

8.3 Acid Deposition

Question Paper

Course	DP IB Chemistry
Section	8. Acids & Bases
Topic	8.3 Acid Deposition
Difficulty	Hard

Time allowed: 20
Score: /10
Percentage: /100

Question 1

Acid rain can be up to 50 times more acidic than normal rain, which has a pH around 5.5. What is the approximate concentration of H^+ in acid rain?

- A. $2.50 \times 10^{-3} \text{ mol dm}^{-3}$
- B. $2.50 \times 10^{-4} \text{ mol dm}^{-3}$
- C. $2.50 \times 10^{-5} \text{ mol dm}^{-3}$
- D. $50.0 \times 10^{-4} \text{ mol dm}^{-3}$

[1 mark]

Question 2

Natural gas contains on average 5.5 mg / m^3 of sulfur in the form of hydrogen sulfide, H_2S ($M_r = 34$). If a typical household in the UK consumes 0.198 m^3 of gas per day, what is the average annual emission of sulfur in g per household?

- A. $5.5 \times 0.198 \times 365$
- B. $\frac{5.5 \times 0.198 \times 365 \times 34}{1000 \times 32}$
- C. $\frac{5.5 \times 0.198 \times 365}{1000}$
- D. $\frac{5.5 \times 0.198 \times 365 \times 32}{1000 \times 34}$

[1 mark]

Question 3

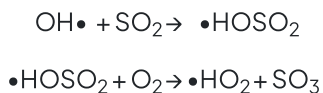
Nitrous acid is produced when nitrogen dioxide dissolves in water to produce acid rain. What is the correct Lewis structure for nitrous acid?

- | | |
|---|---|
| A $\text{H}-\ddot{\text{O}}-\ddot{\text{N}}=\ddot{\text{O}}:$ | B $\text{H}-\ddot{\text{O}}-\text{N}=\ddot{\text{O}}:$ |
| C $\text{H}-\ddot{\text{O}}-\ddot{\text{N}}=\text{O}:$ | D $\text{H}-\ddot{\text{O}}-\ddot{\text{N}}=\ddot{\text{O}}:$ |

[1 mark]

Question 4

Hydroxyl free radicals are thought to be involved in complex reactions converting sulfur dioxide into sulfur trioxide in the atmosphere.



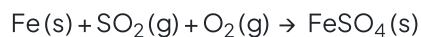
Which is true?

- A. $\text{OH}\cdot$ is catalytic
- B. $\cdot\text{HOSO}_2$ contains 24 electrons
- C. Both reactions are redox
- D. The first reaction is exothermic

[1 mark]

Question 5

Iron structures can be damaged by dry deposition such as the equation below:



Given that,

$$\Delta H_f^\ominus (\text{SO}_2) = -297 \text{ kJ mol}^{-1}$$
$$\Delta H_f^\ominus (\text{FeSO}_4) = -929 \text{ kJ mol}^{-1}$$

What is the enthalpy change for this reaction?

- A. $-297 - 929$
- B. $297 + 929$
- C. $-297 + 929$
- D. $297 - 929$

[1 mark]

Question 6

Acid deposition results in leaching of aluminium ions from the soil. Which are true?

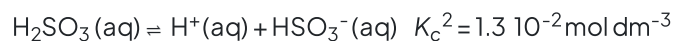
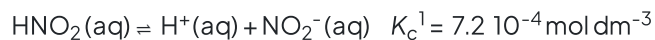
- I. Al^{3+} ions damage plants roots
- II. Al^{3+} ions damage fish gills
- III. Al^{3+} ions affect human health

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

[1 mark]

Question 7

The equilibrium constants for the dissociation of nitrous and sulphurous acid found in acid rain are as follows:



Which is true?

	Stronger acid	Effect on K_c of mixing the same volume and concentration the acids
A	Nitrous	No effect
B	Sulfurous	No effect
C	Nitrous	K_c^2 decreases
D	Sulfurous	K_c^1 decreases

[1 mark]

Question 8

How many different types of ions can be found in acid rain, assuming it contains a mixture of sulfuric, sulfurous, nitric and nitrous acids?

- A. 4
- B. 5
- C. 6
- D. 7

[1 mark]

Question 9

Historic buildings and statues have frequently suffered chemical corrosion from acid rain. Which building materials would be unaffected by this?

- A. Marble
- B. Limestone
- C. Granite
- D. Lime Mortar

[1 mark]

Question 10

Which is true about the hydrogensulfate ion, HSO_4^- , found in acid rain?

- I. It is amphiprotic
 - II. It is amphoteric
 - III. Sulfur is in its highest oxidation state
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

[1 mark]