

- Desferal is a siderophore-based drug that is used in humans to treat iron-overload. One molecule of Desferal (molecular formula:  $C_{25}H_{48}O_8N_6$ ) can bind one  $Fe^{3+}$  ion. A patient with an iron-overload disease had an excess of  $5.34 \times 10^{-4} M Fe^{3+}$  in her bloodstream. Assuming the patient had a total blood volume of 4.84 L, what mass of Desferal would be required to complex all of the excess  $Fe^{3+}$ ?

**2**

Answer:

- Many gases are available for use in compressed gas cylinders, in which they are stored at high pressures. Calculate the mass of oxygen gas that can be stored at 20 °C and 170 atm pressure in a cylinder with a volume of 60.0 L.

**2**

Answer:

**Marks**  
**6**

- If 20.0 mL of a 0.100 M solution of sodium phosphate is mixed with 25.0 mL of a 0.200 M solution of zinc chloride, what mass of zinc phosphate will precipitate from the reaction?

Answer:

What is the final concentration of zinc ions in solution after the above reaction?

Answer:

What is the final concentration of sodium ions in solution after the above reaction?

Answer:

- Human haemoglobin has a molar weight of  $6.45 \times 10^4 \text{ g mol}^{-1}$  and contains 3.46 g of iron per kg. Calculate the number of iron atoms in each molecule of haemoglobin.

Answer:

**Marks**  
**3**

- If 50 mL of a 0.10 M solution of  $\text{AgNO}_3$  is mixed with 50 mL of a 0.040 M solution of  $\text{BaCl}_2$ , what mass of  $\text{AgCl}(s)$  will precipitate from the reaction?

Answer:

What is the concentration of  $\text{NO}_3^-$  ions in the final solution from the reaction above?

Answer:

**Marks**  
**4**

- Solutions of lead(II) nitrate (0.080 M, 60 mL) and potassium iodide (0.080 M, 40 mL) are mixed. What amount (in mol) of  $\text{PbI}_2(\text{s})$  precipitates?

Answer:

What is the final concentration of  $\text{K}^+(\text{aq})$  ions remaining in solution after the reaction?

Answer:

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Given that haemoglobin contains 4 Fe atoms per molecule and its concentration in blood is 15.0 g per 100 mL, calculate the total mass of Fe in the patient's blood *before* being treated with Desferal. (The molar mass of haemoglobin is  $6.45 \times 10^4 \text{ g mol}^{-1}$ .)

**Marks**  
**4**

ANSWER:

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**Marks**  
**5**

- Some micro-organisms thrive under warm, acidic conditions where sulfuric acid is produced as a metabolic by-product from the reaction between sulfur (S), water and oxygen (O<sub>2</sub>). Write a balanced equation for this reaction.

Calculate the volume of oxygen that is required to react to completion with 0.0655 g of sulfur at 1.00 atm and 55 °C.

ANSWER:

Calculate the pH of the final solution if the reaction is carried out in 20.0 L of water. Assume that the sulfuric acid fully dissociates.

ANSWER:

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