

1. A [1]
2. D [1]
3. B [1]
4. D [1]
5. D [1]
6. B [1]
7. (a) (i) diatoms / (other) algae 1
- (ii) trout 1
- (b) nutrients are recycled in a food web and energy enters and leaves/is not recycled; nutrients are recycled by saprotrophs/returned to environment and reused; while energy (enters as light and) is dispersed as heat; 2 max
- (c) (the shape of pyramid) shows energy lost from base to top of pyramid/80 to 90% lost at each trophic level; (because) energy is used/released through cell respiration/heat/metabolism/movement (at each trophic level); not all tissues are eaten *i.e.* bone/hair/cellulose/excretion/undigested/die (so energy is not available for next trophic level); 2 max [6]

8. (a) 166 mg m^{-2} (Allow answers in the range of $162\text{--}168 \text{ mg m}^{-2}$)
1

(b) rapid rise and fall between April and August;
peak in May/June;
fluctuates between August/September and December;
low December/January until February/March;
cyclical; 2 max

(c) negative relationship / during period of defoliation, biomass
(of terrestrial invertebrates) is at its lowest;
less leaves means less food/habitats / easier for predators to
see invertebrates;
defoliation occurs in winter/autumn and the cold may kill
invertebrates; 2 max

(d) (aquatic invertebrate flux) decreases because movement to the
forest has occurred (by adult forms) / fewer aquatic invertebrates
left in the stream so fewer are moving;
fluctuation due to movement of different species/different life
cycles/second generation;
decreases because invertebrates left at the beginning of
winter/cold season;
(adult forms) move to utilize (changes in) food supply in forest; 2 max

[7]

9. (a)

exponential/rapid growth phase labelled/highlighted properly; (*accept log phase*)
transitional/slowing phase labelled/highlighted properly;
plateau/no growth phase labelled/highlighted properly; (*accept stationary phase*)
carrying capacity/K drawn and labelled as a parallel line to
x-axis at plateau level; 4 max

- (b) *Accept examples of the points below, provided that the terms underlined are clearly identified. Accept only named examples (Latin or common names) from natural ecosystems only. Do not award marks for general names such as “fish” or “tree”.*

food chain shows transfer of nutrients/energy in an ecosystem /
arrows from one trophic level to the next in examples;
between different trophic levels / shown in a correct chain or web;
starting with a producer;
followed by at least two levels of consumers / shown in a correct
chain or web;
food web is the (branched) interaction of multiple food chains /
cross arrows in examples;
using (multiple) producers as a source;
transferring nutrients/energy to consumers from different food chains;
same consumer could be at different trophic levels in a food web;

6 max

- (c) *Award [2 max] from the following list of greenhouse gases:*

water vapour;
carbon dioxide;
methane;
oxides of nitrogen;

all (of these gases) occur naturally;
and human activity has increased the normal level of these gases in
recent years;
incoming shorter wave radiation from the Sun;
is re-radiated as longer wave radiation/infrared;
(mainly) in the form of heat;
captured by greenhouse gases;
which increases the atmospheric/ocean temperature;
at a higher rate than normal / creating a positive imbalance;
which threatens ecosystems/climatic patterns/ocean patterns;
Earth's history had many fluctuations in gas levels/global
temperature / some scientists are skeptical about enhanced
greenhouse effect;

8 max

(Plus up to [2] for quality)

[20]

10. (a) Award [1] for each of the following shown on a diagram of the carbon cycle.
Award [5 max] for points not shown on a diagram.

The following show carbon which is static within the cycle at this point in time.

carbon dioxide in air/water;
(sugars/carbon compounds in) plants/producers;
(carbon compounds in) animals/consumers;
(carbon trapped in) coal/oil/gas/fossil fuels;

The following should show arrows in direction of carbon flow.

carbon dioxide absorbed by plants/producers and used in photosynthesis;
carbon dioxide released by (cell) respiration in plants/producers;
plants/producers eaten by animals/primary consumers/herbivores;
primary consumers eaten by secondary consumers;
carbon dioxide released by (cell) respiration in animals/consumers;
plants/animals die and are decomposed by (saprotrophic) bacteria/fungi;
carbon dioxide released by combustion of coal/oil/gas/fossil fuels;
carbon dioxide released by (cell) respiration in bacteria/fungi/decomposers;
forest fires/combustion releases carbon dioxide from trees/plants;
carbon dioxide emitted by volcanoes;

9 max

- (b) diagram of food chain showing at least three organisms and two linkages with arrows showing direction of energy flow;
trophic level is a step/position in the movement/flow of energy through an ecosystem;
(in a field situation) observe which organisms eat each other;
producer/name from example (first trophic level) does not eat other organisms/captures energy through photosynthesis;
primary consumer/name from example (second trophic level) feeds on producers;
secondary consumer/name from example (third trophic level) feeds on primary consumers;

4 max

Since the command term is explain, the answer must be explicit to gain marking points d–f. Named examples for producer and consumers in diagram or explained example must represent a coherent food chain. Reject chains using general names such as fish or tree or grass. But, accept sardine or oak.

- (c) measure production of oxygen;
because oxygen is a by-product of photosynthesis;
example of technique for measuring oxygen production (count bubbles/use sensors/other);
measure uptake of carbon dioxide;
because carbon dioxide is used during photosynthesis;
example of technique for measuring carbon dioxide production (sensor, aquatic pH shift);
measure biomass of (batches of) plants;
increase in biomass gives (indirect) measure of rate of photosynthesis;
Since the command term is explain, reasons must be given to receive full marks.

5 max

(Plus up to **[2]** for quality)

[20]