Surname	Date	Tutor
First name(s)		

BioWelsh

GCE A LEVEL

BW-A2-3.6-W1

TOPIC WORKSHEET 1 – 3.6 HUMAN IMPACT

BIOLOGY – A2 unit 3

Energy, Homeostasis and the Environment

Suggested time: 3 hours 25 minutes

For Tutor's use only

Question	Maximum Mark	Mark Awarded	Question	Maximum Mark	Mark Awarded
1.	10		9.	10	
2.	11		10.	11	
3.	10		11.	10	
4.	10		12.	10	
5.	11		13.	10	
6.	12		14.	10	
7.	10		15.	9	
8.	10		Total	154	

ADDITIONAL MATERIALS

In addition to this worksheet, you will require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name and the date in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you are working on screen, write your answers on paper and number each one clearly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question. The worksheet is out of **154** marks.

The assessment of the quality of extended response (QER) will take place in question **15**.

The quality of written communication will affect the awarding of marks.

This worksheet is written by BioWelsh in the style of the WJEC A level Biology examination, following the WJEC specification (topic 3.6). It is not an official WJEC paper.

Tutor only

Answer **all** questions.

1. The passenger pigeon, *Ectopistes migratorius*, was once the most numerous bird in North America, with an estimated 3 to 5 billion individuals in the early 1800s. It nested in huge colonies in the forests of eastern North America. It was hunted on a massive scale for cheap meat, and much of its forest habitat was cleared for farming. The last known individual died in a zoo in 1914. **Image 1.1** shows a museum specimen.

Image 1.1

(a) State what is meant by an endangered species and by an extinct species. [2]

Endangered .....

.....

Extinct .....

The background rate of extinction is about 10^{-6} extinctions per species per year. There are thought to be about 8.7 million species of eukaryote on Earth.

(b) (i) Calculate the number of species expected to become extinct each year at the background rate. [1]

Number of species = ...

Tutor only

(ii) Human activity has raised the extinction rate in some areas to 1 000 times the background rate. Calculate the number of species that would become extinct each year if this rate applied worldwide. [1]

Number of species = ...

(c) Using the information above, explain why the passenger pigeon became extinct. [2]

.....

.....

.....

.....

(d) Passenger pigeons bred successfully only in very large colonies. Suggest why the species still became extinct when several thousand birds were left alive. [2]

.....

.....

.....

.....

(e) Explain why the extinction of a species is described as the permanent loss of a gene pool. [2]

.....

.....

.....

.....

10

Tutor only

2. The hazel dormouse, *Muscardinus avellanarius*, is a small mammal of woodlands and hedgerows in Wales and England. It spends most of its life in trees and shrubs and rarely crosses open ground. Ecologists checked nest tubes in woods of different sizes in one county to find out whether dormice were present. **Table 2.1** shows the results.

Table 2.1

Area of wood / ha	Number of woods surveyed	Number of woods with dormice	Percentage of woods with dormice
less than 2	40	3	7.5
2 to 10	32	9	.....
10 to 50	18	10	.....
more than 50	6	5	83.3

(a) Complete **Table 2.1**. Give your answers to **1 decimal place**. [2]

(b) Describe the relationship shown in **Table 2.1**. [2]

.....

.....

.....

.....

(c) Explain why dormouse populations in small, isolated woods are more likely to become extinct. [3]

.....

.....

.....

.....

.....

.....

(d) Suggest how planting hedgerows to link woods could help to conserve the dormouse. [2]

.....

.....

.....

Tutor only

.....

(e) Suggest why a wood in which no dormice were found may still contain dormice. [1]

.....

.....

(f) Suggest **one** variable, other than area, that should be taken into account when comparing the woods. [1]

.....

.....

11

Tutor only

3. The northern lapwing, *Vanellus vanellus*, nests on the ground in fields where the vegetation is short in spring. **Image 3.1** shows a lapwing.

Image 3.1

Table 3.2 shows the number of breeding pairs of lapwings in an area of farmland in Wales, and the percentage of the arable land in the area that was sown with cereals in the autumn rather than in the spring.

Table 3.2

Year	Number of breeding pairs of lapwings	Arable land sown in autumn / %
1985	420	35
1990	310	52
1995	190	68
2000	125	79
2005	88	84
2010	71	86

(a) Calculate the percentage decrease in the number of breeding pairs between 1985 and 2010. Give your answer to the **nearest whole number**. [2]

Percentage decrease = ... %

Tutor only

(b) Suggest why sowing cereals in the autumn rather than in the spring reduces the nesting success of lapwings. [2]

.....

.....

.....

.....

(c) Farms have also removed hedgerows to make large fields for monocultures. Explain why a monoculture reduces species diversity. [2]

.....

.....

.....

.....

(d) A student concluded that autumn sowing caused the decline in lapwings. Evaluate this conclusion. [2]

.....

.....

.....

.....

(e) Suggest **two** ways a farmer could continue to produce cereals while helping lapwings to breed. [2]

.....

.....

.....

.....

10

Tutor only

4. Large areas of tropical rainforest in South East Asia have been cleared to plant oil palms, shown in **Image 4.1**. Palm oil is used in food and to make biodiesel.

Image 4.1

Table 4.2 shows approximate values for the carbon stored in the vegetation of three types of land, and the number of species of bird recorded in each.

Table 4.2

Type of land	Carbon stored in vegetation / tonnes per hectare	Number of bird species recorded
primary rainforest	250	150
logged rainforest	150	120
oil palm plantation	40	30

(a) Calculate the mass of carbon released when 5 000 hectares of primary rainforest are replaced by oil palms. **Give your answer in standard form.** [2]

Mass of carbon = ... tonnes

(b) Explain how the carbon stored in the forest is released into the atmosphere as carbon dioxide when the forest is cleared. [2]

.....

.....

.....

.....

Tutor only

(c) Using **Table 4.2**, explain why replacing rainforest with oil palm plantations reduces biodiversity. [2]

.....

.....

.....

.....

(d) Explain why soil erosion and flooding increase after rainforest is cleared. [2]

.....

.....

.....

.....

(e) Biodiesel is sometimes described as carbon neutral. Suggest why using biodiesel from oil palms planted on cleared rainforest may increase carbon dioxide emissions overall. [2]

.....

.....

.....

.....

10

Tutor only

5. Coppicing is a traditional way of managing woodland in Wales. Hazel trees are cut down to a stump, called a stool, and many new shoots grow from it, as shown in **Image 5.1**. The wood is divided into areas called coupes. One coupe is cut each year, so each coupe is cut about every ten years.

Image 5.1

(a) Explain why coppicing is a sustainable way of producing wood. [2]

.....

.....

.....

.....

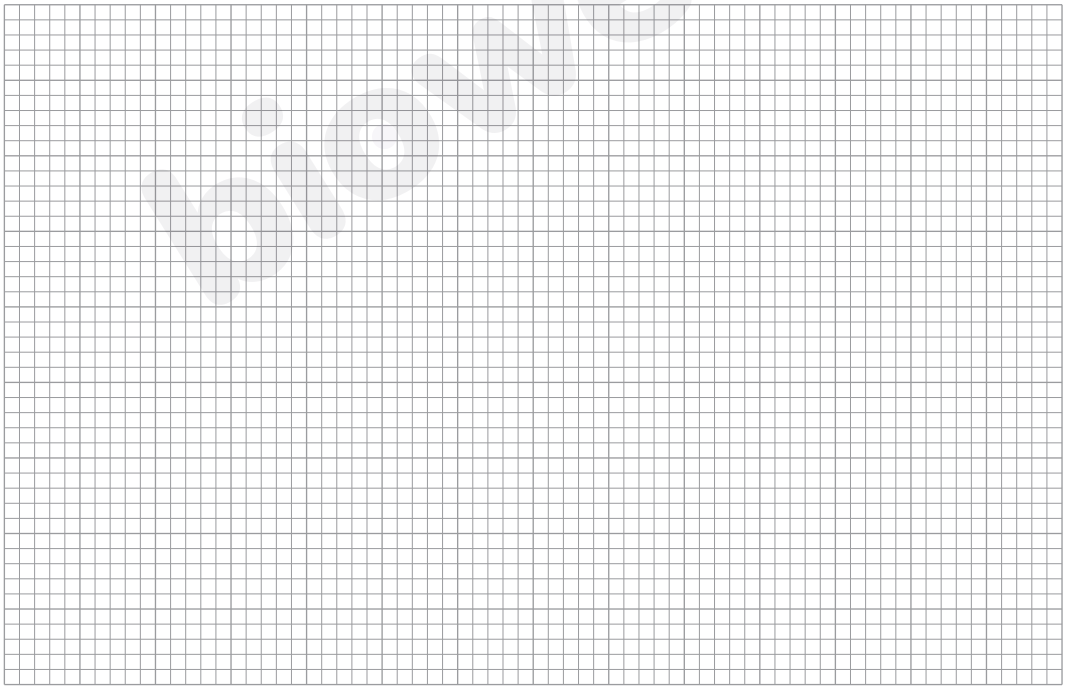
Tutor only

Students counted the number of species of flowering plant in ten 1 m^2 quadrats placed at random in coupes that had been cut different numbers of years before. **Table 5.2** shows the mean results.

Table 5.2

Time since the coupe was cut / years	Mean number of flowering plant species per quadrat
1	9.4
2	12.6
3	11.8
5	8.5
7	6.1
10	4.2
15	3.6

(b) Plot a graph of the data in **Table 5.2** on the grid below. Join the points with straight lines. [4]



(c) Explain the changes in the number of plant species after a coupe is cut. [2]

.....

.....

Tutor only

.....

.....

(d) Explain why cutting a different coupe each year increases the biodiversity of the wood as a whole. [2]

.....

.....

.....

.....

(e) Suggest how the students made sure their quadrats were placed at random. [1]

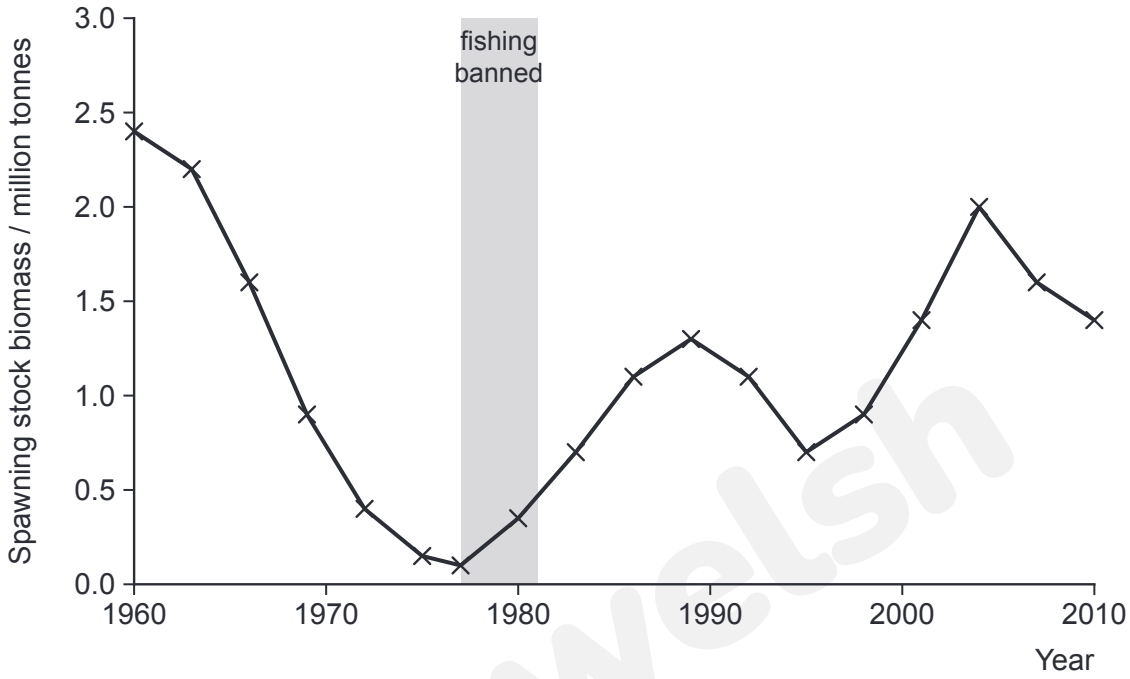
.....

.....

11

Tutor only

6. **Graph 6.1** shows the spawning stock biomass of herring in the North Sea between 1960 and 2010. The spawning stock biomass is the total mass of the fish that are old enough to breed. Fishing for herring in the North Sea was banned from 1977 to 1981. The data have been simplified.



Graph 6.1

(a) Explain what is meant by overfishing. [2]

.....

.....

.....

.....

(b) Calculate the percentage decrease in spawning stock biomass between 1960 and 1977. Give your answer to the **nearest whole number**. [2]

Percentage decrease = ... %

(c) Describe the changes in spawning stock biomass after 1977. [2]

.....

Tutor only

(d) Explain why the stock recovered after fishing was banned. [2]

(e) When fishing restarted, nets with a larger mesh size had to be used. Explain how this helps to keep the stock sustainable. [2]

(f) Suggest why scientists base fishing quotas on the spawning stock biomass rather than on the mass of fish landed. [2]

12

Tutor only

7. Atlantic salmon, *Salmo salar*, are farmed in cages in sheltered coastal waters, as shown in **Image 7.1**.

Image 7.1

Table 7.2 shows approximate values for the mass of feed needed for each 1 kg increase in body mass of four farmed animals, and the percentage of the body mass that is eaten.

Table 7.2

Farmed animal	Mass of feed for 1 kg increase in body mass / kg	Percentage of body mass eaten
salmon	1.2	68
chicken	1.8	46
pig	3.0	52
beef cattle	8.0	41

(a) Calculate the mass of feed needed to produce 1 kg of meat that is eaten, for salmon and for beef cattle. Give your answers to **1 decimal place**. [2]

Salmon .....

Beef cattle .....

(b) Explain why salmon convert feed into body mass more efficiently than cattle. [2]

.....

.....

.....

.....

Tutor only

(c) Explain why diseases and parasites spread easily among farmed salmon and can then affect wild salmon. [2]

.....

.....

.....

.....

(d) Farmed salmon that escape can breed with wild salmon. Suggest why this could reduce the survival of wild populations. [2]

.....

.....

.....

.....

(e) Much of the feed given to farmed salmon is made from wild fish such as anchovies. Suggest why salmon farming may not reduce the pressure on wild fish stocks. [2]

.....

.....

.....

.....

10

Tutor only

8. Seed banks store the seeds of wild plants to conserve their gene pools. **Image 8.1** shows packets of seeds in a seed bank. Before storage, the seeds are dried until they contain about 5 % water, then they are kept at –20 °C.

Image 8.1

(a) Explain why drying and freezing allow seeds to stay alive for many years. [2]

.....

.....

.....

.....

(b) Explain why collectors take seeds from many plants in several different populations of each species. [2]

.....

.....

.....

.....

Turn over.

Tutor only

Every ten years, a sample of 50 seeds is removed from storage, placed on agar and the number that germinate is counted. **Table 8.2** shows the results for one species.

Table 8.2

Time in storage / years	Number of seeds that germinated	Germination / %
0	48	96
10	47	94
20	45	.....
30	41	.....

(c) (i) Complete **Table 8.2**. [2]

(ii) When germination falls below 85 %, the seed bank grows plants from the stored seeds to produce fresh seeds. Suggest why. [1]

.....

.....

(iii) Explain why only a small sample of seeds is tested. [1]

.....

.....

(d) The seeds of some species, such as oak, die if they are dried. Suggest **one** other way to conserve the gene pool of such a species. [1]

.....

.....

(e) Give **one** disadvantage of conserving a species only as seeds in a seed bank. [1]

.....

10

Tutor only

9. The giant panda, *Ailuropoda melanoleuca*, lives in mountain forests in China and feeds almost entirely on bamboo. **Image 9.1** shows a giant panda.

Image 9.1

Conservation has included creating nature reserves, planting bamboo corridors between forests and breeding pandas in captivity. In 2016 the status of the giant panda was changed from endangered to vulnerable. **Table 9.2** shows the estimated wild population from three national surveys.

Table 9.2

Survey completed	Estimated number of pandas in the wild
1988	1 114
2003	1 596
2014	1 864

(a) Calculate the percentage increase in the wild population between 1988 and 2014. Give your answer to the **nearest whole number**. [2]

Percentage increase = ... %

(b) Explain how nature reserves help to conserve the giant panda. [2]

.....

.....

.....

.....

Tutor only

(c) Wild pandas live in about 30 separate groups. Explain how bamboo corridors between forests help the panda population. [2]

.....

.....

.....

.....

(d) Captive breeding programmes keep a studbook, a record of the ancestry of every captive panda. Explain why. [2]

.....

.....

.....

.....

(e) Pandas bred for release are raised with their mothers and with very little contact with people, and keepers wear panda costumes. Suggest why. [2]

.....

.....

.....

.....

10

Tutor only

10. Planetary boundaries are thresholds for nine Earth systems that regulate the stability of the planet. **Table 10.1** shows approximate values for six of these systems. For forest cover, ozone and carbonate saturation, the boundary is a minimum value; for the other three it is a maximum value.

Table 10.1

Earth system	Measure used	Boundary	Estimated current value
climate change	carbon dioxide concentration / ppm	350	420
nitrogen flow	nitrogen fixed by industry and farming / Tg $year^{-1}$	62	150
land-system change	forest cover as a percentage of original cover	75	62
freshwater use	human use of fresh water / km^3 $year^{-1}$	4 000	2 600
stratospheric ozone	ozone concentration / Dobson units	276	284
ocean acidification	carbonate saturation as a percentage of pre-industrial	80	84

(a) Explain what is meant by a planetary boundary. [2]

.....

.....

.....

.....

(b) Using **Table 10.1**, identify the **three** systems whose boundaries have been crossed. [2]

.....

.....

.....

.....

(c) Calculate the percentage by which the current carbon dioxide concentration exceeds the boundary. [2]

Percentage = ... %

Tutor only

(d) Ozone was being destroyed rapidly by chlorofluorocarbons (CFCs) in the 1970s and 1980s. Explain why the ozone boundary has not been crossed. [2]

.....

.....

.....

.....

(e) Explain why crossing a planetary boundary is a concern even when large effects have not yet been seen. [2]

.....

.....

.....

.....

(f) Suggest why no boundary has yet been set for atmospheric aerosols. [1]

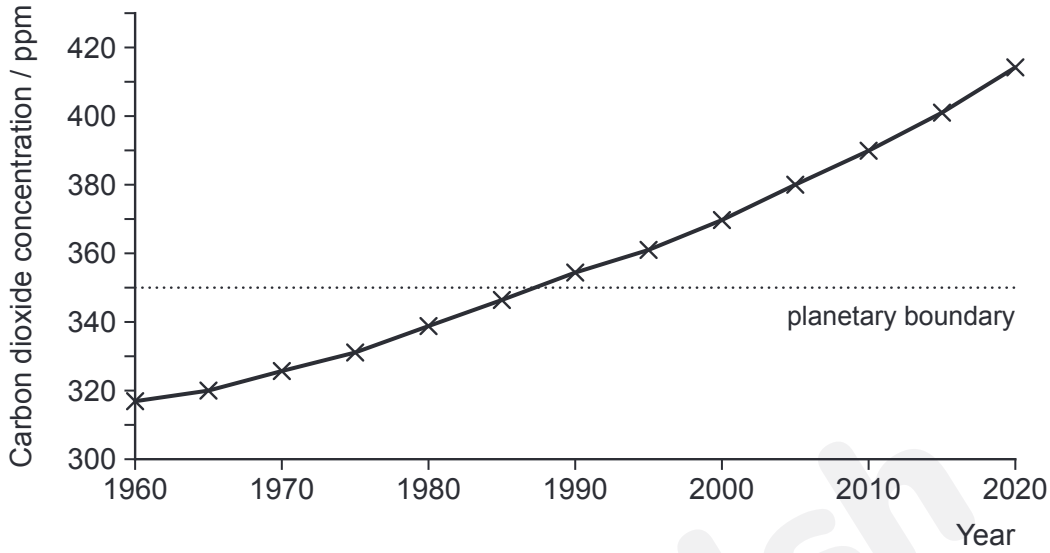
.....

.....

11

Tutor only

11. **Graph 11.1** shows the annual mean concentration of carbon dioxide measured at an observatory in Hawaii since 1960. The planetary boundary for climate change is shown.



Graph 11.1

(a) Use **Graph 11.1** to state the year in which the boundary was crossed. [1]

.....

.....

(b) Calculate the mean rate of increase in carbon dioxide concentration between 2000 and 2020. Give the units. [2]

Rate = ...

Table 11.2 shows estimates of the greenhouse gas emissions from producing and burning different fuels, for each megajoule (MJ) of energy released.

Table 11.2

Fuel	Emissions / g CO_2 equivalent MJ^{-1}
petrol	94
bioethanol from sugar cane	25
bioethanol from wheat	45
biodiesel from oil palms on cleared peat swamp forest	280

Tutor only

(c) (i) Explain why burning bioethanol adds less carbon dioxide to the atmosphere than burning petrol. [2]

.....

.....

.....

.....

(ii) Calculate the percentage reduction in emissions when petrol is replaced by bioethanol from sugar cane. Give your answer to the **nearest whole number**. [2]

Percentage reduction = ... %

(iii) Suggest why producing bioethanol from wheat still causes some greenhouse gas emissions. [2]

.....

.....

.....

.....

(d) Suggest **one** other problem caused by growing crops for biofuel. [1]

.....

.....

10

Tutor only

12. About 97 % of the water on Earth is salt water, and most of the fresh water is frozen in ice sheets and glaciers. Many dry countries produce drinking water from seawater by desalination. **Image 12.1** shows the principle of reverse osmosis.

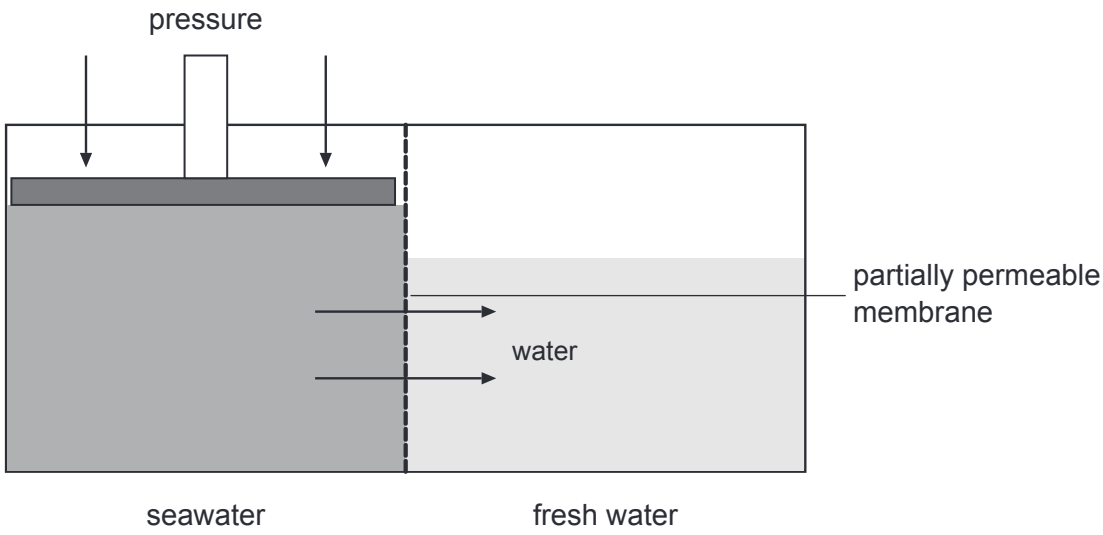


Image 12.1

(a) Explain how reverse osmosis produces fresh water from seawater. [2]

.....

.....

.....

.....

A desalination plant produces 50 000 m^3 of fresh water each day. It uses 3.5 kWh of electrical energy for each m^3 of water.

(b) (i) Calculate the energy used by the plant in one year of 365 days. **Give your answer in standard form.** [2]

Energy = ... kWh

(ii) Suggest why desalination could increase pressure on other planetary boundaries. [2]

.....

.....

.....

Tutor only

.....

(c) The brine released from the plant has about twice the salt concentration of seawater. Explain how it could kill marine organisms near the outlet. [2]

.....

.....

.....

.....

(d) Suggest **two** changes in human choices that would reduce the demand for fresh water. [2]

.....

.....

.....

.....

10

Tutor only

13. Lichens absorb water and dissolved substances over their whole surface. Many species are sensitive to air pollutants such as nitrogen dioxide and sulfur dioxide. **Image 13.1** shows a lichen growing on a branch.

Image 13.1

(a) Explain why lichens are useful indicators of air quality. [2]

.....

.....

.....

.....

Students counted the number of lichen species on 15 oak trees within 20 m of a busy road and on 15 oak trees in a park 1 km from the road. **Table 13.2** shows their results.

Table 13.2

Site	Number of trees	Mean number of lichen species per tree	Standard deviation
near the road	15	3.4	1.6
in the park	15	5.6	2.2

The students used a t-test to find out whether the difference between the means was significant. The value of t was 3.13.

(b) (i) State a suitable null hypothesis for this investigation. [1]

.....

(ii) The number of degrees of freedom is $(n_1 + n_2 - 2)$, where n_1 and n_2 are the numbers of trees at each site. State the number of degrees of freedom. [1]

.....

Tutor only

Table 13.3

Degrees of freedom	p = 0.10	p = 0.05	p = 0.01	p = 0.001
26	1.706	2.056	2.779	3.707
27	1.703	2.052	2.771	3.690
28	1.701	2.048	2.763	3.674
29	1.699	2.045	2.756	3.659

(iii) Use **Table 13.3** to decide whether there is a significant difference between the means. Explain your answer. [3]

(c) Suggest **two** variables, other than air pollution, that could explain the difference in the number of lichen species. [2]

(d) The council will use these results when deciding whether to create a clean air zone. Explain why a statistical test should be used before such a decision is made. [1]

10

Tutor only

14. A company plans to build a wind farm on an upland area of blanket bog in Wales. Blanket bog is a deep layer of peat, formed from dead plant material that has built up over thousands of years in waterlogged conditions. Before planning permission is given, an environmental impact assessment (EIA) must be carried out. **Table 14.1** shows some estimates from the assessment.

Table 14.1

Estimate	Mass of carbon dioxide / tonnes
saved each year by replacing electricity from fossil fuels	48 000
released by making, transporting and building the turbines	60 000
released from peat that is drained or dug up for roads and foundations	84 000

(a) Explain what is meant by an environmental impact assessment. [2]

.....

.....

.....

.....

(b) Calculate the number of years before the wind farm has saved as much carbon dioxide as was released in building it. [2]

Number of years = ...

(c) Explain why draining peat releases carbon dioxide. [2]

.....

.....

.....

.....

(d) Golden plovers and hen harriers breed on the bog. Suggest **two** ways the developer could reduce the effect of the wind farm on these birds. [2]

.....

.....

Tutor only

(e) The final decision will be made by government ministers. Explain why the decision should be based on evidence gathered using sound scientific principles. [2]

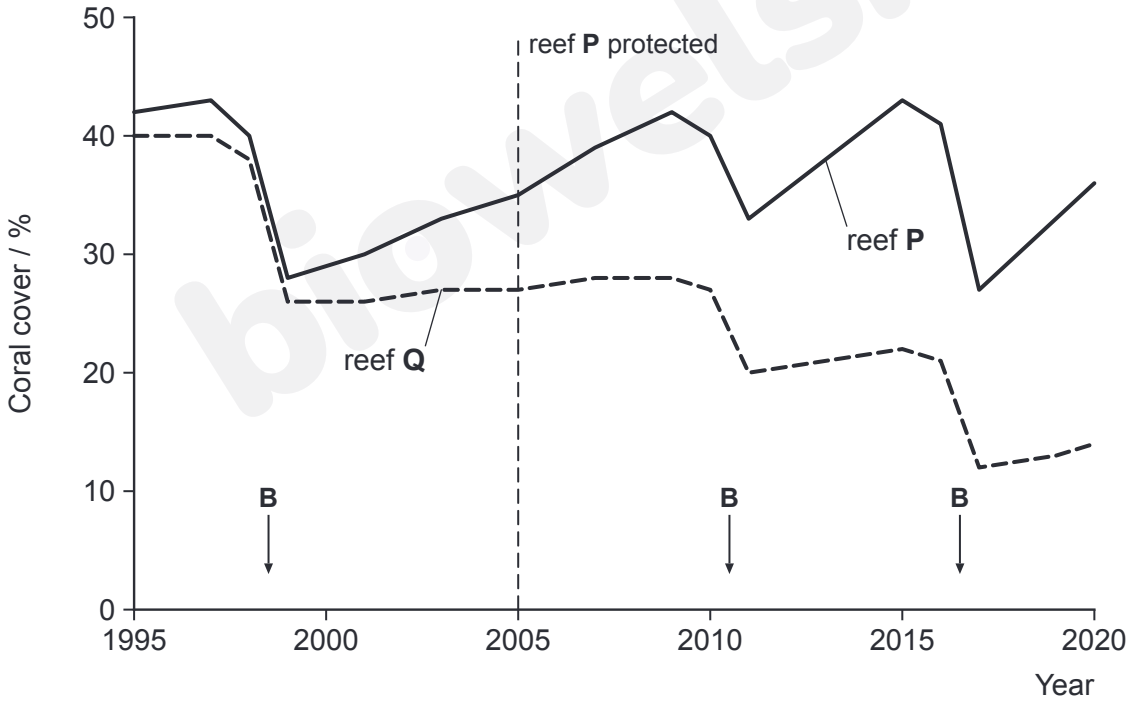
10

Tutor only

15. Coral reefs cover less than 1 % of the ocean floor but support about a quarter of all marine species. Reef-building corals contain photosynthetic algae in their tissues. When the sea is warmer than normal for several weeks, the corals expel the algae and turn white, which is called bleaching. **Image 15.1** shows healthy and bleached corals.

Image 15.1

Graph 15.2 shows the percentage of the sea floor covered by living coral on two reefs, **P** and **Q**, in the same region. **B** marks years of mass bleaching. In 2005, reef **P** became part of a marine protected area in which fishing and anchoring are banned. Reef **Q** is still fished.



Graph 15.2

Explain why it is important to conserve coral reefs. Describe how human activities threaten coral reefs, including the link to the climate change and ocean acidification planetary boundaries. Use **Graph 15.2** to evaluate the effect of the marine protected area on reef **P**.

[9 QER]

.....

.....

Tutor only

Tutor only

.....

.....

END OF WORKSHEET

9

A Tutor Meets Tutee project

BioWelsh worksheets are written and checked by Tutor Meets Tutee tutors for WJEC A level Biology students.

Mark this worksheet with the BioWelsh mark scheme **BW-A2-3.6-W1** (MS).

Acknowledgements

Image 1.1: Photo: James St. John, CC BY 2.0 (Wikimedia Commons). Cropped to remove a label.

Image 3.1: Photo: Yrjö Jyske, CC BY 2.0 (Wikimedia Commons). Cropped.

Image 4.1: Photo: Irvin calicut, CC BY 3.0 (Wikimedia Commons). Cropped.

Image 5.1: Photo: Naturenet, CC BY 2.5 (Wikimedia Commons). Cropped.

Image 7.1: Photo: Peter Whyte, CSIRO, CC BY 3.0 (Wikimedia Commons). Cropped.

Image 8.1: Photo: R. C. Johnson, CC BY 2.5 (Wikimedia Commons).

Image 9.1: Photo: Jeff Kubina, public domain (Wikimedia Commons).

Image 13.1: Photo: USFWS Midwest Region, CC BY 2.0 (Wikimedia Commons). Cropped.

Image 15.1: Photo: NOAA, public domain (Wikimedia Commons). Cropped.

Graphs and diagrams without a credit are original BioWelsh drawings. WJEC is a registered trade mark of WJEC CBAC Ltd, which has not written or endorsed this worksheet.