



National
Qualifications
2018

2018 Environmental Science

National 5

Finalised Marking Instructions

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General marking principles for National 5 Environmental Science

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

- (a) Marks for each candidate response must **always** be assigned in line with these general marking principles and the detailed marking instructions for this assessment.
- (b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.
- (c) If a specific candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.
- (d) There are no half marks awarded.
- (e) Where a candidate makes an error at an early stage in a multi-stage calculation, credit should normally be given for correct follow-on working in subsequent stages, unless the error significantly reduces the complexity of the remaining stages. The same principle should be applied in questions which require several stages of non-mathematical reasoning.
- (f) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including unit) on its own.
- (g) Where a wrong answer (for which no credit has been given) is carried forward to another step, credit will be given provided the end result is used correctly.

Marking instructions for each question

Section 1

Question			Expected answer(s)	Max mark	Additional guidance
1.	(a)	(i)	Metal, building stones, solar energy, roof tiles, wind power, timber, land.	2	Non-living resources. Any two.
		(ii)	Wind power, solar power, wood, biomass.	2	
	(b)		Renewable energy should be available indefinitely and will never run out. Any other valid response.	1	
2.	(a)		The sun.	1	
	(b)		Arrows indicate the direction of energy flow.	1	
	(c)		<ul style="list-style-type: none"> • Fox and owl. • Weasel and owl. • Vole and chaffinch. • Chaffinch and dormouse. • Vole and dormouse. 	1	Any one of these correct pairings.
	(d)	(i)	<p>Stay the same: owls will eat something else.</p> <p>Decrease: food supply will be less.</p>	1	Mark awarded for giving appropriate reason not for the prediction on its own.
		(ii)	<ul style="list-style-type: none"> • Mammal traps. • Camera traps. <p>Description.</p> <p>OR</p> <p>Any other valid response.</p>	2	One mark for correct method. One mark for correct description.

Question		Expected answer(s)	Max mark	Additional guidance
3.	(a)	<ul style="list-style-type: none"> • X-axis with countries labelled. • Y-axis appropriate in size and scale. Labelled correctly. • All bars drawn correctly according to scale drawn. 	3	<p>Overarching Label Country underneath required.</p> <p>% of transport fuel that comes from Biological Sources.</p> <p>Top line to be correct with no daylight between line and drawn line.</p>
	(b)	6.78 billion litres.	1	$23.4 \times 29 / 100$ 6.786 Accept 6.786 or 6.8 billion litres
	(c)	<ul style="list-style-type: none"> • Increased use of agricultural land to provide energy and not food. • Can be more expensive. • Will destroy native habitats. • Not carbon neutral. • Increase in food costs. 	2	Any two for two marks.

Question			Expected answer(s)	Max mark	Additional guidance
4.	(a)	(i)	'F' to be positioned between 'Protein in sheep' and 'Ammonium compounds'.	1	
		(ii)	'N' to be positioned between 'Nitrogen in the air' and 'Protein in legumes'.	1	
	(b)		Bacteria.	1	
	(c)		For example Addition of fertiliser <ul style="list-style-type: none"> to provide additional nitrates. Add manure <ul style="list-style-type: none"> to provide material for decay resulting in more nitrates. Drain field <ul style="list-style-type: none"> to limit action of denitrifying bacteria. 	2	Any other valid response. (1 mark) for suggestion. (1 mark) for explanation.
	(d)		0.4 kg	2	8 kg – 6 kg = 2 kg 20% of 2 kg = 0.4 kg
	(e)		<ul style="list-style-type: none"> Water table will become low and farmers in the future may not be able to obtain water from it. Irrigation in a warm dry climate may result in a salt crust forming in the top layer of soil. Irrigating crops may wash nitrates rapidly through the soil, which can contaminate water courses. 	2	Any two for (2 marks).

Question			Expected answer(s)	Max mark	Additional guidance
5.	(a)	(i)	200 (km)	1	40 km per day 5 days per week $5 \times 40 = 200$ km
		(ii)	50 (km)	1	10 km per day petrol = 50 km per week
		(iii)	5 litres	1	5 days \times 1 litre = 5 litres
	(b)		<ul style="list-style-type: none"> • Cheaper to operate. • Personal/moral responsibility. • Legislation to encourage using the hybrid. • Better for the environment. 	1	
	(c)		<ul style="list-style-type: none"> • Car share (with teacher A). • Buy a bike. • Walk. • Get bus. 	2	Any two for (2 marks)
	(d)		<ul style="list-style-type: none"> • Still uses fossil fuels. • Too expensive. • Requires more resources. • More to go wrong (petrol engine and electric motor). • Lack of public charging structure. • Petrol non-renewable. • Less polluting. • Better for human health, less particulates. 	2	Any two for (2 marks)

Question		Expected answer(s)	Max mark	Additional guidance
6.	(a)	<p>For example</p> <ul style="list-style-type: none"> • Cereal farming – use of agrochemicals to increase yield. • Conservation – against the use of agro-chemicals because it kills insects. • Wind farms – produce renewable energy. • Conservation – protecting areas for birds and bats, concern over flying into turbine. • Shooting estates – need open moorland for grouse rearing. • Forestry plantations – impede on flight paths of birds. 	2	<p>Activity with no explanation – No marks.</p> <p>Looking for both sides of the argument.</p> <p>Any other appropriate pairing and explanation.</p> <p>(1 mark) for the activity (eg use of agro-chemicals) and (1 mark) for consequence (eg kills insects).</p>
	(b)	Sheep/dairy/beef farming/road building/housing/hillwalking.	1	<p>Any other valid response.</p> <p>Do not accept tourism.</p>
	(c)	Lamb/mutton/wool/milk/beef/potatoes/strawberries.	1	Any other valid response.
	(d)	<p>For example</p> <p>SEPA – monitors pollution.</p>	2	<p>Any other valid response.</p> <p>(1 mark) for organisation.</p> <p>(1 mark) for description of role.</p>

Question			Expected answer(s)	Max mark	Additional guidance
7.	(a)	(i)	Weathering – the exposure and breaking down of rocks in situ at the Earth’s surface over geological time due to interaction with the atmosphere.	2	Answer must have key concepts, ie Breakdown of rock in one place AND Biological, chemical and physical action.
		(ii)	<ul style="list-style-type: none"> • The weathered rock fragments have been transported by water/wind/ice. • During transport they are eroded into smaller fragments. • Then deposited into the ocean. • After settlement, they become compacted due to the weight of added sediments above. • Sediments are then cemented. (Water between the pore spaces is driven upwards and replaced by minerals). 	3	Any three from <ul style="list-style-type: none"> • Transport • Erosion • Deposition • Compaction • Cementation
		(iii)	Melting. Becomes magma.	1	Heat and pressure becomes so intense that the rock begins to melt.
	(b)		Limestone: formation in shallow tropical sea water (1 mark) as a result of calcium carbonate dissolved in the water precipitating out. (1 mark)	2	Accept answers referring to fossilised sea creatures/shells.

Question			Expected answer(s)	Max mark	Additional guidance
7.	(c)	(i)	<ul style="list-style-type: none"> • Daily explosions/noise of crushing plant will be frustrating and may frighten livestock and wildlife. • Dust from quarry will coat everything in the town; could be a danger to human health. • Quarry will be an eyesore, could impact on tourism in the area. • Local river will be polluted with excess iron washed out of the deposit. 	2	Any two for (2 marks) OR any other valid response
		(ii)	<ul style="list-style-type: none"> • Construction. • Agriculture. • Iron & steel manufacture. • Cement. • Glass making. 	1	

Question		Expected answer(s)	Max mark	Additional guidance																								
8.	(a)	A natural biological unit made up of living and non-living parts, ie the community and the habitat.	1																									
	(b)	(i) <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">Organism</th> <th colspan="2">Photosynthesis</th> <th colspan="2">Respiration</th> </tr> <tr> <th>Daylight hours</th> <th>Darkness hours</th> <th>Daylight hours</th> <th>Darkness hours</th> </tr> </thead> <tbody> <tr> <td>Aquatic plant</td> <td>✓</td> <td>x</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Shrimp</td> <td>x</td> <td>x</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Bacteria</td> <td>x</td> <td>x</td> <td>✓</td> <td>✓</td> </tr> </tbody> </table> <p>(1 mark) for each correct row.</p> <p>OR</p> <p>(1 mark) for each correct column up to (3 marks).</p>	Organism	Photosynthesis		Respiration		Daylight hours	Darkness hours	Daylight hours	Darkness hours	Aquatic plant	✓	x	✓	✓	Shrimp	x	x	✓	✓	Bacteria	x	x	✓	✓	3	
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Shrimp	x	x	✓	✓																								
Bacteria	x	x	✓	✓																								
		(ii) Glucose + oxygen → carbon dioxide + water	1	Accept CO ₂ - not CO ²																								
		(iii) <ul style="list-style-type: none"> • Plant absorbs water from the environment, which is replenished when the plant and animals/bacteria respire. (1 mark) • Plant gets carbon dioxide from the water that animals/bacteria release when they respire. (1 mark) • Plant gets sunlight through clear glass/window. (1 mark) 	3																									

Question		Expected answer(s)	Max mark	Additional guidance
9.	(a)	Invasive non-native species. Accept invasive species.	1	
	(b)	(i) <ul style="list-style-type: none"> Disguise so mink more likely to enter. Prevent people from spotting it and vandalising it. 	1	OR any other valid response
		(ii) <ul style="list-style-type: none"> Use several rafts. Leave rafts set up for long periods of time. 	1	
		(iii) <ul style="list-style-type: none"> Misidentifying prints. Raft positioned in wrong place. Mink scared of raft. 	1	OR any other valid response
	(c)	(i) Predation reduces bird <ul style="list-style-type: none"> Population. (1 mark) Biodiversity. (1 mark) 	2	
		(ii) <ul style="list-style-type: none"> Trapping. Shooting. Introduce a predator of the mink. 	1	OR any other valid response

Section 2

Question			Expected answer(s)	Max mark	Additional guidance
10.	(a)	(i)	Anemometer.	1	
		(ii)	Norway spruce will act as a shelter belt which clearly reduces the speed of the prevailing wind. Lambs are less likely to die of exposure.	1	
		(iii)	Wind speed at B would be similar/ identical to location A. Wind speed at location B would increase.	1	
	(b)	(i)	<ul style="list-style-type: none"> • Net-like vein, • Spear-shaped, • Compound, • Toothed and • Opposite. 	2	4 correct = 2 2/3 correct = 1
		(ii)	2: Compound leaf 3: Leaf lobed 4: Leaf hand-shaped 4: Silver Birch	2	4 correct = 2 2/3 correct = 1
		(iii)	Leaves are not on (some/most of) the trees in winter.	1	
	(c)	(i)	Pitfall trap. (1 mark) Place a small container in a hole in the ground, so that its rim is level with the soil surface. (1 mark)	2	1 for name, 1 for description Must include - rim is level with the soil surface.
		(ii)	Woodland X is mixed woodland.	1	OR any other valid response. Do not accept <i>X is larger</i> . No mark if not all sources used.

Question			Expected answer(s)	Max mark	Additional guidance
10.	(d)	(i)	Woodland X provides greater calorific value/more heat than woodland Y. OR Converse.	1	Note: Must use the table to answer question.
	(d)	(ii)	2950 (kWh tonne ⁻¹)	2	(3500 + 3000 + 2700 + 2600) / 4 = 2950 (1 mark) for correct selection of values. (1 mark) for correct calculation. If just correct value given then award both marks as assumption that correct values have been selected is implied.
		(iii)	<ul style="list-style-type: none"> • Wind power: prevailing wind from south east. • Solar power: location Z is on a south facing slope. • Hydro: steep slope with head of water, river, flat valley to construct moderate sized power station. 	2	Only wind OR only solar OR only hydro, but no reference to the sources provided – no marks. Any two for (2 marks) .

Question		Expected answer(s)	Max mark	Additional guidance
10.	(e)	<p>Arguments for biomass plant:</p> <ul style="list-style-type: none"> Plant would create jobs in this rural area (1 mark) examples such as forester, lorry driver, plant operator. (1 mark) A small number of jobs in a rural area can have a significant positive impact on the local economy. (1 mark) Young people belonging to this area will be encouraged to stay if a variety of jobs are available. (1 mark) Wood is a renewable resource and clearly grows well in this area. (1 mark) Importing this resource from further away would be expensive and the transport of such a bulky item would require burning fossil fuels. (1 mark) Woodland area may need to be extended to make the plant sustainable. As the trees grow, this could create an area for outdoor activities such as mountain bike routes, zip wires, adventure playgrounds. (1 mark) The larger woodland will create more opportunities for livestock to gain shelter. (1 mark) 	4	<p>A maximum of (2 marks) for an appropriate extended reason.</p> <p>(Therefore it would be possible to attain full marks if only two reasons were covered but in detail.)</p> <p>(1 mark) for reasons that are more briefly explained. (Therefore four acceptable reasons would need to be given.)</p> <p>Candidates can attain full marks by putting forward legitimate reasons for letting the plant go ahead.</p> <p>OR</p> <p>Preventing the plant.</p> <p>OR</p> <p>Giving a balanced set of arguments which outline both sides of the debate.</p>

Question		Expected answer(s)	Max mark	Additional guidance
10.	(e)	<p>Continued.</p> <p>Arguments against biomass plant:</p> <ul style="list-style-type: none"> • Sheep farmer may lose his livelihood if he cannot use the Norway Spruce plantation as a shelter belt. (1 mark) • Trees have to be felled to enable them to be used (1 mark); loss of trees would destroy habitat (1 mark) and reduce local biodiversity. (1 mark) • Plant would produce smoke/smell/noise (1 mark) and put off visitors which would harm the local tourist industry eg B+B. (1 mark) Impact on local businesses that rely on visitors attracted by the quiet and attractive landscape. • Other renewable sources of energy should be considered (1 mark) eg Hydro – no smell. (1 mark) 		

Section 3

Question			Expected answer(s)	Max mark	Additional guidance
11.	A	(a)	<p>Shortwave radiation from sun passes through atmosphere, (1 mark) marginal impact on increase in atmospheric temps. (1 mark)</p> <p>Earth's surface absorbs short wave radiation, (1 mark) earth's surface heats up (1 mark), releases energy back into atmosphere (1 mark) as long wave radiation. (1 mark)</p> <p>Greenhouse gases in the atmosphere (eg CO₂, nitrous oxide etc 1 mark for each gas, max of 2 marks) absorb this form of radiation. (1 mark)</p> <p>This traps the heat thus warming the atmosphere. (1 mark)</p>	7	<p>Max (4 marks).</p> <p>A simple definition alone is only worth (1 mark).</p> <p>Any other valid response.</p>
		(b)	<p>Human activity adds additional greenhouse gasses. (1 mark)</p> <p>Increasing the ability of the atmosphere to trap heat. (1 mark)</p> <p>Impacts eg loss of biodiversity, more tropical storm events, rising sea levels, inundation of coastal areas.</p>		<p>Maximum of two marks for description of enhanced greenhouse effect OR impacts.</p> <p>All three marks not awarded if ONLY description of enhanced greenhouse effect OR impacts are mentioned.</p> <p>Any other valid response.</p>

Question			Expected answer(s)	Max mark	Additional guidance
11.	B	(a)	<p>Steep sided valley/gradient to enhance energy potential. (1 mark)</p> <p>Head of water for storage. (1 mark)</p> <p>Impermeable geology enhances the ability to store water. (1 mark)</p> <p>Constant supply of water eg rainfall, snowmelt. (1 mark)</p> <p>Proximity to national grid to reduce distribution costs. (1 mark)</p> <p>Close to population centres to ensure demand for product. (1 mark)</p> <p>Current land use is of low value. (1 mark)</p>	7	<p>Award one mark for each correct statement up to a maximum of four.</p> <p>Max three marks for a list.</p>
		(b)	<p>Potential gravitational converted to kinetic (1 mark) converted to electric energy (do not accept <i>electricity</i>). (1 mark)</p> <p>Moving water turns turbines (1 mark) which turn electromagnetic generators to produce electrical energy. (1 mark)</p> <p>Penstocks (pipes) to reduce friction of the water flow. (1 mark)</p>		<p>Award one mark for each correct statement up to a maximum of four.</p> <p>Any other valid response.</p>

Question		Expected answer(s)	Max mark	Additional guidance
12.	A	<p>Food security reduced as more nations struggle to produce enough food to cope with the growing population. (1 mark)</p> <p>Regions in this situation are more likely to experience famine. (1 mark)</p> <p>Nations in this situation have to import more food from other countries. (1 mark)</p> <p>This will reduce the money available to improve sanitation, health care education etc making the country less developed. (1 mark)</p> <p>Attempting to produce more food locally often involves farming on more marginal land resulting in soil degradation (1 mark) loss of natural habitat. (1 mark)</p> <p>Population less healthy due to malnourishment. (1 mark)</p> <p>Conflict between nations over scarce fertile land will increase. (1 mark)</p> <p>Bigger world population means more building land reducing land available for food production. (1 mark)</p> <p>Farmers turning to more intensive methods. (1 mark)</p> <p>Farmers using agrochemicals to increase yields. (1 mark)</p> <p>Farmers using GM crops. (1 mark)</p> <p>Food more expensive/rising cost. (1 mark)</p>	7	Any other valid response.

Question		Expected answer(s)	Max mark	Additional guidance
12.	B	<p>Problem: Human waste(sewage) will cause more pollution in rivers/oceans and lead to more eutrophication.</p> <p>Solution: Treat it, fertilizer, anaerobic digestion.</p> <p>Problem: Landfill, nations will produce more waste and policies such as land fill will not be sustainable as there will be fewer suitable locations.</p> <p>Solution: Reduce, reuse, recycle incinerate more solid combustible waste, but this results in air pollution.</p> <p>Problem: Consumables.</p> <p>Solution: Recycling products will have to increase. This will have to be considered/planned for by manufactures producing new products. And local authorities/ governments that remove domestic/ industrial waste. Goods such as washing machines may be leased in the future where the manufacturer is responsible for removing the product and recycling/reusing it.</p> <p>More solid waste will enter the world oceans (eg plastic) threatening aquatic life.</p>	7	<p>Definitions for Reduce, reuse, recycle - (1 mark each)</p> <p>Any other valid response.</p>

[END OF MARKING INSTRUCTIONS]