INTERNATIONAL BACCALAUREATE
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MARKSCHEME

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ENVIRONMENTAL SYSTEMS

Standard Level

Paper 3

1. (a) (i)   name ecosystem *e.g.* mangrove, temperate forest, lake or more specifically [1];
               Describe technique [1] /
               e.g. light and dark bottle technique for aquatic plants [1] covered and uncovered
               quadrats for terrestrial [1];
               NPP = GPP - R [1];
               dark bottle / covered plot gives losses from respiration, light bottle / uncovered plot
               gives respiration losses and photosynthetic gains [1]   *[4]*

        (ii) *Allow any reasonable explanation* [1], *e.g.*
              method to increase photosynthetic rate [1] / - increase light / carbon dioxide levels [1] /
              add fertiliser [1] / remove vegetation to reduce NPP [1] / spray with herbicide or other
              agrochemicals [1]   *[1]*

    (b) (i)   measure gross secondary productivity by food eaten - faeces [1]; measure net secondary
               productivity by increase in biomass over time [1];
               name organism and some detail of technique *e.g.* silkworms, weigh at start, feed
               known weight of food, collect and weigh faeces, reweigh silkworms [1]   *[2]*

        (ii) *Accept any reasonable answers, allow [1 mark] per point*
              e.g. not measuring dry weight /
              some individuals may die and not be included at end /
              may not collect all waste   *[3]*

    (c)   name two ecosystems (general - *e.g.* desert, temperate forest, or specific) [1] / *Do not have to*
          be the same as in 1(a)(i)
          e.g. desert and tropical rain forest [1];
          desert - low rainfall, high temperature and insolation [1] /
          photosynthesis limited by lack of water [1];
          so low NPP [1];
          TRF - high rainfall, temperature and insolation, [1] /
          high photosynthetic rate but also high respiration [1];
          so generally high NPP [1]   *[5]*

Total 15 marks

2.   (a)   (i)   motor vehicles   *[1]*
         (ii) total population
               [1 mark] for both correct answers.

     (b)   (i)   x 11 (accept x 10-12)   *[1]*
           (ii) x 4 (accept x 3-5)   *[1]*

     (c)   (i)   *Accept any valid points with explanation* **[1]** *e.g.*
               •   increase in consumption of petrol (gasoline) - increase in lead, nitrogen oxides
                   and other car-exhaust gases / increase in traffic congestion / destruction of
                   habitats from freeway (motorway) construction **[1]**;
               •   increase in demand for power / electricity for cities - increase in carbon dioxide
                   levels / increased global warming **[1]**;
               •   increase use of fossil fuels - search for these in more extreme environments /
                   pollution of the seas **[1]**;
               •   increase in use of renewable energy sources - improved technology / more wind
                   farms / more efficient use of energy **[1]**;   *[4]*

           (ii) *Accept any valid points with explanation* **[1]** *e.g.*
               •   intensification of agriculture - increased use of fertilisers / pesticides /
                   environmental consequences **[1]**;
               •   increased pressure on marine resources - possible collapse of fisheries **[1]**;
               •   use of alternative food sources - plant versus animal protein **[1]**;
               •   increase in area under cultivation - resultant dangers of increase in salinity in
                   irrigated areas / removal of forests **[1]**;   *[4]*

     (d)
               •   ecological footprint concept - needs of urban population for food, oxygen, energy,
                   water, recreation, waste disposal use far more land and resources than the area of the
                   city **[1]**;

               Then any **three** valid points, *e.g.*
               •   pollution of water by sewage / runoff from roads / buildings / industrial waste **[1]** /
               •   lead pollution from motor vehicles **[1]** /
               •   clearance of forest / natural vegetation for agriculture / housing / industry **[1]** /
               •   environmental damage from recreational use **[1]** /
               •   construction of dams, reservoirs / tapping of aquifers for water supply **[1]** /
               •   atmospheric pollution / smog / haze over a large area **[1]**   *[4]*

                                                                                              Total 15 marks

3. (a) separation of two populations by a barrier they cannot cross so gene pools are isolated [1];
different populations are subject to different natural selection pressures as their habitats are
slightly different so genetic drift occurs in each population [1];
differences increase with time so that if populations are reunited, isolation mechanisms may
act to stop interbreeding [1] /
mechanisms may be mechanical (reproductive parts different), behavioral, temporal (mating
seasons different), ecological or gamete incompatibility, hybrid infertile or inviable [1].   *[3]*

(b) (i) the more land area protected, the fewer endangered species [1] /
the less land area protected the more endangered species [1].   *[1]*

(ii) *Accept any 2 reasonable factors. e.g.*
high biodiversity in tropics / Indonesia and Brazil [1] / more species exist in the tropics
[1];
Brazil and Indonesia are much larger countries and have more species [1]
greater threats in Indonesia and Brazil due to forest clearance [1]   *[2]*

(c) (i) extinct - species not definitely located in the wild during the past 50 years [1]   *[1]*

(ii) *Accept any reasonable explanation up to [2 marks]. e.g.*
first need to identify species - many have not been named or even found [1];
difficulty in finding species - particularly if small / microscopic / in remote areas [1]   *[2]*

(d) (i) endangered - species in danger of extinction and whose survival is unlikely if the
causal factors continue operating. [1] (May already be extinct now but seen in last 50
years.)   *[1]*

(ii) Habitats have been destroyed so unlikely that population numbers will increase [1];
Species numbers may be so low that the gene pool is too small for a breeding
population [1];
Any reasonable comment [1]   *[2]*

(e) named species [1];
(Either extinction or recovery are acceptable.)
consideration of some of the social, political and economic pressures [1];
ecological aspects [1] /
methods used to increase numbers / reintroduce [1]   *[3]*

Total 15 marks

4. *[CATs convert carbon monoxide to carbon dioxide; nitrogen oxides to nitrogen and oxygen; hydrocarbons to water and carbon dioxide. They increase fuel consumption and carbon dioxide levels and are ineffective until the engine warms up.]*

(a) (i) carbon monoxide, hydrocarbons, nitrogen oxides, lead [1] (as cannot be used with CATs)
Allow [1 mark] for 3 or 4 of the above, 0 marks for 2 or less.

(ii) particulates - [1]   *[2]*

(b) diesel engines / industry [1];
irritant to respiratory tracts [1]; block respiratory surfaces of invertebrates [1] / cover foliage so reduce photosynthesis [1]   *[3]*

(c) biogas use - energy in homes and is obtained from composting / [1];
methane used for heat / cooking in industry or home from land fill sites [1];
alcohol used to power motor vehicles (mixed with petrol to get gasohol) from fermenting plant material (- sugar cane in Brazil) - and distilling it to get alcohol, [1];

Advantages - renewable sources [1] / less pollution from their combustion [1];
Disadvantages - difficult to collect and need transporting from site of production to site of use [1] / alcohol from *e.g.* sugar cane would need large land area for crop [1] / cost of converting / building machines to run on these new fuels [1].   *[5]*

(d) (i) abundance of species [1]; diversity of species [1]; tolerance of species to pollution [1]
Any two of these.   *[2]*

(ii) position quadrats [1]; along a transect at right-angles to road [1]; identify all species in the quadrat [1] / record abundance of each [1] / use data to calculate biotic index [1].   *[3]*

Total 15 marks