Mark scheme

Chemistry of our environment

Chemistry 0620 · Questions from Paper 3, Paper 4 and Paper 6

Total marks

85

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
6	7	7	8	9	6	8	8	12	14	**85**

Question 1 [6]

1(a)	sedimentation / filtration (1) chlorination / adding chlorine (1)	2
1(b)	test: (anhydrous) copper(II) sulfate / (anhydrous) cobalt(II) chloride (1) observations: white to blue / blue to pink (1)	2
1(c)	carbon dioxide: global warming / climate change (1) oxides of nitrogen: acid rain / photochemical smog / respiratory problems (1)	2

Question 2 [7]

2(a)	78 (%)	1
2(b)(i)	vehicle engines / high temperature furnaces / lightning	1
2(b)(ii)	breathing difficulties / asthma	1
2(c)(i)	phosphorus	1
2(c)(ii)	to increase crop growth / to replace elements taken from soil by previous crops	1
2(c)(iii)	flame test / put potassium (compound) in (non-luminous) flame (1) lilac colour (1)	2

Question 3 [7]

3(a)(i)	sewage	1
3(a)(ii)	particulates	1
3(a)(iii)	methane	1
3(b)	1.4 (mg)	1
3(c)	low sulfur fuels / flue gas desulfurisation	1
3(d)	low melting point / low boiling point (1) poor electrical conductivity / poor thermal conductivity (1)	2

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Question 4 [8]

4(a)	addition of carbon – to remove tastes / odours sedimentation – to remove solids chlorination – to kill microbes all 3 correct = 2 marks 1 correct = 1 mark	2
4(b)	**heat** to melting point of the sample and **measure** mp OR **heat** to 0 °C and observe if it's melting	1
	pure water melts at 0 °C / has a sharp melting point / if not 0°C then it must be impure. OR impure water melts at a **lower** mp than 0 °C / melts over a range of temperatures OR compare the melting point of the water sample to the mp of pure water.	1
4(c)(i)	sulfur dioxide: acid rain (1) particulates: respiratory problems / cancer (1)	2
4(c)(ii)	calcium oxide (1) neutralisation (1)	2

Question 5 [9]

5(a)	dip indicator paper in to water (and record the colour) (1) compare the colour with (universal indicator) colour chart match colour with colour chart (1)	2
5(b)(i)	nitrogen (1) oxygen (1)	2
5(b)(ii)	large(r) particles cannot get through (the small gaps in) the filter / large(r) particles get trapped in the filter / large(r) particles too big to get through (filter) (1) water passes through (1)	2
5(b)(iii)	to kill bacteria / to kill micro-organisms	1
5(c)	(from) blue (1) (to) pink (1)	2

Question 6 [6]

6(a)	(gas) syringe;	1
6(b)	arrow under copper;	1
6(c)	orange / red / brown / pink; to black;	2 1 1
6(d)	volume of oxygen = 10 cm^3; % oxygen = 10/50 × 100 = 20%;	2 1 1

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Question 7 [8]

7(a)	any 2 from: carbon dioxide; nitrogen; any named noble gas;	**2**
7(b)	any 6 from: carbon monoxide; from incomplete combustion (of carbon-containing fuel); sulfur dioxide; from burning fossil fuels / roasting ores which contain sulphur / volcanoes; oxides of nitrogen; nitrogen reacting with oxygen in car engines / lightning; methane; from anaerobic decomposition / anaerobic decay;	**6**

Question 8 [8]

8 **(a)** **(i)** (waste gases) from animals [1]
decaying vegetation / anaerobic decay [1]
accept: decomposition of organic material / natural gas

(ii) carbon dioxide [1]
water [1]

(b) photosynthesis removes carbon dioxide from the atmosphere [1]
both respiration and combustion produce carbon dioxide [1]
any **two** of the following: [2]
plants photosynthesis changes carbon dioxide into carbohydrates
(burning) of fossil fuels / named fuel / petrol / alkanes
respiration by living organisms to obtain energy from
carbon–containing compounds
comment that the balance between these processes determines the percentage of carbon dioxide

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Question 9 [12]

9(a)	*Any **two** fossil fuels from:* crude oil / petroleum; natural gas / methane; petrol / gasoline; kerosene / paraffin; diesel (oil) / gas oil; fuel oil; refinery gas / LPG; propane; butane;	**2**	**I** ethane / oil / naphtha / coal / gas **R** coke / bitumen / lubricating oil / wood
9(b)	hydrogen, oxygen, nitrogen; *All three for 2 marks* *two for 1 mark*	**2**	**A** H, O, N **I** H_2, O_2, N_2
9(c)(i)	M1 oxygen and nitrogen (from air) react; M2 oxides of nitrogen **OR** nitrogen oxide(s) are formed; M3 nitrogen oxides formed react with water (to form acid);	**3**	**A** nitrogen combust for M1 **R** M1 if oxygen or nitrogen originate from the fuel **A** named oxide of nitrogen e.g. nitrogen dioxide **A** correct formulae **A** NO_x
9(c)(ii)	*Any **two** from:* M1 lowers pH or acidifies lakes / rivers or kills fish; M2 changes composition of soils or reduces fertility of soil or reduces crop yields deforestation or kills crops / trees / plants / leaves; M3 attacks (limestone) buildings or statues; M4 attacks metal (structures) / bridges;	**3**	**R** 'global warming / greenhouse effect' **R** 'increases pH of lakes so kills fish' for M1 **A** removes nutrients / leaches the soil **A** alternative words for 'attacks' e.g. damages / reacts with / corrode / erode for M3 and M4 **I** rusting but **A** 'enhances rusting' for M4 **I** toxicity to humans
9(d)	*Any **three** from:* M1 wood burns to produce (less) carbon dioxide; M2 trees (wood) take in carbon dioxide; M3 by photosynthesis; M4 wood is carbon neutral fuel;	**3**	

Question 10 [14]

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10 **(a)** anhydrous copper sulfate / white copper sulfate [1]
ignore oxidation numbers
turns blue [1]

OR

anhydrous cobalt chloride / blue cobalt chloride (1 mark)
ignore oxidation numbers
turns pink (1 mark)
note second mark is dependent on the first being correct BUT cobalt chloride turns pink = 1 mark

(b) coolant / solvent / hydroelectric power [1]
allow for cooling / to cool
allow specific reactions e.g. making sulfuric acid / making ethanol
allow: for washing or cleaning if specific industrial process mentioned
allow for agriculture / for growing crops (on a large scale) / brewing
ignore for cooking / for drinking / for power (unqualified) / for watering plants / for cooling food

(c) substance OR liquid which dissolves another (substance) /
substance which does the dissolving [1]
ignore it dissolves / it is a liquid / names of solvents

(d) **(i)** burning coal / burning fossil fuels / burning petrol petrol / burning specified fuel (as long as it contains sulfur) / from volcanoes / from heating sulphide ores [1]
ignore burning pure substances e.g. hydrogen, methane / car exhausts
ignore from ores without qualification /

(ii) any two effects (1 mark each) e.g. [2]
- forest death / kills trees / deforestation / destroys trees / damages trees
  ignore kills plants / rots trees / kills crops
- acidification of lakes / acidification of rivers
  ignore acidifies soils
- kills fish / aquatic plants / plant in lakes or rivers
  ignore kills fish or plants in the sea / kills animal (unqualified) / kills plants (unqualified)
- erodes buildings made from limestone / erodes carbonate rocks / damages buildings made from limestone / damages carbonate rocks
  allow destroys building made from limestone / destroys carbonate rocks
  ignore just erosion of buildings or rocks unqualified / dissolves buildings / chemical weathering
- corrosion of metal structures / corrosion of named metal structures e.g. bridges or railings / damages metal structures
  allow erosion of metal structures / damaging metal structures / destroys metal structures / reacts with metals
  ignore dissolves metals
  ignore effects on humans

(iii) 64 (g) [1]

(e) In each of these points, the explanation mark depends on the correct step

filtration or words to that effect [1]

removal of undissolved substances / solids / impurities get trapped / removes insoluble impurities [1]

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allow removes dirt
ignore solids which would sediment rapidly or are large e.g. pieces of metal, batteries, twigs etc. / removes impurities

chlorination / adding chlorine [1]
allow chlorification

kills bacteria [1]
allow kills microbes / kills germs / disinfection / sterilisation
ignore kills bugs / removes bacteria

allow other stages with correct explanation e.g.
screening (1 mark) removing large objects / removing twigs etc. (1 mark)
sedimentation (1 mark) allowing particles to settle (1 mark)
adding carbon (1 mark) removes tastes / removes smells (1 mark)
flocculation (1 mark) coagulates clay / makes small particles clump together (1 mark)
lime (1 mark) idea of neutralisation or removal of acids (1 mark)

(f) **(i)** 20 (%) allow 19–21 (%) [1]

(ii) 28 (g) [1]

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