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MARKSCHEME

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ENVIRONMENTAL SYSTEMS

Standard Level

Paper 3

9 pages

SECTION A

Matrix should be ticked (checked) with the ecosystem that the candidate has studied. No marks given for this (or removed if not completed), but candidates should answer in relation to system indicated. If no system indicated, make very sure answers are consistent.

Also no mark awarded for naming an organism but answers must follow on.

1. (a) Species named should be non-motile / not be able to move about and distributed 2-dimensionally *[1]* (*e.g.* most terrestrial rooted plants / barnacles).
Accept trees.   *[1 max]*

(b) The percentage of quadrats / squares / samples *[1]*; in which the species is present *[1]* / how often the species is found present *[1]*; expressed as a percentage *[1]*.   *[2 max]*

(c) 19 or 20 *[1]*; because more would not give a different / more reliable result *[1]* / less would give a less reliable result *[1]*.   *[2 max]*

(d) Fluctuations would increase *[1]* / fluctuations would continue for a greater number of quadrats *[1]* / the amplitude of the fluctuations might decrease (as the number of individuals within each quadrat would be reduced).   *[1 max]*

Accept any reasonable suggestion supported by logical argument.

(e) Name appropriate herbivore for laboratory study (*common or scientific names acceptable*) *[1]*;
measurements: mass of herbivore at start and finish of experiment *[1]* / dry mass equivalent for this species *[1]*; dry mass of food eaten *[1]* / dry mass of food given minus food remaining *[1]*; dry mass of faeces *[1]*.

If the words "dry mass" are not used, deduct [1].

(For other approaches to gain credit, they must lead to productivity in terms of dry mass or energy, not numbers of organisms.)   *[4 max]*

(f) *Allow [1] for factor and [1] for effect*
e.g. temperature *[1]*; increase leads to increased productivity *[1]* / *e.g.* water availability *[1]*; increase leads to increase in food so increase in productivity.   *[2 max]*

(g) *Method [2]; evaluation [1]*
e.g. temperature – use of thermometer *[1]*; at regular intervals *[1]* / repetition of readings *[1]* / take mean value *[1]*;
evaluation – reliability *[1]* / range appropriate *[1]* / validity of sampling points *[1]* / adequate numbers of sampling points *[1]*.

Allow for any method appropriate to factor indicated.   *[3 max]*

SECTION B

2.   (a)   Population **B**: as ecological footprint is smaller than population *[1]* / are living sustainably *[1]*.   *[1 max]*

(b)   *Award [1] for each two correct items.*
Per capita CO_2 production / *per capita* land requirement for absorbing waste CO_2 from fossil fuels / rate of absorption of CO_2 by local vegetation per unit area / *per capita* food consumption / rate of food production locally per unit area / population number.

(If candidate states total population CO_2 production and food consumption, then population number is superfluous.)

Other correct answers are acceptable but those above are on syllabus.   *[2 max]*

(c)   *Any two of:* lower latitudes – higher net productivity in local vegetation – so smaller ecological footprint for the same CO_2 output *[1]* / low latitudes may provide better conditions for food production – so smaller ecological footprint to supply same food production *[1]* / higher latitudes have lower temperatures – greater need for energy sources – greater CO_2 wastes – larger ecological footprint *[1]*.   *[2 max]*

(d)   Population **A** *[1]*;
because it takes a greater area than that available to sustainably supply its resources *[1]*.   *[2]*

(e)   (i)   *Allow any two of:*
one population might use intensive farming techniques *[1]* / monoculture *[1]* / use of fertilisers *[1]* / pesticides *[1]*.

Allow for ECF from (a) and (d).   *[2 max]*

(ii)   intensive farming techniques would lead to greater food production per unit area *[1]*; so smaller footprint *[1]* / eating more food or more meat would require more agricultural production *[1]*; so larger footprint *[1]* OWTTE.   *[2 max]*

(f)   *Sustainability up to [2]*
fossil fuel use is unsustainable as a non-renewable resource *[1]* / as rate of consumption > rate of renewal *[1]*;
hydroelectricity – sustainable as replenishable *[1]* / water cycle continues through input of solar energy *[1]*;

Impacts up to [2]
fossil fuels – CO_2 release increases global warming *[1]* / SO_x and NO_x causing acid rain *[1]* / NO_x causing ozone depletion *[1]*;
hydroelectricity – building of dams floods and destroys ecosystems *[1]* / reduces downstream flow rates *[1]* / reduces downstream flood plains *[1]* / blocks fish migration *[1]*.   *[4 max]*

3.   (a)   Biodiversity is the variety of forms of life on earth *[1]*; encompasses species, habitat and genetic diversity *[1]* / generic term for the abundance of and number of species on earth.   *[2 max]*

(b)   Habitat diversity – if the habitat is destroyed, there is nowhere for the species to live *[1]* / conservation of habitats leads to conservation of species and genetic diversity *[1]*.   *[1 max]*

(c)   (i)   Disturbance by humans reduces habitat diversity *[1]* / habitats lost as humans clear vegetation / build cities *[1]*;
most live in temperate forest zone so most disturbed here *[1]* / most disturbed is temperate forests *[1]*; – logged and cleared by humans for last few thousand years *[1]* / most converted to crop land *[1]*;
diversity much reduced as habitats lost *[1]*;
tropical rainforest highest diversity *[1]*; as least limiting factors *[1]*;
most threatened at present *[1]*;
desert and tundra have lower diversity as conditions more limiting *[1]*;
tundra least threatened at present *[1]*; desert nearly half disturbed.   *[6 max]*

(ii)   *Accept any appropriate argument for any of the four ecosystems.*
e.g. tropical rainforest – under most pressure from humans in clearing and burning the forest *[1]*; highest species diversity / many ecological niches *[1]*;

e.g. desert - productivity easily damaged *[1]*;
long recovery time *[1]* / more disturbed areas *[1]*.   *[2 max]*

(d)   *For named example award no marks, but award [1] for each valid reason up to [2].*
e.g. Dodo – ground-living / tame so vulnerable / small total population / hunted by sailors as food.   *[2 max]*

(e)   *e.g.* World Heritage sites to protect habitats such as south-west Tasmania / coastline of north-east England *[1]*; education of the public by conservation organisations – WWF publicising pandas *[1]* / any valid example *[1]*.   *[2 max]*

4.   (a)   Non-point source as pollutant drains through soil into water bodies *[1]* / mixes with other pollutants *[1]*; is untraceable to a particular source *[1]* / blown by wind over large area *[1]*.

Allow marks for a reasoned argument for a point source e.g. a single nozzle spray and a contact pesticide [2]   *[2 max]*

(b)   (i)   Because the carnivorous birds consume the insecticide in their food *[1]*; the insecticide becomes more concentrated in their bodies / causing decreased birth rates *[1]* / interference with breeding (shells weakened) *[1]*. Carnivorous birds may feed on insect eating birds *[1]*; decline in these → less food for carnivores *[1]*.   *[2 max]*

(ii)   Insecticide targets insects so insect-eating birds get more insecticide *[1]* / food is scarcer *[1]*.   *[1 max]*

(c)   (i)   By measuring relative abundance of species *[1]*; variety of species present *[1]* / named species *[1]*; and relative tolerance / sensitivity of those species present *[1]* / can estimate the impacts of pollution on biotic components *[1]* / needs a baseline survey *[1]*.   *[3 max]*

(ii)   Identify a number of sampling sites above and below point of discharge *[1]*; carry out standardised sampling for aquatic organisms at the sites *[1]* / e.g. Surber sampler / kick samples *[1]* / identify all species in samples *[1]*; find the group sensitivity / tolerance to which they belong in the biotic index *[1]* / count number of individuals per species *[1]*; calculate biotic index from data *[1]* / compare sites up and downstream from discharge *[1]* / examples of organisms / biotic indices *[1]* .

Allow measurement of faecal bacteria (or similar) *[1]*.   *[4 max]*

(iii)   *Any one of:* turbidity / oxygen concentration / suspended solids / temperature / nitrogen / phosphate *[1]*.   *[1]*

(d)   *e.g.* electric vehicles *[1]*; limited range *[1]* / limited to towns *[1]* / heavy batteries need recharging frequently *[1]* /
e.g. LPG / alcohol *[1]*; cost of conversions *[1]* / lack of infrastructure to deliver it *[1]*.   *[2 max]*