**Test Review**

1. Which is an example of negative feedback?

A. Loss of vegetation leading to soil erosion leading to further loss of vegetation.

B. A decline in a large predator population after they have eaten most of their prey population.

C. Melting of permafrost in the tundra due to climatic change leading to further release of methane, causing further change.

D. Unsustainable slash and burn agriculture practices in tropical rain forests.

2. A lake with a stream flowing into it, but with water lost only by evaporation, is an example of a system which is

A. isolated.

B. stable and closed.

C. unstable and closed.

D. open.

3. Inputs to a closed system may be

A. matter only. B. energy only.

C. matter and energy. D. heat only.

4. The capacity of a system to self-regulate is generally increased by

A. the presence of positive feedback.

B. the presence of negative feedback.

C. low energy inputs in the system.

D. energy outputs greater than energy inputs in the system.

5. What do outputs from an open system consist of?

A. Energy only

B. Matter only

C. Energy and matter

D. Neither energy nor matter

6. Which of the following best describes the result of positive feedback in a system?

A. The system changing further in the same direction

B. The system remaining stable

C. The system changing in the opposite direction

D. The system remaining unchanged

7. How are the flows and storages of matter and energy generally represented in flow diagrams?

|  |  |  |
| --- | --- | --- |
|  | **Storages** | **Flows** |
| A. | arrows | boxes |
| B. | circles | boxes |
| C. | boxes | arrows |
| D. | boxes | circles |

8. Which statement best describes the second law of thermodynamics?

A. In all ecosystems, energy is neither created nor destroyed, but it may be converted from one form to another.

B. Energy cannot leave a system.

C. The entropy of a system always remains constant for a spontaneous process.

D. In any isolated system entropy tends to increase spontaneously.



9. The diagram above is an example of

A. steady state equilibrium.

B. positive feedback.

C. negative feedback.

D. static equilibrium.

10. Over a long period of time, energy input to a system is

A. always equal to energy output.

B. usually greater than energy output.

C. always greater than energy output.

D. always less than energy output.

11. “The change in a system’s internal energy is equal to the energy absorbed by the system minus the energy released into its surroundings.”

This statement best illustrates

A. the law of conservation of mass.

B. the first law of thermodynamics.

C. the second law of thermodynamics.

D. the third law of thermodynamics.

12. Which of the following is a transfer process / are transfer processes?

I. Deposition of sand by waves on beaches

II. Organic matter entering the ocean

III. Decomposition of organic matter at the bottom of a lake

IV. Run-off of water from land to rivers

A. I and IV only

B. III only

C. I, II and IV only

D. I, II, III and IV

13. Which row shows how energy and materials move through each type of system?

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Isolated System** | **Closed System** | **Open System** |
| A. | energy flows through system | materials flow through system | energy flows through system |
| B. | energy does not enter system | materials flow through system | energy does not leave system |
| C. | energy does not leave system | energy flows through system | materials flow through system |
| D. | materials do not leave system | energy flows through system | materials do not leave system |

14. (a) Define the term *feedback*.

the return of part of an output of a system (or subsystem) as an input,  
so as to affect succeeding outputs *OWTTE*

(b) Explain, with the help of an example, the term *negative feedback* in relation to an ecosystem.

*Answers must have a definition, some explanation of negative  
feedback and an example (which need not be as detailed as that  
below) to achieve full marks.*

*negative feedback*:  
feedback that tends to damp down, neutralize or counteract any  
deviation from an equilibrium and promotes stability/*OWTTE*;

*example*:  
increase in number of predators (*e.g.* owls) → decrease in small  
mammals (*e.g.* mice, voles, shrews) → increase in small  
mammals → increase in predators;

*explanation*:  
understanding of ecological relationships/processes;**3 max**

*For the final mark the answer must show some understanding of  
ecological relationships or processes, such as predation, disease,  
breeding success. This material may be incorporated in the  
example. Some or all of the information may be given in the  
form of a diagram.*

15. The diagram below shows storages (in percentage of total water) and flows in the global water cycle. The rates of flow are given in 1015 kg yr–1.



1. Name a storage of water in the biosphere that is not shown in the diagram, and explain how water is transferred in and out of this storage.

Vegetation/plants/animals/organisms/biomass/soil water ***[1]***;  
Appropriate mechanisms for transfer ***[2]***/  
*e.g.* organisms – water enters by absorption through roots or  
digestive system ***[1]***;  
water leaves by transpiration or excretion (sweating, urination) ***[1]***.**max 3**

1. (b) State briefly **one** way in which one of the other flows in the diagram might change if evaporation rates were to increase.

Condensation/precipitation/run off/groundwater flow would  
increase (because of extra water in atmosphere) ***[1]***

**Or:** run off/groundwater flow would decrease (because of  
extra evaporation from warmer surfaces)

16. (a) State the first law of thermodynamics.

energy is neither created nor destroyed/energy is  
conserved/*OWTTE*;

(b) Calculate the amount of energy output in the model below.



1000 kJ – 100 kJ (10%) = 900 kJ;  
output = 900 kJ – 135kJ (15%) = 765kJ

17. The figure below shows a model of the climatic system.



[Source: O’Hare and Sweeney, *The Atmospheric System*, (1986), Oliver and Boyd, page 189]

(a) Define the term *model*.

a simplified description of reality;  
designed to show the structure or workings of an object, system or concept;...

1. Evaluate the strengths and limitations of the model in the figure above for describing the atmospheric system.

*strengths:*it stresses the interactions (feedback) within the system;  
represents the complex atmosphere as a system with inputs, outputs  
and transfers;  
*Accept other reasonable strengths*.

*limitations:*nature of the interactions is not really shown;  
some categories are too broad to be helpful *e.g.* atmospheric circulation;  
some interactions are not shown;  
relative importance of different parts of the system not shown;**4 max***Answer must refer to both strengths and limitations for full marks.*

18. Below is a diagram from UNESCO showing relationships between development, the environment and health.



[Source: Sustainable development spirals, United Nations Environment Programme]

(a) State, giving **one** reason, what kind of system feedback is illustrated by the descending spiral.

positive feedback because the effects of the problem make the  
problem worse; **1***Award* ***[0]*** *if no reason is given for positive feedback.*

(b) Discuss the meaning of the term *sustainable development* with reference to the diagram above.

traditionally defined as development which meets the needs of the  
current generation without compromising ability of future generations  
to meet their own needs;  
but in this context it suggests development which has a positive  
role in enhancing the environment;  
and is dependent in some way on a healthy population;**2 max***Accept any other reasonable responses.  
Award* ***[1 max]*** *if no reference is made implicitly or explicitly to  
figure 2.*

(c) Evaluate the strengths and limitations of the models shown in the diagram above.

simple, easy to see the connections;  
shows clearly how actions in one area can have a knock-on effect  
on the original development;  
can distinguish between positive and negative actions and  
consequences;  
but far too simple, detail of what constitutes sustainable as opposed  
to inappropriate development is not clear;  
exact natures of the causal relationships are not explained;**2 max***Award* ***[1]*** *for a strength and* ***[1]*** *for a weakness.*

19. The Gaia Hypothesis proposes that our planet functions as a single organism that maintains conditions necessary for its survival by feedback mechanisms. It was formulated by James Lovelock in the mid-1960s. In his recent book *The revenge of Gaia*, he suggests that we have passed the “tipping point” on global warming and that feedback mechanisms will speed up the rate of global warming.

(a) State what type of system the Earth is and what the inputs and outputs are

Earth is a closed system;  
inputs – solar radiation/Sun’s energy/light and output – heat energy;  
materials recycled within the system/matter recycled (may discuss  
space ships and meteorites moving a small amount of matter in and out);

(b) Scientists use computer simulations to model the effects of changes in the temperature of the Earth. Discuss the advantages and disadvantages of this modelling.

*advantages*: ***[2 max]***allows us to predict;  
simplifies complex systems;  
can change inputs and see what happens;  
can show them to others;  
*Accept any other reasonable suggestions.*

*disadvantages*: ***[2 max]***not accurate;  
rely on the expertise of the people making them;  
on validity of input data;  
different people interpret them differently;  
can be hijacked politically;**4 max** *Accept any other reasonable suggestions.*