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MARKSCHEME

May 2013

ENVIRONMENTAL SYSTEMS AND SOCIETIES

Standard Level

Paper 2

Subject Details: Environmental Systems and Societies SLP2 Markscheme

Mark Allocation

Candidates are required to answer **ALL** questions in Section A *[25 marks]* and **TWO** questions in Section B *[40 marks]*. Maximum total = *[65 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 <u>underlined</u> 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.

SECTION A

1.   (a)   (i)   the Sun/solar energy/insolation;
wind;
Do not accept Coriolis Force or rotation of the Earth/heat or the moon/gravitation.   *[1]*

   (ii)   garbage/rubbish/trash overboard from ships/boats/vessels / garbage dumped at sea;
plastic pieces in sewage outfall;
river discharge/wind carries plastic waste;
shipwrecks/accidents;
garbage tipped/thrown into sea along beach/coastlines/urban runoff;
lost/thrown away fishing gear/drifting fishing net;
natural disaster *eg* tsunamis/storm surge/flood;   *[1 max]*
Award [1] for two of the above.

   (iii)   sample a number of/many/several places/quadrats/times within the GPGP;
collect garbage using a net/scoop/consistent known volume measure;
sample at a range of depths/in water column at the GPGP;
sample ocean floor for sunken plastic pieces;
weigh/measure volume of the plastic collected;
take the average/mean of the samples/quadrats;
calculate from the average/mean/sample the extrapolation/estimate for the whole area;
an estimate of the area of coverage/extent can be done from a plane/satellite (along with depth information);
Do not accept indirect methods for monitoring plastic in the oceans eg plastic on the beach or the contents of bird's stomachs. These give no indication of quantity.   *[3 max]*
Accept other reasonable responses.
Award [1] each for three of the above.

   (iv)   recycle/reuse/reduce use of plastic would immediately create less pollution;
but it is difficult to find other alternatives/lifestyles are suited to plastics;

use other materials (*eg* paper) which may break down more easily;
but paper may not be as effective in a range of uses/it can have other environmental/pollution effects;

stop plastic reaching the ocean by using filters on waste water;
but this is difficult to achieve due to non-point source pollution of plastic/hard to police;

removal of plastic from the oceans which reduces the long term impact;
but this may be too late/the damage has already been done/ it is difficult/expensive in the middle of the ocean;

economic incentives to use alternatives to plastic/fine polluters/plastic tax/energy tax;
but requires legislation/enforcement;

Describe/identify the strategy [1 mark] and then make a positive or negative evaluation [1 mark]. Two strategies needed so 2 + 2 marks. **[4 max]**
Accept other reasonable responses.

(b)   (i)   plastic pieces fill up stomach/digestive system reducing hunger/creating a feeling of satiation;
plastic pieces fill up stomach/digestive system so the gut can get blocked/damaged;
plastic pieces when eaten give no nutrients to the chick;
Do NOT accept: bird poisoned by plastic pieces inside it as this is not linked to starvation.   **[1 max]**

(ii)   because POPs are not biodegradable/are persistent/long lasting in the environment they are stored/accumulate in bodies / bioaccumulation;
animals at the top of food chain/web rely on eating animals that have each accumulated POPs themselves/*eg* one albatross eats many fish which may have eaten many plankton containing small amounts of POPs/small plastic pieces act as "chemical sponges" and absorb POPs, animals eating these also take in toxins/POPs;
because other biomass is metabolized/respired as it passes along the food chain the concentration of POPs increases;
so the concentration in the top organism is multiplied many times from the food it eats/biomagnification occurs;   **[2 max]**

(iii)   to identify species requiring some level of conservation/with concern about their conservation status/to catalogue (and highlight) those plants and animals that are facing a higher risk of global extinction/raise awareness;
Do not accept protect or conserve wildlife.   **[1]**

(iv)   eating plastic/poisoned/pollution from oil spills;
caught in the fishing nets/long line hooks;
habitat destruction/lack of nesting sites;
food limited/fish stocks reduced/overfishing;
change is distribution of food/fish as climate change occurs;
small populations interbreeding;
unable to find mates;
hunting/accidental killing of albatross by humans;
predation may be increasing due to human interference/natural disaster;
increase in species that compete for food with the albatross;   **[1 max]**
Award [1 max] for any two of the above. Pollution by itself is too vague/also air pollution is not likely over the open ocean so do not accept.

(c)   (i)   9 in 20 or 21 years / one every 2.2 or 2.3 years (except 2 years)/ one every 24 months / 0.45/0.5 event per year / *OWTTE*;

(ii) populations are larger/denser/more urbanised;
increased frequency over the last 30 years;
increasing intensity/duration and so impact more people;
initial environmental conditions are worse today, so the impact today
is larger / *eg*, in an already eroded area, drought/rainfall will have an
even greater effect;   *[2 max]*
Accept any other reasonable response.

(d) (i) carbon dioxide <u>and</u> water/ CO_2 <u>and</u> H_2O ;
Do not accept sun/solar or nutrients.
*Mark the **first** two items **only**.*   *[1]*

(ii) La Niña events;
global warming/climate change;
deforestation of the Amazon/fewer trees/less forest cover;
changes in local climate/microclimate;
fewer trees means less evapotranspiration/evaporation/transpiration to create
the local water/rain cycles;
both had exceptionally high temperatures which increased
evaporation/evapotranspiration rates;   *[2 max]*
Accept any other reasonable response.

(iii) *Do not accept vague statements like "pollution" "overpopulation" or activities that are not related to the carbon cycle, like "toxics released by industry" or related activities (garbage dumping) without appropriate connection to the carbon cycle.*
Award [1] for identifying human activity:
Eg Deforestation/slash & burn;

Award [1] for identifying change/deviation it causes in system:
Eg Decomposition/burning/reduction of C sink/absorption lead to increase of atmospheric CO2;

Award [1] for identifying feedback link accelerating initial change/deviation:
Eg Increase CO2 leads to climate change/warming so more forest fires/ decomposition of trees …so yet more CO2;
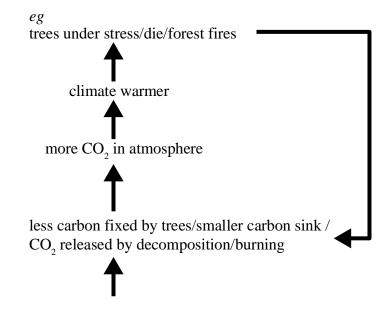
OR eg:

Burning fossil fuels releasing CO2;

Increase CO2 leading to higher temps/more droughts in Amazon and so death of trees;

Decomposition/loss of C sink/absorption …so yet more CO2;

Award [2 max] for diagrams that are unclear/incomplete/missing.
Award [1 max] when no human activity has been mentioned.

eg
trees under stress/die/forest fires

climate warmer

more CO_2 in atmosphere

less carbon fixed by trees/smaller carbon sink /
CO_2 released by decomposition/burning

trees felled/burned/slash and burn agriculture

[3]

(e) (i) trend up/upwards / increasing global mean temperatures since 1950 /
fluctuating up to about 1910 then slowly increasing / levels off in early 1950s; *[1]*

 (ii) may have used different techniques;
may have measured in different places;
may have interpreted the data in different ways/take averages differently;
Met office have used error bars or range and the others have not;
the early data may have come from limited equipment/technology *eg* pre 1900; *[1 max]*

SECTION B

General Essay Markscheme

Each essay is marked out of *[20]* of which *[2]* are for clarity of expression, structure and development of ideas.

> *[0]* Quality of expression, structure and development is poor.
> *[1]* Quality of expression, structure and development is limited.
> *[2]* Quality of expression is clear, structure is good and ideas are well developed.

*Candidates can use bullet-pointed lists in responses where these are appropriate eg for questions using command terms such as state and identify. However, for command terms such as discuss, compare and contrast, explain and evaluate, bullet points alone, without **any** evidence of a developed, logical line of reasoning, could gain no credit for EoI.*

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2. (a) growth in human population;
increase in affluence/wealth (resulting in more energy intensive lifestyles);
technological developments (*eg* increased use of electrically/ fossil fuel powered appliances/ machines);
increased travel (*eg* more air travel);
increased industrialization (especially in LEDCs);
increased international trade/globalization; *[3 max]*

(b) (i) *For explanations why some countries are trying to reduce their carbon dioxide emissions levels:*
Students could mention: political pressure, reduce pollution/global warming, green credentials, econ benefit of carbon credit, energy security/self-sufficiency.

increasing awareness/concern about the problems of global warming/climate change caused by greenhouse gas/carbon dioxide emissions;
honouring international commitments to reduce CO2;
so the country avoids penalties/inability to meet obligation;
gain economic benefit from carbon credits/carbon trading;
pressure from the population to be more carbon neutral/responding to ecocentric values nationally/globally;
to avoid rising costs of fossil fuels;
to maintain energy security/self-sufficiency;
Do not accept to reduce pollution on its own. *[2 max]*

(ii) *Achieved through use of:*
Award [2 max] for each way with a developed example.
national policies/legislation / international policy/treaties (way);
eg Kyoto Protocol/EU directives; (should be at country or local level and may demonstrate implementation of international policy/legislation)
eg change in building/building construction regulations to reduce energy use for heating or cooling;

eg developing a low carbon economy is one way of achieving sustainable development/aim for sustainable development;
economic instruments which reward carbon reductions/penalize carbon emissions(way);
eg tax carbon emissions;
eg reduced use of fossil fuels by increasing taxes/duty on fuel;
eg reduce individual car use in favour of lower emission forms of transport by increasing difficulty of using cars (*eg* increased cost of fuel and parking) and improving public transport (increased services, wider geographical coverage, park and ride facilities);
eg reduce air travel by increasing cost of travel (increase airport duties, increase fuel cost, removal of fuel subsidies);
Do not accept using catalytic converters as they do not decrease CO2.

run education campaigns/programmes to encourage changes in behaviour(way);
eg change a light campaign in the USA, replace incandescent bulbs with fluorescent bulbs;
eg recycle/charge/ban plastic bag use;
take public transport campaign;

energy conservation/efficiency (way);
eg modifying building to retain heat / home insulation in cold countries;
eg modify buildings to reduce heat absorption in warm countries;
eg use of more energy efficient appliances;
drive more fuel efficient cars/drive electric cars;

use of renewable sources of energy/reduced use of fossil fuels(way);

eg use of solar panels to heat buildings and water;
eg construction of nuclear power plants in France;
Do not accept just tidal/solar etc this is not enough for a mark.
Do not accept deforestation, this is not a carbon emission reduction.   *[6 max]*

(c) *Award [1 max] for two named countries with at least one valid energy choice **each** (reasons not necessary for this mark).*
Reasons may include:
Availability:
eg location (*eg* coastal for tidal/offshore wind / thin crust for geothermal);
eg topography (mountains/rivers for HEP);
eg geology (reserves of coal/oil/gas);
Economic:
High standard of living/technological development requires high capacity variety of sources;
National wealth may limit choice of affordable technology/resources;
Cultural:
countries may have strong historical traditions/value systems/international reputations to maintain;
historical events may influence decisions (*eg* countries experiencing nuclear disasters / oil embargoes;

Political:
countries may need to respond to changing values in their own population *eg* (rising ecocentrism);
countries may need to meet international agreements / maintain energy security;
technological:
tech development may make new choices available;
countries may or may not have tech expertise for certain choices;
*Award **[6 max]** for reasons valid for the countries identified. Award **[4 max]** if there is no clear links (of comparison or contrast between the countries).*   ***[7 max]***

Expression of ideas: ***[2 max]***

Total: ***[20]***

3.   (a)   anthropocentrism is people centred/attitude changing (value system)
          while technocentrism is technology centred (value system);   *[1 max]*

Anthropocentrism: [2 max]
people can manage environment in a sustainable manner;
regulation/policies can be used to manage use of natural resources/restrict
environmental damage;
economic/educational tools can be used to encourage sustainable behaviour;
population control seen as important as resource use;
problems solved via a wider consensus/ community participation;

Technocentrism: [2 max]
trust in science/technology to provide solutions to environmental
problems;
seeks for scientific analyses/understanding of issues (rather than
more political/socio-economic);
technological evaluations/solutions need to be limited to experts (so
exclude the wider community);   *[4 max]*

(b)   *Award [1 max] for any suitable definition of sustainable development.*
       eg sustainable development is development that meets current needs without
       compromising the ability of future generations to meet their own needs;

Candidates may approach this in a number of ways eg using case studies or
specific value systems like deep ecologist/environmental manager to structure
their answer.

eg Anthropocentric: [3 max]
agreement/cooperation/mutual consensus about resource use;
giving legal rights to local people would raise their ecological awareness and urge
them to actively protect the environment / *eg*,
local people gain income by adjacent National Parks or peasants owning the land
they cultivate;
strong regulation of development/Governments impose appropriate economic
incentives or counter-incentives towards sustainable goals;
eg the various permit trading schemes like Australia's carbon pricing scheme or
Acid Rain Program of USA / or the various green/carbon taxes/fees;
Offer compensation offered (by governments or NGOs) to people afflicted by pro-
sustainability regulation / *eg*, compensate shepherds for sheep being eaten by
wolves that were re-introduced in the vicinity;

eg Technocentric: [3 max]
technological solution to environmental degradation/resource shortage through
substitution/pollution clean-up/non-polluting solutions;
understanding the environment can enable humans to manipulate it and still
provide for future generation;
transnational corporations will be able to provide sustainable development with
technology changes as market forces drive economic growth;

eg Ecocentric: [3 max]

minimal disturbance of natural processes/resource use so minimal impact of development;

takes a holistic approach towards sustainable development / integrates spiritual, environmental and social aspects which should minimise resource use;

believes overconsumption of resources/materialism is wrong and unsustainable;

limits over-exploitation and environmental degradation;

but the problem is that self imposed restraint on resource use restricts development/economic growth;

Please note that the [6 marks] can be gained from two value systems and the definition.

[Max 3] for whole question if only 1 value system is mentioned.

Credit the use of case studies that contrast the value systems of differing societies.

Do not credit the same points in (b) as given in (a) *[6 max]*

(c)   *Award [1 max] for a named intergovernmental organization **and** a named non-governmental organization.*
eg United Nations Environment Programme (UNEP) and World Wide Fund for Nature (WWF)/Greenpeace;
Accept other examples, you may need to check online.

Responses should include a comparison/similarity and a contrast of the two organizations. Similarity (s) difference/contrast (d)

Eg use of media:
Non-governmental organization (NGO) can mobilize public protest to put pressure on governments (d);
Intergovernmental organization Control /works with media (at least one TV channel propagates the official policy in even the most democratic regimes) so communicates its decision/attitudes/policies more effectively to the public (d);
Non-governmental organization (NGO) gain media coverage through variety of protests (*eg* protest on frontlines /sabotage) sometimes access to mass media is hindered (especially in non-democratic regimes) (d);
Intergovernmental organization and NGOs provide environmental information to the public of global trends, publishing official scientific documents and technical reports gathering data from plethora of sources (s);

Eg speed of response:
Intergovernmental organization slow to respond – agreements require consensus from members (d);
Non-governmental organization (NGO) fast to respond – usually its members already have reached consensus (or else they wouldn't have joined in the first place) (d);
Intergovernmental organization directed by governments, so sometimes may be against public opinion (d);
Intergovernmental organization can be bureaucratic and take time to act (d);

Eg diplomatic constraints/ political influence:
Intergovernmental organization decisions can be politically driven rather than by best conservation strategy (d);
NGOs can be idealistic/driven by best conservation strategy / often hold the high moral ground over other organizations/may be extreme in actions or views (d);

Eg public image:
Non-governmental organization (NGO) are organized as businesses with concrete allocation of duties (d);
Both lead and encourage partnership between nations and organizations to conserve and restore ecosystems and biodiversity (s);
NGOs can be confrontational/radical approach to an environmental issue like biodiversity (d);
Intergovernmental organizations like to cultivate a sober/upright/measured image based on scientific/businesslike approach (d);

Eg Legislation
Intergovernmental organization Enforce their decisions via legislation (may even be authoritarian sometimes) (d);
Non-governmental organization (NGO)serving as watchdogs (suing government agencies/businesses who violate environmental law) (d);
Both seek to ensure that decisions be applied (s);

Eg Agenda:
Intergovernmental organization provide guidelines and implement international treaties (d);
Non-governmental organization (NGO)use public pressure to influence national governments / lobby governments over policy/legislation (d);
both may collaborate in global, transnational scientific research projects (s) ;
NGOs buy and manage land to protect habitats, wildlife *etc.* (d);
both may provide forum for discussion (s);

Eg funding:
Intergovernmental organization fund environmental projects by monies coming from national budget (d);
Intergovernmental organization usually manage publicly owned lands (d);
NGOs fund environmental projects by monies coming from private donations (d);

Eg extent of influence geographically:
Intergovernmental organization monitor regional and global trends (s) NGOs also monitor/research species and conservation areas at a variety of levels (s);
NGOs focus more on local and/or national information, aiming at education – produce learning materials and opportunities for schools and public (d);
[3 max] for each factor.
If only comparisons or only contrasts are given in the whole answer then [6 max].   *[8 max]*

Expression of ideas: *[2 max]*

Total: *[20]*

4. (a) biotic are living/biological components of the environment which influence/affect an organism/ecosystem;
abiotic are non-living factors which influence/affect the organism/ ecosystem;
abiotic *eg* rainfall, temperature, sunlight and biotic *eg* predators eat prey;
biotic is living and abiotic is non-living;
[1 max] if a statement says biotic is living and abiotic is non-living.
*Award [1 max] for correctly identified examples of **each** type.* **[2]**

(b) *Award [1 max] for a named extinct species (world) or a species extinct in a clearly stated specific geographical area (eg Sumatran rhinoceros in China/white Rhino in Uganda).*

low species number could lead to non-viable population/reduced successful breeding/small gene pool;
habitat degradation/fragmentation/loss *eg* logging could lead to loss of food and shelter;
increased competition/predation/disease due to human interference (*eg* invasive/non-native species) or environmental change (*eg* natural disasters);
natural hazards *eg* volcanoes/wildfires can reduce species numbers and habitat;
pollution can degrade the habitat *eg* greenhouse gas and global warming could reduce habitat range in Arctic regions for polar bears;
pollutants can bioaccumulate *eg* some pesticides can biomagnify up the food chain especially affecting successful breeding of species high in the food chain;
hunting/overfishing by humans can reduce breeding numbers;
If no named extinct species or an incorrect species do NOT award mark for this part. [4 max] for the extinct species and reasons.

Interventions to improve conservation status (these need not be linked to the named species above):
eg legislation to stop/reduce hunting;
international agreements to control trade in endangered species eg CITES;
policing and enforcement of legislation/controls (*eg* hunting ban);
legislation to reduce pollution;
community involvement/education/awareness could improve value placed on species;
improved land management/restoration could reduce habitat degradation/fragmentation/loss;
captive breeding/re-introduction programmes could increase numbers;
gene/seed bank to store genetic material to allow for later reintroduction;
setting up a national park/nature reserve;
effective reserve/national park design/management (includes corridors/size/shape/edge effects *etc*);
[6 max] for interventions.
Accept other reasonable responses. **[8 max]**

(c) (i) *Range of goods (G) and services (S) provided should be discussed in the context of the named ecosystem.*
eg in a tropical forest in Amazonia (no mark awarded for the named ecosystem)
mahogany provides building materials but this must be sustainably done (G);
Brazil nuts provide food but only in a natural forest (G);

plants and animals provide medicines *eg* Rosy Periwinkle but potential medicines will be lost with deforestation (G);
Natural forests help prevent soil erosion (S);
evapotranspiration in the tropical rainforest creates a local water cycle/is a climate stabiliser (S);
Forest trees replenish oxygen and absorb the CO2 moderating global warming (S);
Amazon provides amenity value/ecotourism attraction which is used to fund conservation efforts/ to provide a sustainable income to local communities (S);
The Amazon is home to many indigenous peoples providing cultural/spiritual value to them (S);

eg in a coral reef in Australia/Mozambique.
coral rubble provides building materials but this must be sustainably done (G);
curios/jewellery/live fish and plants for the aquarium trade must be carefully taken to ensure sustainability (S);
reef fish provide food to local communities but only grow in a thriving coral reef (G);
plants and animals provide medicines like cancer cures but potential medicines will be lost with coral destruction (G);
coral reefs help protect the shore from erosion (S);
coral reefs are a nursery for many ocean species helping maintain global biodiversity (S);
coral reefs provides amenity value/ecotourism attraction which is used to fund conservation efforts/ to provide a sustainable income to local communities (S);
coral reefs surround many small island nations/indigenous peoples providing cultural/spiritual value to them (S);   *[6 max]*
Award up to 3 max for examples of goods or services that are simply identified/named. To gain full credit there needs to be some development/discussion of identified goods and services, similar to marking points above.
The goods and services must be for human use. So biodiversity is too vague unless linked to medicines, food or tourism for example.

(ii) without economic valuation, services provided may be ignored by decision makers;
valuation allows for a comparative measure *eg* value against income generated from building roads through woodlands;
difficult/impossible to objectively quantify aesthetic/intrinsic value;
ideologically, need to move away from economic/monetary value and be guided by intrinsic value in nature;
organisms have rights like humans and no price is attached to human life;
Award marks for argument for either case or both cases.
Do not award a mark for just a simple "yes" or "no" response rewording the question.
Award marks for argument for either case.   *[2 max]*

Expression of ideas: *[2 max]*

Total: **[20]**

5.   (a)   *point source:*
          the release of pollutants from a single, clearly identifiable site/localised/easily
          monitored;
          non-point source:
          the release of pollutants from numerous, widely dispersed origin/hard to monitor;

          Point source is pollution from a single source whereas non-point is from multiple
          sources;
          point is pollution from a clearly identified/localised source whereas non-point is
          from widely dispersed sources;
          WTTE;
          Award 1 max for correctly identified examples of each pollution type. The example
          must be detailed enough. For example point source example: chimney or factory is
          too vague.   **[2 max]**

      (b)   *Solutions must be linked to a named problem to gain a mark. P = problem, S =*
          solution.
          milk lakes and grain mountains caused by agricultural policies like subsidies (P);
          remove subsidies and mass agriculture will reduce, creating less environmental
          pressure (S);
          eg increased use of pesticides can lead to death of non target species/loss of
          biodiversity/contamination of the environment (P);
          build up of pesticide resistance (P);
          health impacts on farmers exposed to toxic chemicals (P);
          reduce pesticide use by only targeted/selective use (S);
          use of integrated pest management (S);
          use of natural predators to reduce pest numbers (S);
          eg increased use of fertilizers can result in leaching of nutrients into nearby
          watercourses resulting in eutrophication (P);
          reduce application of fertilizer (S);
          control timing/location of fertiliser application;
          use of riparian/wetland vegetation as filter/buffer;

          eg contamination of waterways with silage/slurry, leading to low oxygen levels
          within rivers (P);
          also results in low water clarity and reduction in photosynthesis (P);
          improve management of slurry through containment/treatment (S);
          keep livestock away from rivers/streams (S);
          use buffer zones around watercourse to filter any potential pollutants (S);
          eg treatment of livestock can lead to antibiotics and other drugs entering the food
          cycle (P);
          reduce use of antibiotics and drugs and only use when necessary (S);

          intensive land use can lead to desertification (P);
          increased soil erosion due to unsustainable farming techniques (P);
          afforestation/wind breaks/shelter belts/bunds(S);
          improve land drainage / irrigation (S);
          enrich land with compost/organic material/manure (S);
          reduce stocking rates (S);

(some consider) GM crops have potential to cross pollinate with native species/lead to "superweeds" (P);
improve knowledge and understanding of use of GM crops / monitor and research impacts of GM (S);
control/ban use of GM crops until better understood (S);
cross pollination of "organic" crops with GM crops, may revoke a farmer's organic certification (P);
eg use of fossil fuels in farm machinery/fertilizer manufacture leads to increase in carbon emissions (P);
use renewable sources of energy (S);
use more organic fertilisers/less artificial (S);
make farm machinery more energy efficient (S);

eg loss of biodiversity due to monoculture (P);
monoculture can increase risk of losses from pest damage disease (P);
manage by diversification /rotation of crops (S);   *[10 max]*
Accept any other reasonable examples.
Award [1 mark] for each problem and [1 mark] for each solution linked to a problem. Do not give marks for solutions that are not linked to problems and award [5 max] if no solutions are included.

(c)   *Ecological footprint:*
the area of land and water required to support a defined human population at a given standard of living;
the measure takes account of the area required to provide all the resources needed by the population, and the assimilation of all wastes / *OWTTE;*
Award [1 max] for an understanding of the concept of EF.
Responses should demonstrate understanding of the concept of sustainability when applied to freshwater water use. A case study can be used but the link to the ecological footprint should be clear.

Sustainability in a freshwater resource requires use of water at a rate below the rate of replenishment/input/rainfall/supply;
The EF model uses a given population's rate of water use to predict the (local) area required to sustainably supply water;

If the ecological footprint is greater than the area currently available to the population, this shows the resource use (freshwater water) is un/not sustainable (s);
The model therefore shows sustainability or unsustainability (s);
The model is useful as it measures the current rate of water use and the local rate of replenishment (s);
The EF model is not ideal for assessing sustainability of water resources (w);
because the model is based on an area and water supply is not closely related to area/the water area may be large but the quantity/renewal rate may be low (w);
water availability/replenishment can vary seasonally/with climate change/pollution levels, the model cannot easily accommodate this (w);
models (generally) simplify complex systems/involve assumptions/inaccuracies (w);   *[6 max]*

*Award [4 max] for whole question if **only** strengths (s) or **only** weaknesses (w)
are discussed OR the answer does not address freshwater resources.*

Expression of ideas: *[2 max]*

Total: *[20]*