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Markscheme

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Environmental systems and societies

Standard level

Paper 1

11 pages

1. Tropical Rainforest
Cerrado / savanna / tropical savanna
Caatinga / thorny shrub
Pantanal / (periodically) wet land
Atlantic Rainforest / tropical semi-deciduous forest
Pampas / grassland **[1 max]**

Accept any two responses from above.
*Award **[1]** for two correct responses and **[0]** for one correct response.*
Do not accept only "rainforest".

2. (a) climate differences in insolation/rainfall/temperature has led to greater biodiversity in Atlantic Rainforest;
more diverse/complex habitats in Atlantic Rainforest than Cerrado / Atlantic Rainforest has more niches / Atlantic Rainforest also includes coastal habitats;
Atlantic Rainforest may have greater variation in elevation resulting in a wider range of habitats;
greater loss of biodiversity in Cerrado due to deforestation/logging/agriculture expansion/cattle ranching expansion/slash and burn clearance/urban expansion/mining activity/hunting/human impact;
habitats in Cerrado less resilient to external factors *eg* climate change/pollution;
habitats in Atlantic Rainforest may have been surveyed more fully than habitats in the Cerrado; **[2 max]**

Response must be clear which site has higher/lower biodiversity or where there is greater biodiversity loss to be credited. Response must state specific location.
Do not accept the difference in biodiversity is due to the Atlantic Rainforest being further along the process of succession/near the coast/contains many rivers.

(b) high number of endemic/unique species;
high number of species / species richness / high biodiversity / major portion of World's biodiversity;
under high threat from human activity/logging/over-hunting/habitat destruction;
these regions contain multiple ecosystems;
regions provide economic benefits/natural capital (*eg* tourism/education/food);
regions provide ecological services (*eg* as a carbon sink/flood control/production of oxygen);
these regions have intrinsic value/existence value; **[2 max]**

Do not accept "ethical reasons" as this is too vague.
Do not accept "aesthetic value" without reference to its use eg tourism/recreation.
Do not accept only "these areas contain species that are classified as endangered/threatened / cover a large area".

3. reduction in population size;
population size / numbers of mature individuals / number of individuals able to reproduce;
geographical range / area of occupancy (*ie* where species are normally found) / extent of occurrence (boundary line that can be drawn around sites that the species occupies);
reduction in number of locations (the species is found in);
degree of fragmentation (*eg* via road or urban development);
quality of habitat / loss of habitat / habitat degradation;
probability/high risk of extinction; **[2 max]**

Do not accept "availability of food/water/shelter".
Do not accept "deforestation/hunting/low reproductive potential/habitat threatened" unless a link is made to the IUCN factors, as listed above.

4. an ideal flagship species (has a wide appeal to the public);
conserving this species will (result in habitat protection that will) also protect other species;

eg Golden tamarin:
potential attraction for eco-tourism;
as a primate it is closely related to humans/easy for humans to empathize with;
it has a human-like face / it is cute/cuddly/aesthetically attractive;
not found anywhere else / unique to Brazil (unlike other three species);
highly suitable for publicity/fund raising (*eg* posters/soft toys);

eg Brazilian merganser:
is critically endangered (most under threat and therefore needs conservation measures more quickly than the other organisms);
may attract many tourists/bird watchers/ornithologists;
appearance may be considered aesthetically attractive;

eg Broad-snouted caiman:
potential attraction for eco-tourism;
it is a predator and its loss could negatively impact other/keystone species;

eg Giant metallic ceiba borer:
may be a keystone species / its loss could impact on other species;
IUCN Red List status has not been assessed and therefore we should be cautious and ensure that it is not lost;
it is shiny which could be considered aesthetically attractive; **[2 max]**

*Award **[0]** if any plant species is used, or if an animal not listed above is used as an example.*
Accept any reasonable responses.

5. (a) (natural increase $= \frac{(14.46 - 6.58)}{10}$) $= 0.788\% / 0.79\% / 0.8\%$;
7.88 per thousand; **[1 max]**

Correct units (% or per thousand) are required to be credited the mark.

(b) migration/emigration; **[1]**

6. initially the population will continue to grow rapidly;
…because there are still a significant number entering child-bearing age;
however, because the base of pyramid is decreasing/there are fewer children;
…this suggests fewer will be entering fertile bracket in future;
…lower birth rate;
…which will lead to slower growth rate;
…fertility rates may fall below replacement levels / reduction in fertility rates;
increasing proportion of higher age / in future an aging population (over 65 years old);
…the average age of the population will increase / higher median age of population;
…will lead to a larger senior dependency ratio;
a greater number of people in working age group (16–65 years old);
…compared to children (0–16 years old) will improve dependency ratio;
Brazil is at stage 3 and is moving to stage 4;
…will lead to a more stable population / equal proportion in each age group / birth rates are equal to death rates; **[3 max]**

Accept any other reasonable suggestions.

7. deforestation / habitat fragmentation / loss of terrestrial habitat / loss of habitat due to flooding / increase in aquatic habitat;
change from a lotic/moving/river water ecosystems to a lentic/still/lake aquatic ecosystem;
loss of species/biodiversity;
change in habitat may favour different/invasive species;
interference of natural flow of water/hydrological cycle /change of flow downstream which affects downstream species/communities/environment;
loss of flow of sediments downstream affecting river/coastal erosion / makes downstream/coast more prone to soil erosion;
loss of homes/displacement of communities when land is flooded;
homes/communities/land downstream can be protected from flooding;
loss of fish species due to interference with fish migratory route;
stabilize local temperatures and increase precipitation/rainfall;
reduction in use of fossil fuel (to generate electricity) resulting in reduction of GHG emissions / less dependency on non-renewable energy sources;
water from dam may cause seismic movement/earthquakes;
loss of carbon sink (as a result of deforestation) / potential release of methane/carbon dioxide (from decomposition of organic matter/trees within lake); **[2 max]**

Accept any other reasonable suggestions.
Do not credit only "habitat loss" without reference to the cause (eg flooding / land clearance) or type of habitat lost (eg terrestrial/land/wetland/aquatic).
Do not credit "some loss of river system" without reference to loss of habitat/ecosystem/biodiversity.
Do not credit only "reduction of air pollution/pollution/emissions from combustion of fossil fuels / pollution from dam construction / impact on ecosystems".

8. (from figure 7(b) GDP increase of approximately 260 % (range 250–275 %) over 22 years, therefore average annual increase $= \frac{260\,\%}{22}$)
= 11.8 %; **[1]**

Accept increase of GDP between 11–13 % annual.
Correct units (%) are required to be credited the mark.

9. (a) the amount of grain production has significantly increased over time / the amount of grain produced has increased almost 4-fold / from about 50 million tonnes to about 200 million tonnes over 24 years;
whereas the amount of land used to grow grain has only increased slightly/from about 30 million hectares to about 50 million hectares;
the increase in land used is not proportional to the increase in grain production / grain production is independent to harvested area / there is no relationship between grain production and land harvested / grain production has increased more rapidly than harvested area;
there is a (slight/small) positive relationship/correlation between the amount of land used and amount of grain produced / crop production increases (to some extent) with the amount of land used; **[2 max]**

If quantification is used the units should be correct, ie either in thousand thousand/million hectares/tonnes.

(b) intensification of farming methods/technological improvements that does not increase amount of land used to grow more crops / more efficient land use leads to increase in crop production;
increase in use of fertilizers to increase crop production;
increase in irrigation to increase crop production;
use of pesticides to reduce crop losses to pests or reduce competition;
growing pest resistant plants resulting in higher yields;
use of crop varieties (genetically modified organisms GMOs) that produce high yields / high yielding varieties HYV;
use of crops that grow more quickly allowing multiple harvests;
increase in mechanization allowing greater speed of planting/harvesting crops reducing crop losses;
increase in number of times crops are planted in a year; **[2 max]**

Do not accept "more land available, the more grain can be produced" as it does not address the large increase in crop production.
Method must relate to increase in crop production.
Accept any other reasonable suggestions.

10. (a) biofuel crops can be used to absorb carbon dioxide;
biofuels produce less greenhouse gases (when burnt) compared to fossil fuels/oil/petrol/gas;
use of biofuels is carbon neutral / carbon dioxide released during combustion is equal to the amount of carbon dioxide absorbed during plant growth (stage of biofuel production);
due to efficiency of biofuel production, further land clearance is not required, potentially protecting carbon sinks/forests;
production of biofuels may release less emissions than extraction and production of fossil fuels;
use of biofuels can reduce/replace use of fossil fuel (a non-renewable resource) / biofuels can replace use of fossil fuels in vehicles;
it can reduce the amount of carbon dioxide entering the atmosphere from storage; **[4 max]**

(b) producing biofuels can conflict with production of sufficient food supply (for growing population) / reduce land used for food production / can reduce food production/availability of food;
…leading to more food being imported / this can elevate cost of food, (particularly impacting on the poor) / cause food shortages / it could lead to famine;
production of biofuels can use limited resources *eg* water for irrigation;
…this can result in water shortages/insufficient water for other uses;
adoption of intensification of farming practices can lead to greater use of fertilizers and pesticide;
…this can result in greater pollution of the environment *eg* nutrient run-off can cause eutrophication / use of pesticides can cause death of non-target species;
increasing amounts of land are required for growing biofuel crops;
…this can result in loss of habitats for native species/loss of biodiversity/land clearance can lead to soil degradation;
biofuels can be expensive;
…therefore less likely to be used;
growing crops for biofuels usually involves monocultures that reduces diversity;
…monoculture system is less resilient / high risk of crop failure; **[2 max]**

Only one limitation should be credited.
*For **[2]** the limitation and its impact must be explained.*
Do not accept that burning biofuels still releases carbon dioxide as net increase compared to use of fossil fuel is still reduced.
Accept any other reasonable suggestions.

11. ecological footprint increasing over period suggests they are moving toward unsustainability;
biocapacity decreasing over period suggests they are moving toward unsustainability / Brazil is living unsustainably (using resources at a rate that is not replenishable) resulting in a decline in the biocapacity / if the line for biocapacity and ecological footprint meet/crossover it suggests unsustainability;
rate of decrease in biocapacity is falling/stabilizing toward end of period suggests they may remain/be moving towards being sustainable;
the Brazilian population/government will need to reduce their ecological footprint to sustain biocapacity;
ecological footprint being lower than biocapacity suggests population is sustainable; **[2 max]**

Do not accept only "current ecological footprint is unsustainable".
Do not accept "steady ecological footprint is sustainable", as a stable ecological footprint is not necessarily a sign of sustainability.
To be credited the mark the response must link to sustainability.

12. *Evidence **[4 max]**:*
the population is stabilizing which will benefit the environment;
they are employing mitigation strategies that will address issue of global warming / climatic change;
they are improving efficiency of food production limiting area of environment impacted / small increase in amount of arable/agricultural land;
a high proportion of renewable energy/biofuel/hydropower is used that could reduce emissions of GHGs/global warming;
a high proportion of renewable energy/biofuel/hydropower is used that could reduce use of fossil fuels/non-renewable resources/non-renewable natural capital / rapid increase in number of cars using flex fuel / reducing number of petrol/gasoline cars;
Brazil has adopted energy efficiency methods/policies;
compared to other countries, Brazil still has a relatively low proportion of developed/arable land;
NGOs and other organizations are supporting conservation projects (restoring habitats / encouraging sustainable use of forest resources) in the Atlantic Rainforest;
Brazil has maintained a relatively low/stable ecological footprint (despite increase in GDP);

*Limitations **[4 max]**:*
population is not yet stabilized so demands on environment still increasing/urban growth continues;
there are still a significant number of threatened species / high biodiversity loss;
there is still land clearance/deforestation for sugar cane/coffee/soy bean/biofuels/commercial logging/urban growth/urban development/infrastructure development/mining;
the conversion of agricultural land to growing crops for biofuels is causing problems with sufficient production/availability of food;
pollution from mining/manufacture of goods/oil production/commercial agriculture;
high proportion of renewable energy still comes from hydropower that impacts environment;
energy consumption continues to increase;
decrease in biocapacity suggests unsustainable practices / degradation of natural resources / depletion rates are greater than rates of growth / increase in ecological footprint suggest greater use of resources/unsustainability;
Brazil has large number of cattle that leads to high production of methane;
there are still gasoline only cars in use / there has been a reduction in/there are no ethanol only vehicles;

*Opinion/conclusion **[1 max]**:*
there are clear indications in a number of areas that Brazilians are currently taking global warming very seriously / valuing environment over development;
despite the results of this survey, there are clear indications that Brazilians are not taking global warming seriously / there is clear evidence that Brazilians are not valuing the environment over development;

[6 max]

*Award **[5 max]** if there is no opinion/conclusion.*
Accept other reasonable responses supported by information in the resource booklet.
An isolated statement/opinion eg "Brazil is concerned about the environment" should not be considered a valid opinion/conclusion without supporting evidence.