

BIOWELSH WORKSHEET FOR WJEC GCE A LEVEL BIOLOGY
UNIT 3 – ENERGY, HOMEOSTASIS AND THE ENVIRONMENT
TOPIC 3.6 HUMAN IMPACT: WORKSHEET 1 (BW-A2-3.6-W1) MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Mark in red ink. One tick equals one mark, except in the extended response question, where a level of response scheme is used.

Write each question total in the box at the end of the question, and copy the totals onto the grid on the front cover of the worksheet. Add them to give the worksheet total out of 154.

Marking rules

Look at all of the work. Where the scheme says working is needed, the working must be seen. Mark crossed-out work if it has not been replaced. Give credit for correct, relevant answers that are not listed in the scheme.

Extended response question

Read the whole answer first. Decide which level descriptor fits the answer best, judging the overall quality. Then choose the mark within the level: the top mark when the answer matches both the content and the communication statements well, the middle mark when most of the content is there and the communication statement is partly met, and the bottom mark when only the content statements are matched.

Marking abbreviations

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt
ORA = or reverse argument
owtte = or words to that effect

Notation: / separates alternatives; { } groups alternatives within a point; words in () are not needed for the mark; underlined words are essential; (1) is one mark.

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			Endangered: so few individuals remain that it is at risk of becoming extinct (1) Extinct: no individuals remain alive anywhere in the world (1) Reject 'low numbers' alone for endangered	2			2		
	(b)	(i)		8.7 (1) Accept 9		1		1	1	
		(ii)		$8\,700 / 8.7 \times 10^3$ (1) Allow ecf from (i)		1		1	1	
	(c)			Hunting removed birds faster than they could reproduce / death rate greater than birth rate (1) Clearing the forest removed nesting sites and food, so fewer young were raised (1)		2		2		
	(d)			Any two ($\times 1$) from: - Groups were too small to breed successfully / few young were raised (1) - Birth rate stayed below death rate so numbers kept falling (1) - Small population had a small gene pool / low genetic diversity so it was less able to adapt (1) - Small groups were more vulnerable to predators or chance events (1)			2	2		
	(e)			A gene pool is all the alleles in a population / species (1) Once the species is extinct its alleles, which may be useful or unique, cannot be recovered (1)	2			2		
				Question 1 total	4	4	2	10	2	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			28.1 (1) 55.6 (1)		2		2	2	
	(b)			The larger the wood, the greater the percentage of woods with dormice (1) Use of data, for example 7.5 % of woods under 2 ha but 83.3 % of woods over 50 ha (1)		2		2		
	(c)			Any three (×1) from: • Small population / small gene pool with low genetic diversity (1) • Less able to adapt to change / more inbreeding (1) • A chance event such as disease, a harsh winter or felling could kill all of them (1) • Dormice cannot cross open ground, so no immigration to replace losses / no gene flow (1)	2	1		3		
	(d)			Hedgerows act as corridors so dormice can move between woods without crossing open ground (1) Allows interbreeding / gene flow, so populations behave as one larger population / empty woods can be recolonised (1)			2	2		
	(e)			Dormice may not have used the nest tubes / too few tubes / checked while dormice were hibernating / population too small to detect (1)			1	1		1
	(f)			Amount of hazel / shrub layer / types of tree / age of the wood / distance to the nearest wood / how the wood is managed (1)			1	1		1
				Question 2 total	2	5	4	11	2	2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			83 (%) (2) Award 1 mark for $(420 - 71) \div 420 (\times 100) / 83.1$		2		2	2	
	(b)			By spring, autumn-sown crops are too tall / dense for lapwings to nest in or to see predators (1) Spring sowing leaves bare or short ground / winter stubble at the right time for nesting and feeding (1)		2		2		
	(c)			A single crop provides only one habitat / few niches / little variety of food (1) Herbicides and pesticides remove other plants and insects (1)	2			2		
	(d)			There is a (negative) correlation: as autumn sowing increased, breeding pairs decreased (1) But correlation does not prove cause; other factors such as drainage of wet fields, predators or pesticides may be involved (1)			2	2		1
	(e)			Any two ($\times 1$) from: - Sow some fields in spring / leave some winter stubble (1) - Leave bare fallow plots within autumn-sown fields (1) - Keep wet areas / do not drain some fields (1) - Avoid rolling or cultivating fields during the nesting season (1) - Join an agri-environment scheme that pays for these measures (1)		1	1	2		
				Question 3 total	2	5	3	10	2	1

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			1.05×10^6 (tonnes) (2) Award 1 mark for $(250 - 40) \times 5\,000 / 1\,050\,000$		2		2	2	
	(b)			Felled trees and waste are burned / combustion releases carbon dioxide (1) Remaining organic matter is decomposed by microorganisms, which release carbon dioxide in respiration (1)	2			2		
	(c)			A plantation is a monoculture of one tree species of the same age, so there are fewer habitats / niches (1) Data: bird species fall from 150 to 30 (1)		2		2		
	(d)			Roots no longer hold the soil together, so it is washed away (1) No canopy to intercept rain and less transpiration, so more water runs off the land (1)	2			2		
	(e)			The carbon released by clearing the forest is far greater than the carbon saved by replacing fossil fuel (1) It would take many years / decades for the saving to repay this carbon debt; energy is also used for fertiliser, processing and transport (1)			2	2		
				Question 4 total	4	4	2	10	2	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			The stool is not killed; new shoots regrow, so no replanting is needed (1) Only one coupe is cut each year, so wood is harvested no faster than it regrows / the woodland habitat remains (1)	2			2		
	(b)			Axes the correct way round, labelled with quantity and unit: x = time since the coupe was cut / years; y = mean number of flowering plant species per quadrat (1) Suitable linear scales using more than half of the grid (1) All points plotted correctly $\pm$ half a small square (1) Points joined with ruled straight lines (1)		2	2	4	4	4
	(c)			After cutting, more light reaches the woodland floor, so more species can grow / seeds germinate (numbers peak at 12.6 after 2 years) (1) As the new shoots grow, the canopy closes and shades the floor, so fewer species survive / competition for light (1)		2		2		
	(d)			The wood contains coupes at every stage of regrowth / a mosaic of habitats with many niches (1) So species that need open, light conditions and species that need shade are all present (1)		1	1	2		
	(e)			Used random numbers / a random number generator to give coordinates on a grid (1)			1	1		1
				Question 5 total	2	5	4	11	4	5

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			Fish are harvested faster than they can reproduce / be replaced (1) So the population falls / immature fish are caught before they can breed (1)	2			2		
	(b)			96 (%) (2) Award 1 mark for $(2.4 - 0.1) \div 2.4 (\times 100) / 95.8$		2		2	2	
	(c)			Rose from 0.1 to 1.3 million tonnes by 1989 (1) Fell to 0.7 million tonnes in 1995, then rose to 2.0 million tonnes in 2004 (and fell again) (1)		2		2		
	(d)			Fish were not removed, so more survived to reach maturity and breed (1) The birth rate was greater than the death rate (1)		2		2		
	(e)			Young / small fish can escape through the mesh (1) So they survive to become sexually mature and breed, replacing the fish that are caught (1)	2			2		
	(f)			The mass landed depends on fishing effort / measures the death rate, not how many fish can breed (1) Spawning stock biomass shows the breeding capacity / birth rate, so quotas can be cut before the stock collapses (1)			2	2		
				Question 6 total	4	6	2	12	2	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			Salmon 1.8 (kg) (1) Beef cattle 19.5 (kg) (1)		2		2	2	
	(b)			Any two (×1) from: • Fish are ectotherms, so no energy is used to keep the body warm (1) • Water supports the body, so less energy is used in movement / less supporting tissue is needed (1) • Cattle lose more energy in faeces (undigested cellulose) and as methane (1)		2		2		
	(c)			Fish are kept at high density, so pathogens / parasites pass easily from fish to fish (1) Pathogens and parasites pass through the open net into the water and reach wild fish swimming nearby (1)	2			2		
	(d)			Farmed salmon have been selectively bred for fast growth / have low genetic diversity / lack alleles adapted to the wild (1) Their offspring are less well adapted, for example to migration or avoiding predators, so the wild gene pool is weakened (1)			2	2		
	(e)			Large numbers of wild fish are caught to make fish meal and fish oil for feed (1) So feed species may be overfished, affecting the food chains / seabirds and fish that depend on them (1)			2	2		
				Question 7 total	2	4	4	10	2	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)			Low water content and low temperature slow enzyme activity / metabolism / respiration (1) So food reserves are used very slowly / with little water, ice crystals do not form and damage cells (1)	1	1		2		
	(b)			To collect as much of the genetic diversity / as many alleles of the gene pool as possible (1) Different populations may have different alleles / adaptations to their local conditions (1)	2			2		
	(c)	(i)		90 (1) 82 (1)		2		2	2	
		(ii)		To replace the seeds before too many die, so that alleles / the gene pool are not lost (1)			1	1		
		(iii)		Seeds that are tested germinate and cannot be returned to storage, and the number of seeds stored is limited (1)		1		1		1
	(d)			Protect it in the wild / in a nature reserve / grow living plants in a botanic garden / store embryos or tissue in liquid nitrogen (1)			1	1		
	(e)			Stored seeds do not evolve, so the population does not adapt to changes such as climate change or new pests (1)		1		1		
				Question 8 total	3	5	2	10	2	1

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)			67 (%) (2) Award 1 mark for $(1\,864 - 1\,114) \div 1\,114 (\times 100) / 67.3$		2		2	2	
	(b)			They protect the forest and bamboo habitat from logging / farming / building (1) Hunting / poaching is prevented by law and patrols (1)	2			2		
	(c)			Pandas can move between groups and interbreed / gene flow (1) This increases genetic diversity / reduces inbreeding / lets pandas reach new bamboo when bamboo in one area dies (1)		2		2		
	(d)			To choose mating partners that are not closely related / to avoid inbreeding (1) To maintain genetic diversity / reduce the chance of offspring being homozygous for harmful recessive alleles (1)	1	1		2		
	(e)			Any two ($\times 1$) from: • So the pandas do not become used to / approach people, reducing the risk of poaching or conflict (1) • So they learn natural behaviour from their mothers, such as finding food / avoiding danger (1) • So they are more likely to survive and breed after release (1)			2	2		
				Question 9 total	3	5	2	10	2	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)			A threshold / limit for one of the Earth systems (1) Staying within it keeps a safe operating space for humanity; beyond it there is a risk of sudden / irreversible change (1)	2			2		
	(b)			Climate change, nitrogen flow and land-system change (2) Award 1 mark for any two correct Deduct a mark for each incorrect system added		2		2		
	(c)			20 (%) (2) Award 1 mark for $(420 - 350) \div 350 (\times 100)$		2		2	2	
	(d)			CFCs were banned in spray cans and their manufacture was banned by international agreement (in 1987) (1) The ban followed scientific evidence of ozone depletion, so less ozone is now destroyed / the ozone layer is recovering (1)	1	1		2		
	(e)			The response is not linear; beyond a tipping point a small change can cause a large, sudden, unpredictable change (1) Changes may be irreversible / continue for decades, for example temperature and sea level keep rising after emissions stop (1)		1	1	2		
	(f)			Some aerosols (sulfates) cool the Earth and others (soot) warm it, so the overall effect is unclear / concentrations vary greatly (1)			1	1		
				Question 10 total	3	6	2	11	2	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
11	(a)			1988 (1) Accept 1986 to 1989		1		1		
	(b)			2.2 (1) ppm year ⁻¹ / ppm per year (1) Accept 2.1 to 2.3		2		2	2	
	(c)	(i)		The carbon in bioethanol was taken from the atmosphere recently by photosynthesis in the crop, and the next crop takes it up again (1) Petrol releases carbon that was fixed millions of years ago and would otherwise stay locked away (1)	2			2		
		(ii)		73 (%) (2) Award 1 mark for $(94 - 25) \div 94 (\times 100) / 73.4$		2		2	2	
		(iii)		Any two ($\times 1$) from: - Fossil fuels are used by farm machinery / to transport the crop / to distil the ethanol (1) - Making nitrogen fertiliser uses a lot of energy (1) - Fertiliser in the soil releases nitrous oxide (1)			2	2		
	(d)			Uses land that could grow food / raises food prices / leads to habitat destruction and loss of biodiversity / uses large amounts of water (1)			1	1		
				Question 11 total	2	5	3	10	4	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
12	(a)			Seawater has a lower (more negative) water potential than fresh water, so without pressure water would move into the seawater by osmosis (1) High pressure forces water through the partially permeable membrane against its water potential gradient, while salt ions cannot pass (1)	2			2		
	(b)	(i)		6.4×10^7 (kWh) (2) Award 1 mark for $50\,000 \times 3.5 \times 365 / 63\,875\,000$		2		2	2	
		(ii)		The energy often comes from burning fossil fuels, releasing carbon dioxide and adding to climate change (1) Brine / chemicals released into the sea harm marine organisms / biodiversity (1)		1	1	2		
	(c)			The water around the organisms has a lower water potential than their cells (1) Water leaves their cells by osmosis, so the cells shrink / become dehydrated / plasmolysed (1)	1	1		2		
	(d)			Any two (×1) from: - Repair leaking pipes / use water meters (1) - Use drip irrigation instead of flooding fields (1) - Eat less meat, as livestock need large volumes of water (1) - Use water-efficient appliances / collect rainwater (1) - Grow crops suited to dry conditions (1)			2	2		
				Question 12 total	3	4	3	10	2	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
13	(a)			They have no roots / cuticle and absorb pollutants directly from the air and rain (1) Sensitive species die or are absent where air is polluted / they live a long time so show pollution over a long period (1)	1	1		2		
	(b)	(i)		There is no significant difference between the mean number of lichen species on trees near the road and in the park (1)		1		1		1
		(ii)		28 (1)		1		1	1	
		(iii)		Critical value at $p = 0.05$ is 2.048 (1) 3.13 is greater than 2.048 (and than 2.763 at $p = 0.01$), so the null hypothesis is rejected (1) There is a significant difference between the means / the difference is not due to chance (1) Allow ecf from (ii)			3	3	1	3
	(c)			Any two ($\times 1$) from: - Age / size of the trees (1) - Amount of light / shade (1) - Humidity / moisture (1) - pH of the bark (1) - Dust / salt from the road (1) - Which side of the trunk was sampled (1)			2	2		2
	(d)			It shows whether the difference is likely to be due to chance, so the decision is based on reliable evidence (1)		1		1		
				Question 13 total	1	4	5	10	2	6

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
14	(a)			A study that predicts the effects of a proposed project on the environment (1) It describes the alternatives, the significant effects and the measures (mitigation) to reduce them (1)	2			2		
	(b)			3 / 3.0 (years) (2) Award 1 mark for $(60\,000 + 84\,000) \div 48\,000 / 144\,000$		2		2	2	
	(c)			Peat forms because waterlogged (anaerobic) conditions stop dead plants decomposing (1) Draining lets air in, so aerobic decomposers break down the peat and release carbon dioxide in respiration (1)		2		2		
	(d)			Any two (×1) from: - Build outside the breeding season (1) - Place turbines away from nest sites / flight routes (1) - Restore / re-wet another area of bog as new habitat (1) - Stop turbines at times of high bird activity / monitor collisions (1)			2	2		
	(e)			Valid, reliable (peer-reviewed) evidence lets the effects be predicted accurately (1) So benefits (renewable energy) and costs (habitat and carbon loss) are weighed fairly, not decided by opinion or economic pressure (1)		1	1	2		
				Question 14 total	2	5	3	10	2	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
15				Indicative content Credit correct use of data from Graph 15.2 in section C.	3	3	3	9		
				A Why reefs should be conserved A1 Very high biodiversity: many species in a small area A2 Conserves gene pools / alleles that cannot be recovered once lost A3 Possible source of new medicines A4 Supports fisheries and food for coastal communities A5 Protects coasts from storms and erosion; income from tourism						
				B Threats from human activity B1 Burning fossil fuels raises carbon dioxide; the climate change boundary has been crossed B2 Global warming raises sea temperature, causing bleaching and death of corals B3 Carbon dioxide dissolves in the sea, lowering pH / ocean acidification, so fewer carbonate ions for calcium carbonate skeletons B4 Overfishing removes grazing fish, so algae overgrow the coral B5 Fertiliser run-off / sewage causes eutrophication; sediment from deforestation blocks light B6 Physical damage from anchors, trawling or destructive fishing						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				C Evaluation using Graph 15.2 C1 Bleaching events (1998, 2010, 2016) reduced coral cover on both reefs C2 Before 2005 both reefs fell by a similar amount in 1998 (P 43 to 28 %, Q 40 to 26 %) C3 After protection, reef P recovered quickly after each event, reaching 43 % by 2015 and 36 % by 2020 C4 Reef Q recovered little and fell to about 12 % in 2017 and 14 % in 2020 C5 Suggests protection increases recovery, for example grazing fish control algae and there is less physical damage C6 But reef P was already recovering faster than Q before 2005 (28 to 35 % against 26 to 27 %), so other factors may differ C7 Only two reefs and no replicates; protection did not prevent bleaching, which has a global cause, so emissions must also be cut						
				7-9 marks Indicative content of this level is detailed information from all three lists. The candidate constructs an articulate, integrated account, correctly linking relevant points in a logical sequence. The answer fully addresses the question with no irrelevant inclusions or significant omissions. Scientific conventions and vocabulary are used appropriately and accurately.						
				4-6 marks Indicative content of this level is detailed information from two of the lists, or less detail from all three. The candidate constructs an account correctly linking some relevant points, showing some reasoning. The answer addresses the question with some omissions. Scientific conventions and vocabulary are usually used appropriately and accurately.						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				1-3 marks Indicative content of this level is some information from at least one of the lists, or a little information from more than one. The candidate makes some relevant points, showing limited reasoning. The answer addresses the question with significant omissions. Use of scientific conventions and vocabulary is limited.						
				0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.						
				Question 15 total	3	3	3	9	0	0

UNIT 3: ENERGY, HOMEOSTASIS AND THE ENVIRONMENT, TOPIC 3.6
SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	4	2	10	2	0
2	2	5	4	11	2	2
3	2	5	3	10	2	1
4	4	4	2	10	2	0
5	2	5	4	11	4	5
6	4	6	2	12	2	0
7	2	4	4	10	2	0
8	3	5	2	10	2	1
9	3	5	2	10	2	0
10	3	6	2	11	2	0
11	2	5	3	10	4	0
12	3	4	3	10	2	0
13	1	4	5	10	2	6
14	2	5	3	10	2	0
15	3	3	3	9	0	0
TOTAL	40	70	44	154	32	15



A Tutor Meets Tutee project

BioWelsh mark scheme BW-A2-3.6-W1 (MS). Not an official WJEC mark scheme.

