Multiple choice questions

1. If two populations separated by a physical barrier could potentially and successfully interbreed then they are classified as

   A. Two different species
   B. One species
   C. Two sub-species
   D. Two groups

2. Which of the following are maintained in an ecosystem by nutrient cycling?

   I Nitrates

   II Carbon

   III Energy

       A I only

       B 1 and II only

       C I and III only

       D I, II and III

3. Which statement best describes the role of plants and algae in an ecosystem?

   A. All are autotrophs
   B. Most are symbionts
   C. All are producers
   D. Most are autotrophs

4. In what form is energy lost from the ecosystem?

   A. Egestion
   B. Light
   C. Excretion
   D. Heat

5. In aquatic ecosystems, which are the main carbon sources for photoautotrophs?

   I Carbon dioxide

   II Carbonate ions

   III Hydrogen carbonate ions

   IV Glucose

       A I only

B II and III only

C I and III only

D I, II and IV only

6. Food chains have rarely more than 5 levels. What is the major factor that restricts the length of food chains?

A. Energy loss at each trophic level
B. The size of top carnivores
C. Food availability
D. Predation

7. Which unit is most commonly used to measure annual carbon fluxes?

A. Tonnes
B. Grams
C. Gigatonnes
D. Megatons

8. Methane gas is

I Produced by methanogenic archaens

II Is oxidised to carbon dioxide and water in the atmosphere

III Is produced by marshes and waterlogged soils

IV Is a contributor to the greenhouse effect

A 1 and III only

B II and IV only

C I, II and III only

D All of the above

9. Which of the following has been the most important cause of the increase in greenhouse gases in the atmosphere in the last 200 years?

A. Logging and deforestation
B. Agricultural livestock
C. Nuclear reactors
D. Combustion of fossil fuels

10. Which of the following are affected by changing concentrations of greenhouse gases?

I Global temperatures

II UV light incidence on the surface of the earth

III Climate patterns

A II only

B 1 and II only

<mark>C I and III only (an increase in oxone would affect UV reaching Earth's surface but ozone concentrations have been relatively stable over recent years)</mark>

D I, II and III

Structured answer questions

11. Explain why an ecosystem has the potential to be sustainable over a long time period.

(3 marks).

(Providing there is) a continual energy source

Recycling of nutrients/nutrient availability

Removal of toxins

Food chains/webs/saprotrophs/biotic components

(Natural) balance between the biotic components

12. Discuss why sustainability is important in human activities and give an example of one way in which sustainability can be promoted. (3 marks).

Availability/exhaustion of resources

Increasing demand/population

Renewable/sustainable resources

Legislation/education/subsidies/other relevant example

13. Explain why mollusc and corals are important in the formation of limestone. (2 marks).

They have a calcium carbonate shell / hard parts

It can become fossilised into limestone

14. Outline whether a plant-based diet could to some extent aid in alleviating the problem of world hunger (2 marks)

Humans as vegetarians would be eating as primary consumers/2nd trophic level

There is more energy available at this level / less at higher levels

This would feed a larger world population

15. By means of a specific example, describe what is meant by the term carbon flux. (3 marks).

Transfer of carbon from one pool to another (1 mark)

Example and explanation of flux e.g. photosynthesis, carbon dioxide to organic carbon/other relevant example (2 marks) e.g. fossilisation, combustion, respiration etc.

16. Detritivores and saprotrophs both obtain energy from detritus and decaying organic matter. What is the main difference in the manner in which they obtain nutrients? (2 marks)

Detritivores use internal digestion / ingest the organic matter

Saprotrophs use external digestion / release enzymes into the matter

17. Consider the following data (source Ministry of the Interior, Greece)

Emissions by years for NATIONAL TOTAL for CO_2 in Greece (in Gigagrams)	
1996	89,041
1997	93,637
1998	98,289
1999	97,594
2000	103,429
2001	105,506
2002	105,504

There is a general increase in emissions from 1996 to 2001. Suggest a reason why the figures from 2001 to 2002 do not follow this trend. (2 marks).

Suggestion 1 mark, reason 1mark

Legislation/lower car usage

Warmer winter temperatures/less fuel usage

Other relevant example

18. Outline why increased concentrations of dissolved carbon dioxide in marine environments are a threat to coral reefs. (2 marks)

Carbonate ions required for skeletal growth

Increased carbon dioxide levels lead to decreased carbonate levels (in marine environments)

Increased carbon dioxide causes the pH to become lower (more acidic)

Dissolution of shells

19. In the pyramid of energy shown below, 1cm represents 6000 kJ/m^2/yr

    1. Calculate the energy present at the second trophic level. (2 marks).

The length of the second trophic level bar is 5.9cm (+/- 0.5cm depending on the printer settings)
This is multiplied by 6000 kJ/m^2/yr - this is the scale of the graph

5.9 x 6000 = 34800 kJ/m^2/yr (accept 31000 to 39500 because of measuring uncertainty).

Units needed.

    2. Explain the use of the unit kJ/m^2/yr to represent the energy at a trophic level. (2 marks).

Per square meter/area

Per annum/time

    3. List three ways in which energy is lost in passing from the first to second trophic levels

Heat

Respiration

Egestion / excretion

Death and decay

    4. Using the data present in the pyramid of energy, explain why the population of tertiary consumers would be expected to be small. (3 marks)

At each trophic level energy levels fall

90% lost per level

Small amount of energy left at quaternary (4th) level

Low biomass/large organisms

20. A species of buttercup (A) is thought to be able to accumulate nickel in its tissues. A comparable species (B) is not an accumulator.

Species A therefore may be useful for removing nickel pollution from the soil.

Each species of buttercup were seeded into two separate plots, one of which had previously been treated with 3g of nickel sulphate per square meter. Watering and other variables were controlled in all the plots.

A month after germination, the populations were counted using quadrats of $1m^2$ and the following results were obtained:

Species	Untreated plot	Treated plot
A	486 plants in 6 quadrats	608 plants in 8 quadrats
B	584 plants in 8 quadrats	115 plants in 5 quadrats

1. Calculate comparable results and a suitable unit for the plant population in the two plots (2 marks)

   2 for correct figures for each species

Species	Density of plants in the Untreated plot. Plants/m^2	Density of plants in the treated plot. Plants/m^2
A	81	76
B	73	23

2. Suggest a hypothesis to explain the difference in populations of the two species in the treated and untreated plots. (2 marks).

   Species A resistant to/can accumulate/Nickel non-toxic/Null hypothesis no difference in population

   Species B not resistant to/cannot accumulate/ Nickel is toxic

3. Complete the table for each plant and perform the X^2 test to test whether there is a significant difference in the populations of species A in the two plots measured, one untreated and one treated with Nickel sulphate. (5 marks)

Species	Observed density (O)	Expected density (E)	(O-E)	(O-E)^2	(O-E)^2/E
A in untreated	81	78.5	2.5	6.25	0.08
A in treated	76	78.5	-2.5	6.25	0.08

   Expected value is average of 81 + 76 - assuming no difference in density (Null hypothesis).

   Sum (O-E)^2/E = 0.08 + 0.08 = 0.16

   1 mark for each correct column, 1 for correct sum (ignore significant figures)

4. The 0.05 (5%) significance level for X^2 for 1 degree of freedom is 3.85. What can you conclude from your result? (2marks).

X^2 (Chi-squared) value is lower than significance level / there is no significant difference between these results;

Null hypothesis accepted / species A is not affected by nickel pollution / tolerant of nickel pollution.