

Markscheme

November 2017

Environmental systems and societies

Standard level

Paper 1

8 pages

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1. (a) tundra/arctic tundra/taiga/boreal forest/birch forest/coniferous forest;
Do not accept only 'forests/temperate forest/woodlands/ice caps/glaciers/mountains'. [1]
- (b) low temperature/temperature below 0°C for 5 months of the year;
low precipitation/rainfall/ low availability of water/water frozen in winter;
limited sunlight/insolation/only 6 hours of sunshine per day;
climate conditions that cause permafrost/ground frozen; [2 max]

Do not accept 'high rainfall'.

2. no population prior to 874;
steady increase in population between 874 and 1700;
slight decline/no increase in population between 1700 and 1800;
exponential increase in population since around 1800-1900/significant increase in population from around 1900 onwards;
over recent years/past 24 years, birth rates are stabilizing/slight decline in birth rates/less children/reduction in population growth rate/population pyramid suggests population is stabilizing/entering/moving towards stage 4 of the demographic transition model (DTM); [2 max]

3. (a) vegetation cover has been significantly reduced;
change from woodlands to heath/moor/shrubs/desertified/bare landscape;
extent of birch forest has reduced (significantly/by more than half);
increase in coverage of lupins;
lupins replace/outcompete native flora; [2 max]

Do not accept change from 'vegetation cover to desertified landscape'

- (b) deforestation has exposed the soil to erosion/made soil more prone to erosion/
resulted in loss of root system that holds the soil in place;
overgrazing by livestock has prevented regeneration of vegetation/exposed soil to erosion;
climate change/global warming/higher temperatures has led to melting of ice and increased floods causing soil erosion;
trampling on ground can reduce vegetation and expose soil to erosion/cause soil particles to break away and increase erosion/cause soil compaction that increases runoff and associated soil erosion; [2 max]

NB Only credit if reason given is explained, do not accept only 'logging/deforestation/overgrazing/trampling/soil becoming compact/climate change/global warming' without an account of how this impacts erosion. Accept other reasonable responses.

- (c) can be expensive/labour intensive/the longer you leave it the more it costs;
the longer you leave it the lower your chance of success/chance of success is lowered with time/greater stage of vegetation loss;
strategies may have unforeseen/unpredicted effects;
eg lupins (introduced to control soil erosion) are invasive/outcompeting native species/have become a large-scale problem/have spread across the island;
eg herbicides may cause water pollution/adversely affect other species;
eg mowing/grazing/pulling up lupins can increase soil erosion;
harsh climate may make it difficult;
cause of problem may be external/global eg climate change;
reduction/low in soil nutrients/poor soils;

[4 max]

Accept other reasonable responses.

Level of success must be linked to time period/stage of vegetation loss to be credited the mark. Do not accept removal of lupins increases cost of restoration.

4. Positive effects [3 max]:

increase in temperature leads to increase in agriculture/farming productivity;
migration of new species might lead to increase in fishing industry;
forest growth at higher altitude may lead to less erosion;
increase in hydroelectric power as more water in glacial rivers;
increase in temperature lowers heating costs in a cold country;
melting of ice/glaciers could make available land for agriculture/forest;
provide favourable conditions for more species/which increases biodiversity;

Negative effects [3 max]:

reduction in population numbers (eg puffin) due to reduced food sources/may have a detrimental effect on reproduction/species unable to adapt to change in climatic conditions;
loss in biodiversity/extinctions;
shifts in food webs as new species arrive/shifts in food web as some species are lost;
economic loss due to reduction in potential catch in fishing industry/loss of some species could result in loss of food supply for humans;
volcanic eruptions more likely as ice melts;
long term decline in hydroelectric power as melt water decreases;
reduced tourism due to loss of attractions eg ice caps/loss of wildlife;
increased precipitation may lead to increase in soil erosion/increased precipitation could increase leaching of nutrients from the soil;
melting of ice/glaciers could cause flooding/increase soil erosion;
melting of ice/glaciers could reduce stores of potential drinking water;
rise in sea levels could cause coastal flooding;
loss of ice/snow could reduce albedo effect/increase heat absorption and lead to further warming;
melting of permafrost will release greenhouse gases/methane/carbon dioxide;

Opinion/Appraisal statement (that is substantiated with evidence) [1 max]:

eg short-term benefits may be accompanied by long-term problems;
Iceland is going to need to be adaptable as economic opportunities must be balanced by losses;
effects may not be known for some time due to multiple factors/feedback/complexity of systems;

Overall climate change will have a positive effect ... as the warmer temperatures will allow for greater growth of trees that help conserve the soil/result in greater agricultural yields whereas loss to the limited number of endemic species on the island is likely to be minimal;

Max 4 marks if there is no opinion/appraisal.

[5 max]

Do not accept only 'temperature increases productivity/vegetation' without explanation of how this is a benefit.

5. (a) (i) cultural/traditional practice for Icelanders;
they are not locally endangered;
legally allowed in Iceland;
source of protein/food;
economical value;
puffin meat/products may attract tourists;
hunting puffins reduce competition for fish stocks;

[1 max]

- (ii) knock-on effects on food web;
biorights of puffins/intrinsic value of puffins;
population in decline;
status may change from vulnerable to endangered/extinct;
if over-exploited will not be a sustainable source of food/will cease to be a source of food;

[1 max]

Do not accept only 'puffins are vulnerable'.

- (b) number of puffins could decline (as mackerel eat their prey/competition for food sources);

Do not accept only 'there is less food available for puffins'.

[1]

- (c) multiple interrelated threats affecting them;
impact of extreme weather/impact of climate change not fully understood;
unexpected diseases may affect population numbers;
inaccuracies in population counts;
large geographical range makes representative sampling difficult;
difficult to predict future number of prey species/food availability/difficult to predict number of competitors (*eg* mackerel);
calculations only based on estimates with large margin of error;
in future changes may be made to the management/legislation/policies on puffins (*eg* hunting of puffins may be banned);

[2 max]

NB Do not credit for only over-hunted/overfishing/is part of a complex food web/weather'.

- (d) increase in catch due to more boats at sea;
 increase in catch due to improvements in technology;
 increase in catch due to extended fishing grounds;
 increase in catch due to recovery of fishing stocks from over harvesting;
 improved fishing technology/over-fishing may lead to reduced populations over time resulting in reduced catches;
 reduction in catch due to less number of boats allowed to fish/increase in mesh size of nets;
 reduction in catch due to more strict regulations/reduced quotas/total allowable catches/regulations to restrict catches/increase in catch due to increase in quotas/total allowable catches;
 increased number of predators may reduce population of herring/reduction in number of predator (eg puffin) may increase population of herring/reduction in prey reduces herring population/more available prey may result in an increase in the population of herring;
 changes in demand for herring from markets results in an increase/decrease in catches;
 climate change may cause changes in distribution and populations that result in an increase/decrease in catches;

NB A correct reason must be linked to either a rise or fall in the amount of captured Atlantic herring to be credited a mark. Restricting/limiting fishing can be considered as a reduction in fish catches. **[2 max]**

- 6. (a) the energy consumption has increased overtime (from 1940 to 2008);
 in 1940s/initially energy consumption was reliant mainly on coal;
 in 2008/more recently it was predominantly reliant on geothermal/renewable energy/
 has relatively little reliance on fossil fuels/coal/overtime it has changed from being
 mainly coal/fossil fuels/non-renewable to geothermal/renewable energy;
 from around 1940-1970 there is a steady growth in consumption/greater use of oil
 and geothermal;
 from 2004/05 there is a rapid increase in consumption/expansion of geothermal and
 hydropower; **[2]**
*Accept other responses that correctly link the change in growth in energy or the
 balance of energy sources to the time period.*

- (b) economic crisis in 2008 led to industrial decline /reduction of demand for aluminium
 world-wide;
 following economic crisis, households had less money/tighter budgets and therefore
 reduced energy use;
 industry accounts for the largest share of energy consumption (40 %);
 deliberate efforts to reduce consumption through energy conservation **[2]**

*Do not accept only '2008 economic crisis has led to reduction in energy demand'
 without explanation or 'emigration could reduce energy demand'.*

7. *It is a model for sustainability because (max 4 marks):*
renewable energy accounts for a very high percentage of energy consumption (aim of 100% by 2050)/reduced reliance on fossil fuels that produce GHGs;
use of renewable energy sources instead of fossil fuels allows for sustainable development where the needs of the present are met without compromising the needs of future generations;
taking steps to address soil degradation by planting lupins;
attempting to remove invasive species;
fish stocks such as Atlantic herring appeared to have increased/recovered (since 1979) suggesting appropriate management;
growth in tourism can be used as a reason to conserve/protect its wildlife/puffins/whales/areas of wilderness/growth in tourism can provide alternative employment to aluminium smelting/industries that can produce significant levels of GHGs; aluminium smelting which is high energy consumption is located here to make the most of renewable energy;
hunting of puffins is restricted to April/only one month of the year to avoid them becoming endangered/extinct;

It is not a model for sustainability because (max 4 marks):
Icelanders harvest/eat species (eg puffins), whose numbers are in decline/Iceland legalise hunting/eat puffins that are classified as vulnerable;
Iceland has a very high ecological footprint which is three times the Earth share;
home to industries which produce lots of greenhouse gases (eg aluminium smelting);
there are high rates of soil degradation;
there has been a high loss of original birch forest/woodlands;
invasive lupins/alien species are not fully controlled/a threat to native species/wildlife/habitats;
mass tourism during the summer months can stress wildlife/puffins/whales that can reduce reproductive success/cause injury through tourist boats steering too close;
due to the extent of vegetation loss the chances of successful recovery/restoration are low;
development of hydroelectric power schemes can result in reduction of forest areas/pristine areas of wilderness/disrupt migration patterns of some aquatic species/fish;
government has approved oil exploration in Icelandic waters potentially increasing use of non-renewable resources/unsustainable use of natural capital/risk of oil pollution/further emissions of greenhouse gases;
population has grown significantly since 1800/1900 resulting in greater use of natural resources/resulting in overfishing/overgrazing;
with high rates of vegetation/woodland loss the restoration costs are high with low probability of success;
use of herbicides to remove lupins may adversely affect non-target species/native species;
energy industry (including geothermal)/industrial processes still emits substantial amounts of the Iceland's greenhouse gases;

Opinion/Conclusion (1 mark):

Eg While Iceland has a high EF, it is actively working to reduce GHG by focusing on renewable energy and replanting forest/focusing on reducing soil degradation, and therefore can be considered as a role model of sustainability to other countries;
Despite aiming to use 100% renewable energy by 2050, Iceland cannot be considered to be a role model of sustainability for other countries because of its high EF and significant loss of forest that has reduced carbon dioxide sinks/stores and also accelerated soil erosion;
Iceland can be considered as being a model because sustainability is the responsible use and management of resources that allows natural regeneration and minimises environmental damage which is evident in how it deals with its energy requirements;

Iceland cannot be considered as a model of sustainability because this requires responsible use and management of resources that allows natural regeneration and minimises environmental damage and Iceland has poorly managed its land that has caused extreme soil erosion/significant loss of forests;

Note to examiners: An isolated statement/opinion, eg “Iceland is a role model for sustainability”, should not be considered as a valid conclusion. A valid conclusion may, however, be stated within the body of the response rather than at the end, and may involve some balanced decision.

Max 5 marks if there is no conclusion/opinion.

Accept other reasonable responses supported by information in the resource booklet.

[6 max]
