Question	Expected Answers	Marks	Guidance
1 (a) (i)	1 NO_x / oxides of nitrogen ; 2 vehicle / car, exhausts / fumes / emissions / gases / AW ; 3 burning fossil fuels in houses / burning forests ; 4 volcanic eruptions / snow melt ;	[1]	IGNORE air pollution unqualified **R** ref. to carbon dioxide 2 **R** cars unqualified 4 **A** volcano(es) unqualified
(ii)	1 leaves / trees / producers / vegetation / plants, harmed / damaged / killed ; 2 trees more likely to get diseased ; 3 bark is damaged ; 4 roots killed ; 5 (sensitive species of) lichens killed ; 6 (named) microorganisms killed ; bacteria / fungi / AW 7 soil pH decreases / soil becomes more acidic ; **A** soil erosion 8 aluminium ions become mobile ; 9 nutrients / named example(s), leached ; 10 food chains / food webs disrupted / AW ; 11 loss of habitat / less biodiversity / extinction of species ;	[max 2]	1 **A** destroyed 1 IGNOR corroded / eroded 9 **A** 'acid dissolves nutrients' 11 **A** fish eggs fail to hatch / death of animals
(b)	1 use, alternative / renewable / green / AW , sources of energy ; **A** example(s) nuclear power / wind power / wave power / solar power / hydrogen power 2 use low sulfur fuels ; 3 reduce use of coal ; 4 flue gas desulfurisation / 'use scrubbers' / chimney electrostatic precipitators / neutralise waste gasses with lime ; 5 catalytic converters ; 6 provide / use, more public transport ; 7 car sharing / car pools / reduce use of cars / hybrid cars / electric cars / use biofuels ; 8 walking / cycling ; 9 reduce food miles / AW ; 10 AVP ; e.g. (named) international treaty for <u>reducing acid rain</u> **R** fewer factories	[max 2]	4 **R** abbreviation (FGD) on its own or unqualified 7 **R** fewer cars unqualified 10 international treaties e.g. Sulphur Emissions Reduction Protocol / Convention on Long-Range Transboundary Air Pollution,

Question	E Answers	Marks	Guidance
1 (c)	*look for positive features, not absent ones apart from unsegmented* unsegmented / not segmented / shell / (muscular) foot ;	[1]	IGNORE soft body
(d) (i)	frogs / black-fly larvae ;	[1]	
(ii)	clams / snails / molluscs ;	[1]	
(iii)	1 enzymes do not function (well) / AW ; 2 acid damages, shells / scales / skin ; **A** only external tissues 3 calcium ions not available for shells / difficult to make shells ; 4 aluminium in solution, toxic to fish / fish die ; 5 acid / low pH, kills fish ; 6 fish produce (lots of) mucus ; 7 blocks gills ; 8 AVP ;	[max 2]	1 **A** enzymes denatured 2 **A** acid dissolves shells IGNORE consequences for food chain
		[Total: 10]	

Question	E Answers	Marks	Guidance
2 (a) (i)	award two marks if the correct answer (92.86 / 92.9 / 93) is given if answer missing or incorrect, award one mark for correct working (difference = 11.7) $\frac{11.7}{12.6}$ x 100 92.86 / 92.9 / 93 ;;	[2]	**R** rounding down to 92.8
(ii)	state link between height and yield (using figures) ; taller plants have more leaves ; more leaves, increases surface area to absorb light / have more chlorophyll *or* chloroplasts ; more leaves increases photosynthesis ; more photosynthesis / more leaves, leads to increased, food production / potatoes / yield ; taller stems allows more, banking / earthing up ; allows more, potato tubers, to form ;	[max 2]	

Question	E Answers	Marks	Guidance
2 (iii)	plots **F** to **H** increased yield, (per hectare / increased yield per plant) / AW ; smaller, increase / effect, when treated with manure compared to chemical fertiliser ; greatest increase when treated with both manure and chemical fertiliser together ; less increase in yield when both manure and chemicals are used rather than one (compared with none) ; comparative use of data ;	[max 3]	
(iv)	nitrate used to make, amino acids / proteins ; ref to protein required for growth* ; ref to enzymes* ; nitrogen / nitrates, used to make chlorophyll **;** ref to photosynthesis* ;	[max 2]	* linked marks must refer to use of nitrat
(v)	control ; to, determine / compare, the effect of adding, chemicals / fertilisers / manure ;	[max 1]	

Question	E Answers	Marks	Guidance
2 (b)	advantages to max 4 higher yields (therefore more food) ; nutrients more readily available (than from manure) ; quick acting / no decomposition needed ; less labour (than using manure) / easier to apply ; exact quantities can be applied ; can apply specific nutrients (that crop requires / that are deficient in soil) ; disadvantages to max 4 loss of soil structure /erosion / reduced earthworm population ; fertiliser lost from land by, leaching / run off (into waterways) ; leads to, eutrophication / growth of algae / algal bloom ; death / migration, of fish / invertebrates / animals ; *two AVP to max 2* AVP ; e.g. allergies / stomach cancer AVP ; e.g. weed growth / wilting	[max 5]	IGNORE references to costing / profit parts of the eutrophication process but not disadvantages therefore IGNORE not credit (algae / plants, die) (decomposers / bacteria, use up oxygen dissolved in water)
		[Total: 15]	

Question	E Answers	Marks	Guidance
3 (a)	concentration of **both** gases (relatively) constant until about 1800 ; steep / AW, increase in **both** from 1800 (until 2000) ; comparative use of figures ; **two figs for one of the gases or one fig for each**	[3]	Ref. to both gases required
(b)	max 3 for carbon dioxide industrialisation / AW ; burning of fossil fuels ; vehicle exhausts / AW ; deforestation / fewer trees / AW ; less carbon dioxide absorbed by plants / AW ; more methane from, rice fields / cattle ; increased waste (disposal) ; methane from (anaerobic breakdown in), landfill sites / waste dumps / AW ; AVP ;	[max 4]	**R** fumes unqualified IGNORE ref to natural disasters, etc. NB incorrect references to methane e.g. cars producing <u>both</u> gases but allow factories producing both gases
(c)	radiation emitted / reflected by earth's surface ; ref to infra red ; heat prevented from leaving (the atmosphere) ; gases, absorb / reflect / trap <u>infra red</u> ; atmosphere gets warmer ;	[max 3]	**A** ref. to global warming
(d)	fewer trees cut down ; less waste ; less material burnt ; ref to, land-fill / rubbish tips / environmental / ecological issues / AW ; conservation of, finite resources / raw materials / AW ; ref to biodegradable products / plastic is non biodegradable ; any correct ref to atmospheric gases e.g. carbon dioxide / methane ; AVP ;	[3]	IGNORE ref to cost of recycling
		[Total: 13]	

Question	E	Answers	Marks	Additional Guidance
4 (a (i)		(oxygen concentration) decreases, steeply / AW ; zero / 0%, concentration ; **A** none / no oxygen more gradual / AW, increase ; increase / returns, to, original / normal / maximum concentration ; **A** 100% comparative data quote ; **A** ref. to at least two sampling stations	[max 4]	**A** rapid decrease / over short distance **A** slow increase / over longer distance **A** 'at first' for **A**, 'at end' for **G**
(ii)		stonefly (nymph) ;	[1]	
(iii)		rat-tailed maggot **and** tubifex (worm) ; **I** midge larva	[1]	**A** maggot and worm
(iv)	**1**	number, of species / invertebrates, decreases as oxygen concentration decreases / *ora* ; **A** correct ref. to stations A to G	[max 3]	MP1 *number of different species is in the question, but make sure it is implied in answer* MP 2 **A** ***ora*** e.g. most/some survive only where there is (lots of) oxygen / few can survive where there is little oxygen
	2	some cannot survive where there is low oxygen / *ORA* ;		
	3	bacteria use oxygen (to decompose sewage) ;		
	4	some invertebrates can only respire aerobically / AW ;		
	5	some (named) invertebrates, can respire anaerobically (as well) ;		
	6	ref. to change in other named condition of river ; e.g. temperature / pH / cloudiness / flow rate / river bed /		
	7	less food ;		
	8	presence of, poisons / toxins (from sewage) ;		
	9	migrate / move, away ;		
	10	AVP ; e.g. other changes such as increase in aquatic plants / better habitat		

Question	E	Answers	Marks	Additional Guidance
4 **(b)**	**1**	enzymes / named enzyme **;**		**R** bacteria are enzymes
	2	<u>secrete</u> / release / pass out of cells / onto food / <u>extracellular</u> / AW **;**		
	3	digest / breakdown, large / complex / insoluble, (molecules) to, small / soluble / simple, (molecules) **;**		**A** small<u>er</u> , simpl<u>er</u>
	4	cellulose → sugar / glucose **;**		
	5	starch → sugar / maltose / glucose **; I** further change, e.g. to carbon dioxide / water		**A** polysaccharides → monosaccharides *if name not given*
	6	protein → polypeptides / peptides / amino acids **;** ***I** further changes e.g. to ammonia, nitrite, etc.*		
	7	fats → fatty acids (and glycerol) **;**		
	8	ref. to respiration **;**	[max 4]	
(c)		*mark to max 2 for each*		
	1	reeds (bed), absorb / take up / use, <u>nitrate</u> (ions) **; I** nodules		**R** if nitrogen absorbed
	2	diffusion / active transport **;**		
	3	use nitrate to make, amino acids / proteins / chlorophyll / enzyme(s) **;** denitrifying bacteria / denitrification **;**		**I** growth
	4	nitrate ions converted to nitrogen (gas) **;**		**R** MP4 if linked to incorrect change to N
	5	ref. to anaerobic conditions in the reed bed **;**		**A** even if MP4 incorrect
	6		[max 3]	

Question	E	Answers	Marks	Additional Guidance
4 (d)	**1**	(methane is) greenhouse gas **;** **A** contributes to the greenhouse effect		*methane contributes to enhanced greenhouse effect = 2 marks*
	2	traps / absorbs, heat / infra red (IR) radiation **;**		
	3	radiated back towards the Earth's surface / heat kept near surface / prevents heat escaping (to space) / AW **;**		**I** *combustion of methane*
	4	<u>enhanced</u> greenhouse effect **;**		
	5	global warming / warming of atmosphere / increase in Earth temperature **;**		**I** effects of methane on ozone
	6	any consequence **;** e.g. rise in sea levels, melting of ice caps, droughts, flooding, desertification, erosion, etc.	[max 3]	
			[Total: 19]	