Titrations:

1. Consider the following statements:

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| --- | --- |
| I | Titration is the progressive addition of one reagent to another reagent |
| II | Titration involves an acid and a base solution. |
| III | The indicator endpoint in a titration should indicate that chemically equivalent amounts have been brought together. |
| IV | Titration results in a solution with a pH of 7.0 at the equivalence point. |

Which statement(s) regarding titration are **ALWAYS true**?

|  |  |
| --- | --- |
| a | I and II |
| b | I and III |
| c | II and III |
| d | I, II, III and IV |

1. Carmen and Isabel were asked to titrate an acidified Fe2+(aq) solution with an acidified Na2Cr2O7 (aq) solution. The correct redox reaction for this titration is \_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| a | 6Fe2+(aq) + Cr2O72-(aq) + 14 H+(aq) 🡪 2Cr3+(aq) + 6 Fe3+(aq) + 14OH-(aq) |
| b | 6Fe2+(aq) + Cr2O72-(aq) + 14 H+(aq) 🡪 2Cr3+(aq) + 6 Fe3+(aq) + 7H2O(l) |
| c | 6Fe2+(aq) + 2 Na+(aq) + Cr2O72-(aq) + 14 H+(aq) 🡪 2Cr3+(aq) + 6 Fe3+(aq) + 7H2O(l) |
| d | 6Fe3+(aq) + Cr2O72-(aq) + 14 H+(aq) 🡪 2Cr3+(aq) + 6 Fe2+(aq) + 7H2O(l) |

1. A strong oxidizing agent is to be titrated using a strong reducing agent. The **least** accurate titration technique would be to add the oxidizing agent to the reducing agent by using a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

|  |  |
| --- | --- |
| a | Graduated cylinder |
| b | Medicine dropper |
| c | Beaker |
| d | burette |

1. Elisabeth prepared a standard acidified solution of Fe2+(aq) and then titrated a KMnO4(aq) solution of unknown concentration. Why did Elisabeth acidify the Fe2+(aq) rather than the KMnO4(aq) solution?

|  |  |
| --- | --- |
| a | Fe2+(aq) cannot act as a reducing agent without an acid |
| b | the acid changes Fe2+(aq) to Fe(s) to form the standard solution |
| c | MnO4-(aq) will not act as an oxidizing agent without an acid. |
| d | Acid is required to dilute the Fe2+(aq) to a lower concentration |

1. In an experiment, 0.21  KMnO4(aq) was titrated to determine the concentration of an acidified Sn2+(aq) solution. The following data was obtained:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Trial I | Trial II | Trial III | Trial IV |
| Volume of Sn2+(aq) (mL) | 10.00 | 10.00 | 10.00 | 10.00 |
| Burette final reading (mL) | 11.26 | 22.15 | 33.03 | 43.93 |
| Burette initial reading (mL) | 0.0 | 11.26 | 22.15 | 33.03 |
| Volume of KMnO4(aq) used (mL) | 11.26 | 10.89 | 10.88 | 10.90 |

The most likely reason that trial I required more KMnO4(aq) than the other trials is that the\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| --- | --- |
| a | flask into which the Sn2+(aq) was pipetted may have been wet |
| b | pipet used to transfer the Sn2+(aq) sample was wet |
| c | Clean, dry burette was not rinsed with KMnO4(aq) before it was filled |
| d | tip of the burette was not filled with KMnO4(aq) |

1. One of the main techniques used in quantitative measurement of redox reactions is

|  |  |
| --- | --- |
| a | Precipitation |
| b | Titration |
| c | Dissociation |
| d | Neutralization |

1. Jody wishes to prepare 100 mL of a 0.0100 SnF2(aq) to titrate with freshly acidified KMnO4(aq) of uncertain concentration. The equipment available to Jody includes a 100 mL volumetric flask, a 10 mL pipette, an electronic balance with a precision of ±0.01 g, and a 150 mL beaker.

Once Jody obtains the appropriate mass of SnF2(s) , which procedure should she use to prepare this solution?

|  |  |
| --- | --- |
| a | Place the SnF2(s) in the beaker and add exactly 100 mL of water from the volumetric flask |
| b | Place the SnF2(s) in the beaker and add exactly 100 mL of water from the pipette in 10 mL portions |
| c | Place the SnF2(s) in the beaker, dissolve it in more than 100 mL of water, and then pour the solution into the volumetric flask to the 100 mL mark |
| d | Place the SnF2(aq) in the volumetric flask, dissolve it in less than 100 mL of water, and then dilute to the 100 mL mark. |

1. Some boys argue about the difference between the equivalence point of a titration and the end point of a titration. They titrate an acidic solution of sodium iodide with potassium permanganate solution. The boys make several predictions about what will happen when they reach the **endpoint.** The TRUE statement below is \_\_\_\_

|  |  |
| --- | --- |
| a | Stephan says a solid will suddenly appear. |
| b | Jared says a green color will suddenly appear |
| c | Justin says a purple color will suddenly appear |
| d | Dale says the pH will suddenly fall. |

1. Some boys argue about the difference between the **equivalence point** of a titration and the **endpoint** of a titration. The four boys titrate a solution of tin (II) nitrate with an **acidic** solution of potassium dichromate. Choose the correct prediction below.

|  |  |
| --- | --- |
| a | Kyle predicts that the equivalence point is blue green and the endpoint is brown |
| b | Matt predicts that the equivalence point is colorless and the endpoint is orange |
| c | Jason predicts that the endpoint is blue green and the equivalence point is brown |
| d | Jeremy predicts that the equivalence point is orange and the endpoint is colorless |

1. Some girls argue about the difference between the **equivalence point** of a titration and the **endpoint** of a titration. Morgan, Rachel, Chelsea and Lara titrate a solution of tin(II) nitrate with an **acidic** solution of potassium permanganate

Choose the **TRUE** statement below.

|  |  |
| --- | --- |
| a | Chelsea says the equivalence point is purple and the endpoint is colorless |
| b | Morgan says the endpoint is blue-green and the equivalence point is brown |
| c | Rachel says the equivalence point is colorless and the endpoint is purple-pink |
| d | Lara says the equivalence point is brown and the endpoint is blue-green |

1. Justin and Martial do an oxidation reduction titration reaction. They titrate a 10 mL sample of 0.010  Cr2+(aq) solution with excess acidified 0.010  Cr2O72-(aq) The equivalence point color will be \_\_\_\_\_\_ and the endpoint color will be \_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| a | Green | Brown |
| b | Blue | Orange |
| c | Green | Orange |
| d | Colorless | Brown |

1. Using acidified 0.20  Cr2O72-(aq), a student titrated a solution of Sn(NO3)2(aq) of unknown concentration. In the titration, 34.0 mL of oxidizing agent was required to react with 43.0 mL of the reducing agent. The concentration of Sn(NO3)2(aq) \_\_\_\_\_\_ 

|  |  |
| --- | --- |
| a | 0.16 |
| b | 0.47 |
| c | 0.25 |
| d | 0.76 |

1. In a titration experiment, a 0.0800 mol/L solution of acidic K2Cr2O7(aq) was used to oxidize Sn2+(aq) to Sn4+(aq). The following data was obtained.

|  |  |
| --- | --- |
| Volume of Sn2+(aq) used | 20.0 mL |
| Final burette reading of K2Cr2O7(aq) | 73.4 mL |
| Initial burette reading of K2Cr2O7(aq) | 14.4 mL |

The concentration of Sn2+(aq) was \_\_\_\_\_\_\_ 

|  |  |
| --- | --- |
| a | 0.708 |
| b | 0.236 |
| c | 8.14 x 10-2 |
| d | 2.84 x 10-4 |

1. The mass of I2(s) that is formed when 800 mL of 0.100 mol/L NaI(s) react with excess chlorine gas, Cl2(g) is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g

|  |  |
| --- | --- |
| a | 102 |
| b | 203 |
| c | 10.2 |
| d | 50.8 |

1. **Numerical response question:** Left justify your answer in the boxes provided.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |

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| Leanne used a standardized 0.12 5potassium dichromate solution to titrate a series of 20.0 mL samples of acidified Sn2+(aq). The following data was collected   |  |  |  |  | | --- | --- | --- | --- | | Trial | 1 | 2 | 3 | | Final burette reading (mL) | 27.2 | 44.5 | 30.1 | | Initial burette reading (mL) | 10.1 | 27.2 | 12.9 |   Based on this information, **determine** the chemical amount of potassium dichromate solution used in the titration. Express the answer in the form a.bc x 10-d mol. The letters a,b,c,d respectively are \_\_, \_\_, \_\_, \_\_. |

1. **Numerical response question:** Left justify your answer in the boxes provided.

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| --- | --- | --- | --- |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A standardized 0.225 solution of KMnO4 (aq) was used to titrate 10.0 mL samples of acidified Fe2+(aq). The following data was collected   |  |  |  |  | | --- | --- | --- | --- | | Trial | 1 | 2 | 3 | | Final burette reading (mL) | 21.4 | 31.3 | 41.0 | | Initial burette reading (mL) | 11.6 | 21.4 | 31.3 |   Based on this information, determine the **concentration** of the Fe2+(aq) as \_\_\_\_\_  Solutions:   1. B 2. B 3. C 4. C 5. D 6. B 7. D 8. C 9. A 10. C 11. A 12. B 13. A 14. C 15. 2153 16. 1.10 |