



Additional Assessment Materials  
Summer 2021

Pearson Edexcel GCSE in Biology (1BI0)  
Higher

Resource Set Topic 9: Ecosystems

Questions

(Public release version)

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## General guidance to Additional Assessment Materials for use in 2021

### Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

### Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

- 4 Since 2003, in France, people have been buying Siberian chipmunks as pets but then releasing them into the wild when they are no longer wanted.

They are now classified as an invasive species.

Figure 7 shows a Siberian chipmunk (*Tamias sibiricus*).



© 2011, Søren Brøndum Christensen

**Figure 7**

- (a) Siberian chipmunks eat acorns which, are the seeds of oak trees.

In Siberia, the natural predators of Siberian chipmunks are wild dogs.

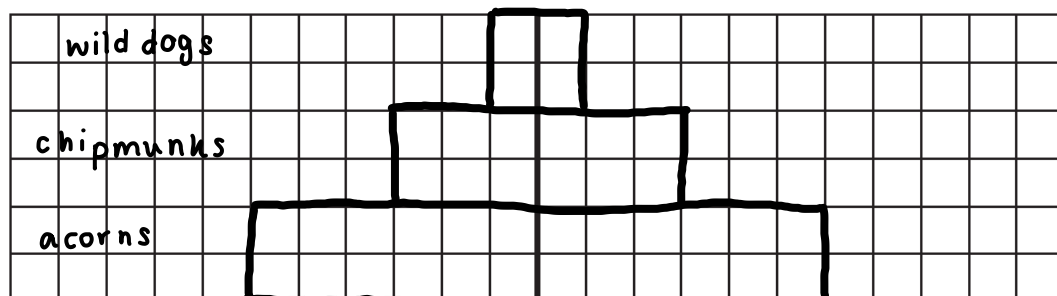
- (i) Figure 8 shows the biomass of three organisms in a food chain from one area of Siberia.

organisms	biomass in kg
acorns	20 650
chipmunks	2 200
wild dogs	230

**Figure 8**

Draw a pyramid of biomass for this food chain.

(2)



(ii) In France, Siberian chipmunks have very few natural predators.

Describe how this affected the Siberian chipmunk population in France.

(2)

Fewer chipmunks are killed so there will be higher number of chipmunks which can reproduce. The population will be larger.

(iii) The percentage of energy transferred from the acorns to the chipmunks is 9.5%.

The energy contained in the acorns is 97 500 kJ.

Calculate the amount of energy transferred to the chipmunks.

Give your answer to the nearest whole number.

(3)

$$97500 \times \frac{9.5}{100} = 9262.5$$
$$\approx 9263$$

9263 kJ

- (b) The black-legged tick (*Ixodes scapularis*) is a parasite that feeds on the blood of animals including Siberian chipmunks and humans.

The tick transmits the Lyme disease pathogen.

Figure 9 shows the number of cases of Lyme disease in humans in France in 2003 and 2015.

Number of cases of Lyme disease in humans in France	
2003	2015
9 500	27 000

Figure 9

- (i) Calculate the percentage increase in the number of cases of Lyme disease in humans in France from 2003 to 2015.

(2)

$$\frac{27000 - 9500}{9500} \times 100 = 184 \%$$

184 %

- (ii) Explain why there has been an increase in the number of cases of Lyme disease in humans in France.

(2)

The number of Siberian chipmunks in France increase so there are more ticks and it is more likely for the Lyme disease to spread to human.

- 7 (a) A student investigated the effect of nitrate ion concentration on plant growth. She placed barley seedlings in three test tubes containing different concentrations of nitrate fertiliser.

Test tube 1 contained distilled water with 1 pellet of nitrate fertiliser.  
Test tube 2 contained distilled water with 2 pellets of nitrate fertiliser.  
Test tube 3 contained distilled water with 3 pellets of nitrate fertiliser.

After 7 days, the lengths of the seedlings were measured.

Figure 13 shows an example of the apparatus used.

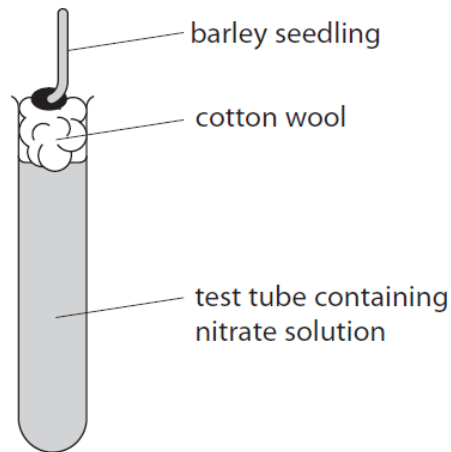


Figure 13

- (i) Describe a control for this investigation.

(2)

Set up the same apparatus but add no nitrate fertiliser to the distilled water.

- (ii) The nitrate fertiliser contains the chemical compound potassium nitrate. The hazard symbol on the bag of potassium nitrate fertiliser is shown in Figure 14.



Figure 14

Which hazard does this symbol represent?

(1)

- A flammable
- B oxidising
- C corrosive
- D explosive

- (iii) Give a method, other than measuring the change in length, that would show the growth of the seedlings.

(1)

measuring the change in mass

- (c) Farmers use crop rotation to reduce the need to add nitrate fertilisers to the soil.

Plants such as peas and beans have a mutualistic relationship with nitrogen-fixing bacteria.

Explain why farmers use these plants in their crop rotation cycle.

(3)

The roots of these plants have nitrogen-fixing bacteria, which can form nitrates from atmospheric nitrogen and increase the nitrate concentration in the soil.



2 (a) A student was investigating the populations of organisms in a garden.

Figure 2 shows the estimates of the number and biomass of some of the organisms in the garden.

organisms	number	mean biomass of each organism in grams	biomass of population in grams
cabbages (plants)	80	70	5600
earthworms	620	3.4	?
slugs	30	4.1	123
hedgehogs	1	620	620
squirrels	2	600	1200

Figure 2

(i) Calculate the biomass of the population of earthworms in the garden.

(1)

$$620 \times 3.4 = 2108 \text{ g}$$

2108g

(ii) Hedgehogs eat slugs and earthworms.

Slug pellets were used to kill the slugs.

Explain how killing the slugs would affect the population of earthworms in this garden.

(2)

Since the population of slug decreases, the hedgehogs will eat more earthworms so the population of earthworms will fall.

(iii) Describe a method that could be used to estimate the population of slugs in the garden.

(3)

Count the number of slugs in a sample site and multiply the number by the number of sites in the garden. Slugs can be trapped using pitfall traps which has food inside and smooth sides to prevent them from escaping.

Sample several sites and calculate an average before multiplying by the number of sites.

(b) Explain how cabbages, earthworms and squirrels contribute to the carbon cycle.

(3)

Cabbages remove carbon dioxide from the atmosphere as they photosynthesis. Earthworms and squirrels return carbon dioxide to the atmosphere through respiration.

10 (a) Figure 12 shows the global movement of carbon into or out of the atmosphere.

process	movement of carbon into or out of the atmosphere in gigatonnes per year
photosynthesis	120.1
respiration	119.6
ocean uptake	92.8
ocean loss	90.0
combustion of fossil fuels	6.4

Figure 12

Calculate the net mass of carbon added to the atmosphere each year.

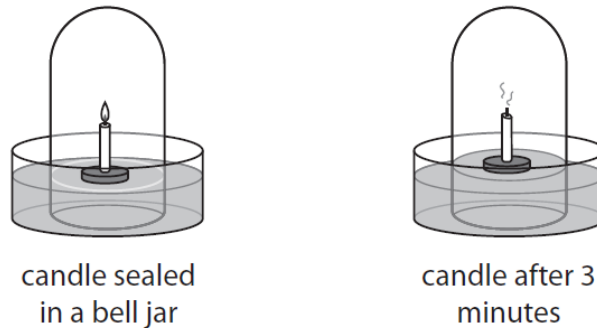
(2)

$$119.6 + 90.0 + 6.4 - 120.1 - 92.8 = 3.1$$

.....**3.1**.....gigatonnes

(b) Joseph Priestley was a scientist who investigated how green plants and combustion affected the carbon cycle.

Figure 13 shows his first experiment.



**Figure 13**

(i) State why the candle was not burning after three minutes.

(1)

Oxygen has been <sup>all</sup> used up.  
inside the bell jar

(ii) Joseph Priestley continued the investigation but placed a plant inside the bell jar as shown in Figure 14.



**Figure 14**

He observed that the candle stayed alight for two minutes more than the candle in the bell jar in the first experiment.

Explain his observation.

(2)

The plant takes in  $\text{CO}_2$  and release  $\text{O}_2$ , so there are more  $\text{O}_2$  available, which is needed for combustion.

(iii) State **two** variables that would need to be controlled to compare these two experiments. (2)

1 size of bell jar

2 type of candle used

(c) Nitrogen is cycled through the environment.

Describe the roles of bacteria in the nitrogen cycle.

Nitrogen-fixing bacteria living in root nodules form nitrate<sup>compounds</sup> from atmospheric nitrogen. Nitrifying bacteria converts ammonia to nitrates. Bacteria can act as decomposers which returns ammonia to the soil. Denitrifying bacteria return nitrogen to the atmosphere by breaking down nitrates. (4)

1 (a) Figure 1 shows the sources of pollution and different levels of water pollution in a river.

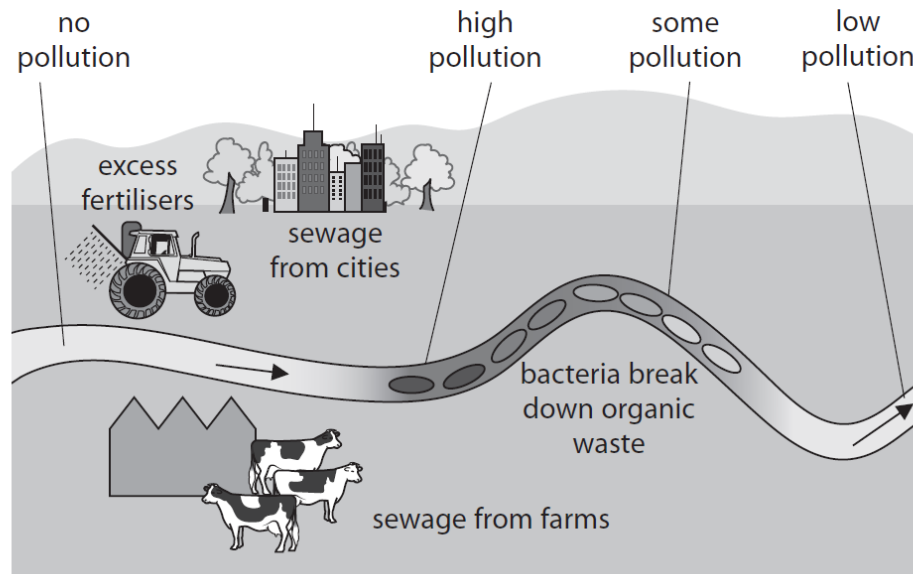


Figure 1

(i) Which part of the river will have the largest number of bloodworms?

(1)

- A no pollution
- B high pollution
- C some pollution
- D low pollution

(ii) Give the names of the **two** indicator species from the box which provide evidence for clean water.

blackspot fungus	lichen	
freshwater shrimp	sludgeworm	stonefly

(2)

1 freshwater shrimp

2 stonefly

(b) Explain why sewage pollution in the river can decrease the oxygen levels in the water.

(2)

Microorganisms which decompose sewage will use the oxygen in the water for aerobic respiration.

(c) (i) Excess fertilisers can cause a build-up of nitrates in the rivers and lakes.

State the name given to a build-up of nitrates in the lake.

(1)

eutrophication

(ii) State why the build-up of nitrates is less likely to affect a river than a lake.

(1)

In a river the water is constantly flowing so the nitrates can be washed away.

2

(c) Figure 3 shows water lilies growing in a lake in Europe.



© lynn gladwell/123RF

**Figure 3**

One water lily plant was brought from America 10 years ago and planted in the lake shown in Figure 3.

Explain why this non-indigenous plant now covers the whole surface of the lake.

(3)

The water lily plants outcompetes the other species in the lake as they block the sunlight from the species in the plant. The population size increases as they reproduce.

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4 Figure 7 shows the world human population from 1800 to 2015.

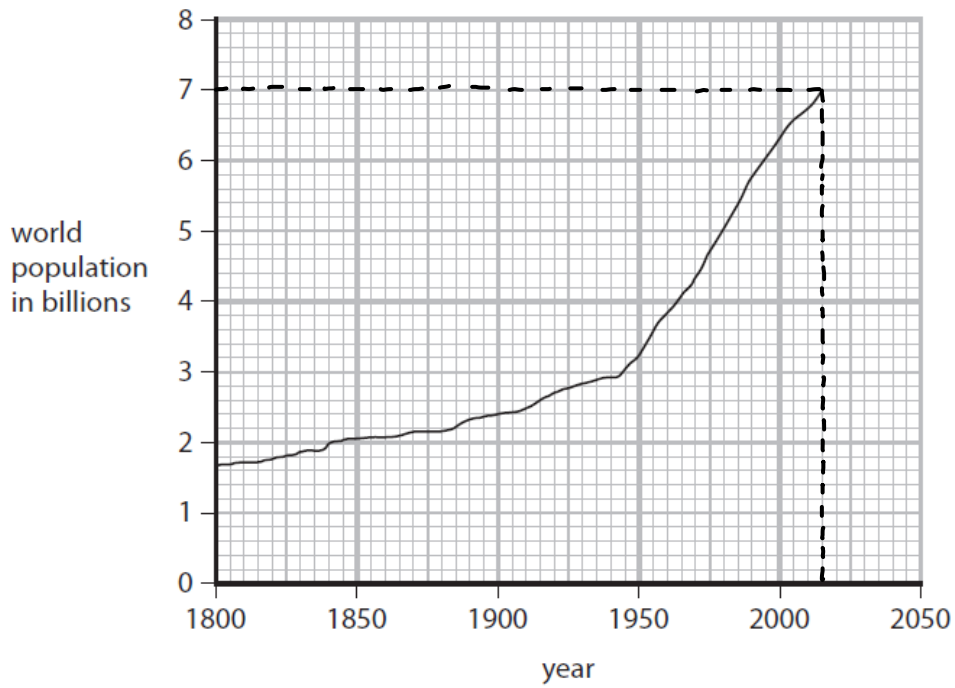


Figure 7

(a) In 2015, 13% of the world human population were classified as malnourished.

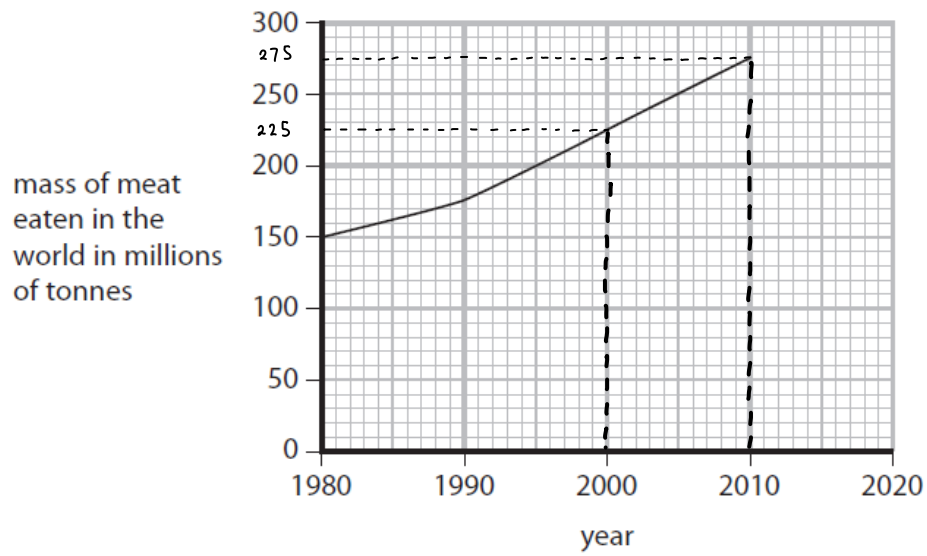
Calculate, using Figure 7, how many people were classified as malnourished in 2015.

(2)

$$7 \times \frac{13}{100} = 0.91$$

..... 0.91 ..... billion

(c) Figure 8 shows the mass of meat eaten in the world from 1980 to 2010.



**Figure 8**

Calculate the rate of increase in the mass of meat eaten in the world from 2000 to 2010. (2)

$$\frac{275 - 225}{2010 - 2000} = \frac{50}{10}$$
$$= 5$$

..... 5 ..... millions of tonnes per year

(d) Figure 9 shows an energy pyramid.

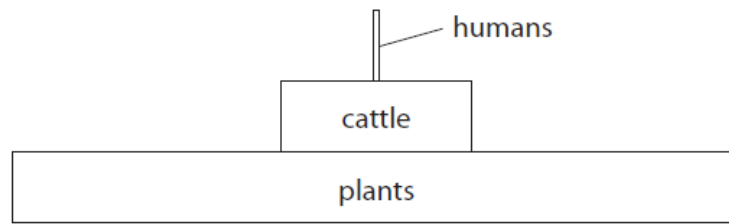


Figure 9

(i) Explain why the area labelled cattle is smaller than the area labelled plants.

(2)

The areas represent the total biomass at each trophic level. The total biomass of all cattles is less than the total biomass of all plants.

(ii) The World Health Organisation uses this definition of food security.

*'When all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life'*

Explain how a large increase in the mass of meat eaten will decrease food security in the future.

(3)

Meat will be transported to areas which has a higher demand to be sold, and there will be less meat available in some areas. People in these areas might not have enough access to meat to maintain a healthy and active life. Less meat availability would increase the meat price making poorer people / countries more vulnerable.

TOTAL = 57 MARKS