

Multiple Choice

2-1 *Safe, Ethical Handling of Chemicals and Waste*

1. Which of the following statements are TRUE?

- I Organic solvents, concentrated acids, and concentrated ammonia should be handled in a fume hood.
 - II A respirator should be worn when handling organic solvents.
 - III All containers should be labeled to indicate what they contain.
 - IV Contact lenses are adequate to protect eyes from liquids and gases in the lab.
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- A) I and II
 - B) II and IV
 - C) I and III
 - D) III and IV
 - E) II and III

Answer: C

Easy

2. _____ is a set of principles intended to help sustain a habitable planet.

- A) Environmental chemistry
- B) Analytical chemistry
- C) Biological chemistry
- D) Atmospheric chemistry
- E) Green chemistry

Answer: E

Easy

2-2 *The Lab Notebook*

3. The _____ fulfills the critical function of reporting what a researcher has done and what they observed, and allows another researcher to repeat their work.

- A) lab report
- B) lab notebook
- C) MSDS
- D) project report
- E) technical note

Answer: B

Easy

4. Which of the following is NOT a good practice when keeping a laboratory notebook?
- A) Use complete sentences when writing notes.
 - B) Write a balanced chemical equation for every reaction used.
 - C) Paste hard copies of important data into the notebook.
 - D) Record the names of computer files where programs and data are stored.
 - E) All of the above are good practices when keeping a laboratory notebook.

Answer: E

Easy

2-3 *Analytical Balance*

5. The mass of the empty receiving vessel used with an analytical balance is the:
- A) linearity.
 - B) buoyancy.
 - C) readability.
 - D) tare.
 - E) tolerance.

Answer: D

Easy

6. _____ is the upward force exerted on an object in a gaseous or liquid fluid. The mass measured by an analytical balance in air is _____ its actual mass.
- A) buoyancy; heavier than
 - B) buoyancy; lighter than
 - C) electromagnetic force; heavier than
 - D) electromagnetic force; lighter than
 - E) tare; equal to

Answer: B

Intermediate

7. Which of the responses below are sources of weighing error?

- I Weighing a sample that is warmer than ambient temperature.
 - II Cooling a sample in a desiccator prior to weighing.
 - III Periodically calibrating the balance.
 - IV The temperature of the balance changing over time.
- A) I and II
 - B) I and III
 - C) II and IV
 - D) II and III
 - E) I and IV

Answer: E
Intermediate

2-4 Burets

8. Which scenario below has the lowest relative uncertainty?

- A) Delivering 35.50 mL of titrant with a 50 \pm 0.05 mL class A buret.
- B) Delivering 15.40 mL of titrant with a 50 \pm 0.05 mL class A buret.
- C) Delivering 18.50 mL of titrant with a 25 \pm 0.03 mL class A buret.
- D) Delivering 5.40 mL of titrant with a 25 \pm 0.03 mL class A buret.
- E) Delivering 97.30 mL of titrant with a 100 \pm 0.10 mL class A buret.

Answer: E (0.10% relative uncertainty)
Hard

9. A student prepares a solution using a 1 L volumetric flask. When he finishes, the meniscus is above the calibration mark on the flask neck. The concentration of the solution is:

- A) less than calculated.
- B) greater than calculated.
- C) unchanged.
- D) irrelevant.
- E) impossible to predict.

Answer: A
Intermediate

10. A student titrated extracted chloride from a soil sample with 0.1 M silver nitrate. During the titration he performed the following actions while operating the buret.

- Washed the buret with silver nitrate solution
- Drained titrant slowly
- Delivered a fraction of a drop near end point
- Read bottom of concave meniscus
- Avoided parallax
- Accounted for graduation thickness in readings

His instructor notes on the student's lab report that the student forgot to ____when operating his buret.

- A) eliminate air bubbles
- B) estimate reading the buret to 1/10 of a division
- C) fill the buret to exactly 0.00 mL
- D) eliminate air bubbles and fill the buret to exactly 0.00 mL.
- E) eliminate air bubbles and estimate reading the buret to 1/10 of a division.

Answer: E

Hard

2-5 Volumetric Flasks

11. Which of the following is FALSE regarding volumetric flasks?

- A) Volumetric flasks are calibrated to obtain a particular volume at 20°C.
- B) Volumetric flasks are calibrated to deliver their indicated volume.
- C) To properly use a volumetric flask, dissolve reagent in less than final volume and then dilute to volume.
- D) The volume of the flask changes with temperature because liquid and glass expand when heated.
- E) To obtain the calibrated volume, the bottom of the meniscus is aligned to the center of the neck of flask.

Answer: B

Intermediate

12. Which of the statements below is(are) TRUE regarding collecting and storing samples for trace analysis?

- I Trace ionic analytes stored in glass are lost by adsorption or contaminated by metals leaching from the glass surface.
 - II Plastic bottles are recommended to collect and store ionic analyte samples.
 - III Amber glass bottles are best for collecting and storing aqueous samples of organic materials.
- A) I and II
 - B) II and III
 - C) I and III
 - D) I, II, and III
 - E) III

Answer: D
Intermediate

2-6 *Pipets and Syringes*

13. _____ are calibrated to deliver one fixed volume and are _____ than _____.

- A) Measuring pipets; more accurate; transfer pipets
- B) Transfer pipets; less accurate; measuring pipets
- C) Measuring pipets; more precise; transfer pipets
- D) Transfer pipets; more accurate; measuring pipets
- E) None of these answers is correct.

Answer: D
Intermediate

14. On a lab quiz, a student listed the steps to properly use a pipet. Which step is incorrect?
- A) Use a rubber bulb to twice pull up a volume of liquid past the calibration mark and discard the contents into a waste container.
 - B) Pull up a third volume past the calibration mark and quickly replace the bulb with the index finger.
 - C) Touch the tip of the pipet to the side of a beaker and use the index finger to drain the liquid until the meniscus reaches the center of the calibration mark.
 - D) Transfer the pipet to the receiving vessel, touch the tip of the pipet to the side of the vessel, and allow the pipet to drain by gravity.
 - E) Use the rubber bulb to blow any remaining liquid from the pipet.

Answer: E
Intermediate

2-7 Filtration

15. _____ is the liquid from which a substance precipitates or crystallizes.
- A) Filtrate
 - B) Eluate
 - C) Effluent
 - D) Mother liquor
 - E) Slurry

Answer: D
Easy

16. _____ is used to convert a precipitate to a known, constant composition.
- A) Ashless filter paper
 - B) A fritted-glass funnel
 - C) Ignition
 - D) A rubber policeman
 - E) A dessicator

Answer: C
Easy

2-8 *Drying*

17. Drying to constant mass is a common gravimetric analysis technique. Which of the statements describe the source of false weights?

- I A warm crucible
- II Touching the crucible with bare fingers
- III Using a microwave oven to dry reagents and crucibles
- IV Using a desiccator

- A) I, II, and III
- B) II, III, and IV
- C) I and II
- D) II and IV
- E) III and IV

Answer: C
Intermediate

2-9 *Calibration of Volumetric Glassware*

18. A 0.1500 M HCl solution was prepared on a day when the temperature was 20°C. What is concentration of the solution when used the next day at 27°C? The density of water is 0.9982071 g/mL at 20°C and 0.9965162 g/mL at 27°C.

- A) 0.1503 M
- B) 0.1497 M
- C) 0.1508 M
- D) 6.653 M
- E) 6.632 M

Answer: B
Intermediate

19. A researcher dispenses distilled deionized water from a 20-mL volumetric pipet into an empty 8.4376 g weighting bottle. If the total mass of water and weighting bottle is 28.5845 g, what is the volume of the water delivered by the 20-mL pipet? The density of water is 0.9967867 g/mL.

- A) 20.21 mL
- B) 20.08 mL
- C) 28.68 mL
- D) 19.94 mL
- E) 19.90 mL

Answer: A
Intermediate

Calculated

2-5 Volumetric Flasks

20) Describe how to prepare a 20.00 $\mu\text{g/mL}$ iron solution from a 1 000 mg/mL iron standard solution using 10-mL and 50-mL volumetric pipets and 500-mL and 1 000-mL volumetric flasks.

Answer: 10 mL 1 000 mg/mL iron solution diluted to 500 mL to give a 20 000 $\mu\text{g/mL}$ iron solution. 10 mL of 20 000 $\mu\text{g/mL}$ iron solution diluted to 1 000 mL to give a 200 $\mu\text{g/mL}$ iron solution. 50 mL of the 200 $\mu\text{g/mL}$ solution is diluted to 500 mL to give a 20 $\mu\text{g/mL}$ solution.
Hard