INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

MARKSCHEME

May 2000

ENVIRONMENTAL SYSTEMS

Standard Level

Paper 3

1. *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.

(a) Up to ***[3]*** for: names of predators ***[1]***/ herbivores ***[1]***/ food sources ***[1]*** (note a plant obtains nutrients from soil, *etc.*)/ disease organisms ***[1]***/competitors ***[1]***;
Up to ***[2]*** for: interrelationships such as that between disease and predation; predation and food supply ***[2]***;
Not all links need to be discussed; full marks could be obtained with detailed discussion of one or two. ***[5]***

(b) identification of trophic levels ***[1]***; arrows correctly shown ***[1]***; names of six organisms ***[1]***; clear diagram ***[1]***. (Marks for six organisms - *i.e.* five plus the "named" organism - allowed.) Note: Sunlight is not an organism. ***[4]***

(c) measure out area ***[1]***/ harvest method ***[1]***; collect and weigh material ***[1]***/ air dry where appropriate ***[1]***/ allowances for underground material *etc.* ***[1]***; for certain organisms collect and weigh sample and determine number per unit area ***[1]***/ calculation of result ***[1]***.

In the case of an animal: catch and count ***[1]***/ weigh organisms ***[1]***/ kill organisms and dry tissues ***[1]***/ or (with ethical considerations in view) obtain values for water content from published source ***[1]***. ***[3]***

(d) measure out area ***[1]*** collect and weigh at start… and end of season ***[1]***; allowances for respiration/predation/herbivory/underground material ***[1]***;
dark and light bottle method where appropriate ***[2]***; calculation of result ***[1]***.

In the case of an animal: weigh amount of food eaten by animals ***[1]***/ weigh amount of faeces produced ***[1]***/ obtain caloric value for tissues ***[1]***/ by experiment (calorimeter) or from published source ***[1]***. ***[3]***

2. (a) Up to ***[2]*** for: Describe: steady increase from zero in 1916 to peak in approx. 1935 ***[1]***; thereafter decline to 1963 ***[1]***/.
Intermediate short-term declines ***[1]***/ very approx. 'J' curve ***[1]***;
Up to ***[2]*** for: Explain: rapid increase in exploitation of new resource ***[1]***../… or possible increase in population ***[1]***; decline due to unsustainable harvesting ***[1]***/intermittent short-term declines due to WWI ***[1]***/Depression of 1930s ***[1]*** WWII ***[1]*** stock almost exhausted by 1960s ***[1]***. ***[4]***

(b) One of each for both marks.
Advantages: source of protein ***[1]***/ source of oils and vitamins ***[1]***/ waste materials can be used for fertilisers or feedstock for animals ***[1]***/ some kinds of fish (at least formerly) relatively cheap ***[1]***.
Disadvantages: overfishing depletes resources ***[1]*** (*e.g*. North Sea)/ interferes with natural food-chains ***[1]*** (reduction of albatrosses)/ many non-target organisms killed ***[1]*** (seabirds, dolphins)/ other interference in marine environment ***[1]***/ uses a lot of energy in relation to food obtained (*i.e.* high level of energy subsidy) ***[1]***/ now quite expensive in some cases ***[1]***. ***[2]***

(c) Systems – *e.g*. prairie cereal farming and subsistence cereal growing in SE Asia; salmon farms and subsistence fishing; or any comparable alternatives ***[1]***;
Efficiency in terms of costs/ energy/ other inputs ***[1]***;
Inputs of energy (electricity, fuels, chemicals, feedstock – 'energy subsidy') ***[1]***;
Outputs of energy (heat, crops, reusable materials) ***[1]***;
Relationship of length of food-chain to energy-flow ***[1]***;
Impacts on environment: pollution/ nutrient build-up/eutrophication/ waste production/ use of land/ amenity (smells *etc.*) ***[1]***;
Allow for reasonable alternatives. ***[6]***

(d) Represents possible cheap source of protein ***[1]***;
Extra link in food-chain so wasteful ***[1]***/ loss with each trophic level ***[1]***/ "10% transfer rule" ***[1]***/ better to use the fish protein directly ***[1]***/ energy required in processing ***[1]***; may be non-sustainable ***[1]***. ***[3]***

3. (a) (i) Northern Andes ***[1]***

(ii) Amazon Basin ***[1]***

(iii) Overall figures are high ***[1]***/ high productivity ***[1]***…/… and structural complexity of tropical ecosystems ***[1]***;
Northern Andes high biodiversity due to genetic isolation on mountain summits and in remote valleys ***[1]***/ range of environments due to altitudinal variation ***[1]***/ Amazon Basin a relatively homogeneous environment ***[1]***;
Any reasonable alternative. *[Must have something more than 'tropical forest ecosystems are complex' for both marks.]* ***[2]***

(b) (i) A species of organism, of which numbers are so low that there is a likelihood of its becoming extinct in the near future/owtte ***[1]***; named species ***[1]***;
[IUCN definition = taxa in danger of extinction and whose survival is unlikely if causal factors continue operating. Includes taxa with numbers at a critical level; those with drastically reduced habitats; and those not seen in the wild in the past 50 years.] ***[2]***

(ii) Any three of: small numbers ***[1]***/ restricted distribution ***[1]***/ complex migration patterns ***[1]***/ complex breeding cycle ***[1]***/ reduced habitat ***[1]***/ low rate of reproduction ***[1]***/ hunting pressure ***[1]***/ economic value ***[1]***/ or reasonable alternatives. ***[3]***

(c) Any 3 ways with examples ***[1]*** each, *e.g.*
Protective legislation (koala in Australia in early 20th century) ***[1]***;
International treaty (CITES) (Green Amazon parrots) ***[1]***;
Breeding programmes (numbats in Australia/pandas) ***[1]***/ protection of habitats (whooping crane in USA) ***[1]***;
Any reasonable alternative
(2 ways, but no examples = ***[1]****)* ***[3]***

(d) Natural selection = a mechanism of evolution ***[1]***/ caused by removal of ill-adapted individuals and survival of those adapted to the environment ***[1]***; evolution in long term → biodiversity by filling available niches ***[1]***; isolation (cutting off islands/ formation of mountains *etc.*) separates populations ***[1]***/ changing environment may create isolated populations ***[1]***/ climatic change may trigger adaptation to new conditions ***[1]***. ***[3]***

4. (a) (i) measuring something affected by pollution rather than measuring the pollution itself ***[1]*** owtte. ***[1]***

(ii) Site A has almost no organisms associated with well oxygenated water, but very large numbers of chironomids/tubificid worms able to tolerate low oxygen levels ***[1]***;
Site B has good numbers of mayfly, caddis larvae, beetles, and even a few fish, associated with high oxygen levels ***[1]***;
max ***[2]*** for descriptions;
Input of sewage (or similar waste) near site A causes abundance of nutrients (especially N and P)/ … → eutrophication ***[1]***/ → oxygen depletion ***[1]***; turbulence of stream/ dilution by incoming tributaries… allows oxygenation ***[1]***/ .. so site B has higher oxygen levels/
The few chironomids/tubificids at site B may be brought downstream by current ***[1]***. ***[4]***

(iii) Any 3 of: N/ P/ pH/ turbidity/ temperature/ current speed / sunlight / salinity / any reasonable alternative, ***not*** *oxygen*. ***[1]***

(b) Allow ***[1]*** each for 3 measures and extra ***[1]*** for more details.
remove heavy metals ***[1]***/ separation of slurry ***[1]***/ oxygenate artificially ***[1]***…/ .. by pumping in air ***[1]***/ separate out industrial waste at source ***[1]***/ pump effluent elsewhere – into sea or underground ***[1]***/ regular monitoring ***[1]***/ any reasonable suggestion. ***[4]***

(c) Allow ***[1]*** for mention of baseline study and ***[2×2]*** for consideration of use of glasses and ceramic mugs versus plastic cups.
Baseline: evaluation of present situation. ***[1]***;
costs of washing and drying ***[1]***/ energy costs of washing and drying ***[1]***/ replacement costs of items stolen or broken ***[1]***/ amount of detergent used in washing ***[1]***/ environmental impact of detergent in effluent ***[1]***/ quantity of water used ***[1]***/ energy costs in manufacturing ***[1]***;
Alternative: financial cost of plastic cups ***[1]***/ how many? ***[1]***/ energy cost of manufacturing cups ***[1]***/ and of transport from factory to school ***[1]***/ use of non-renewable resources in manufacture ***[1]***/ disposal of plastic cups/ if burnt → air pollution, dioxins ***[1]***/ are they biodegradable? ***[1]***.
Or alternative valid points. Note: this is a techniques question and a simple account of the advantages and disadvantages of plastic cups is not what is required. ***[5]***