of women or sex education.

5. (a)
a. public outcry against using nuclear power / concern about nuclear accidents / concern about generation/disposal of nuclear waste;
b. closure of nuclear power stations after Fukushima Daiichi disaster;
c. preference to develop renewable energy sources / use more renewable energy to try and reduce CO_2 emissions / improvements in technology of renewable energy / reduction in cost of renewable energy;
d. imported fossil fuels were cheaper than importing uranium / fossil fuels were relatively cheap to import / nuclear energy is expensive;
e. actual electricity from hydro may be lower than potential due to drought/weather conditions that reduced the flow of water (reducing electricity generation);

[2 max]

Note: *Do not accept that nuclear power station was broken/damaged as the capability was present.*
Do not accept 'differences are due to increase in energy demand'.
Do not accept generic terms eg 'gas emissions' instead of 'carbon dioxide'.

5. (b)

a. aim is to prevent/limit environmental damage/impact of a project;
b. to provide a baseline assessment of the environmental, social and economic impacts of a project;
c. to predict/evaluate possible impacts of a project / to decide if a project will be sustainable;
d. to suggest mitigation strategies for potential problems caused by a project;
e. a tool for planning decisions about a proposed project; **[1 max]**

6. *Arguments for being sustainable **[4 max]**:*

a. aiming to reduce CO2/limit CO2 emissions (and therefore meet Paris Agreement/reducing impact of global warming) (environmental sustainability);
b. shift to renewables reduces contamination/release of greenhouse gases (environmental sustainability);
c. use of renewable energy (locally sourced hydro/geothermal/solar/wind) leads to more self-sufficiency/improved energy security;
d. falling birth rates/ageing population/ negative natural increase rate (NIR) will result in a drop in population, reducing electricity demands and therefore increasing sustainability;
e. plan to return forests to natural state which will boost biodiversity and resilience, improving sustainability;
f. red-crowned cranes are fed during the winter to prevent population decline /red-crowned cranes are protected from hunting (environmental sustainability);
g. promotes nature tourism, so people are more likely to support conservation measures to protect habitat and endangered species (environmental sustainability) / income generated from tourism can help to conserve species/habitats / protected areas can be used to educate the public about the importance of conserving species/habitats/biodiversity;
h. conversion of coniferous forest to natural forest/grasslands protects aquatic recharge areas for the future (environmental and social sustainability);
i. all future energy developments require an EIA, which helps avoid environmental degradation;

*Arguments that they are not sustainable **[4 max]**:*

j. potential for further nuclear accidents still present, which could contaminate the natural beauty/impact societies (environmental and social sustainability);
k. no solution for radioactive waste disposal so not a long-term solution;
l. possible security threat/potential for terrorist attack which could result in a radioactive leak (not sustainable);
m. still heavy reliance on fossil fuels which are finite/produce greenhouse gases, which is unsustainable / nuclear power is not renewable (finite resource) so is not sustainable;
n. large proportion (94% for Japan) of energy is imported which is unsustainable;
o. no evidence that the plan to return monoculture forests to natural forests has occurred, which is unsustainable / proportion of planted monoculture forests is still increasing, leading to soil degradation/loss of biodiversity;
p. 30% of forests are monoculture plantations, which have reduced biodiversity/genetic diversity/more susceptible to disease;
q. (international) tourism is increasing/large number of tourists, causing damage to ecosystems/species;
r. (large number of) ski resorts/tourists can negatively impact the environment through tourist loading/demand for resources, so sustainability will not be achieved;
s. national parks are not connected, creating isolation of species, which is not sustainable;
t. numbers of red-crowned cranes are too large for the habitat/numbers are only robust due to winter feeding stations, resulting in overcrowding and the potential spread of disease, which is unsustainable;
u. red-crowned cranes have changed their natural behaviour as a result of supplemental feeding, making them reliant on this for the future;
v. wetlands are still being drained for agricultural development resulting in loss of habitat;

w. large agricultural production can increase demand for water/increase use of pesticides which can lead to soil toxification/bioaccumulation which is unsustainable;
x. Hokkaido is largest producer of rice (in Japan) which causes methane emissions;
y. indigenous people are a cultural tourism attraction, which impacts social sustainability/their rights may not be protected;
z. reduction in birth rates/aging population reduces the future work force (which maintains the economy and therefore) is not economically sustainable;

Award [5 max] for arguments for and arguments against.
Do not accept 'noise/pollution from airports located near to the national parks can cause disturbance to the wildlife.'
Do not accept '10% of land is protected/Hokkaido has 6 national parks which protects habitats and associated species and therefore is sustainable' as intensive use of these areas has led to damage of habitats/ecosystems.

*Conclusion **[1 max]**:*
For example, "while Hokkaido is working towards promoting environmental sustainability through nature tourism and the move to less polluting sources of energy, the growth in international tourist numbers and the draining of wetlands for agriculture means that their future is not sustainable.

A valid conclusion should be credited if it includes a value judgement (on whether sustainability is being achieved), is explicit, balanced (addresses both sides of the argument) and supported by evidence. Do not credit the conclusion if only one side of the argument has been considered within the overall response.

Accept other reasonable responses supported by the information in the resource booklet. **[6]**