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# Unit 6 - Week 3



# Assignment 3

**The due date for submitting this assignment has passed. Due on 2020-02-19, 23:59 IST.**
**As per our records you have not submitted this assignment.**

This detail given below is for questions 1 through 5. An experiment is performed to obtain density of water by pipetting 1 mL of water into a weighing glass container at $25^{o}C(\rho_{water} = 0.997)$. The experimenter obtains the following values of weight obtained with the use of three different weighing balances “A”, “B”, “C” and “D”. Pick the statement that is true from the following:

Volume (mL): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20
Set A (g): 1.884, 3.878, 5.872, 7.866, 9.860, 11.854, 13.848, 15.842, 17.836, 19.830
Set B (g): 1.994, 3.988, 5.982, 7.976, 9.970, 11.964, 13.958, 15.952, 17.946, 19.940
Set C (g): 2.014, 4.028, 6.042, 8.056, 10.070, 12.084, 14.098, 16.112, 18.125, 20.139
Set D (g): 1.994, 4.008, 6.022, 8.036, 10.050, 12.064, 14.078, 16.092, 18.105, 20.119

1) From the measurements provided above for different weighing balances, what do you think is the precision of each of the balance used, assumed the above values are provided appropriately ***1 point***

- 10 g
- 1 g
- 0.1 g
- 0.01 g
- 0.001 g
- 0.0001 g
- cannot be assessed with provided data

No, the answer is incorrect.
Score: 0

Accepted Answers:
*0.001 g*

2) Set A displays: ***1 point***

- no error
- constant error
- proportional error
- both constant and proportional error
- cannot be assessed from the data given above

No, the answer is incorrect.
Score: 0
Accepted Answers:
*constant error*

3) Set B displays: ***1 point***

- no error
- constant error
- proportional error
- both constant and proportional error
- cannot be assessed from the data given above

No, the answer is incorrect.
Score: 0
Accepted Answers:
*no error*

4) Set C displays: ***1 point***

- no error
- constant error
- proportional error
- both constant and proportional error
- cannot be assessed from the data given above

No, the answer is incorrect.
Score: 0
Accepted Answers:
*proportional error*

5) Set D displays ***1 point***

- no error
- constant error
- proportional error
- both constant and proportional error
- cannot be assessed from the data given above

No, the answer is incorrect.
Score: 0
Accepted Answers:
*both constant and proportional error*

6) An experimenter is trying to estimate the amount of calcium present in a given bone sample. In order to perform the same, the researcher resorts to two independent techniques, one that involves dissolving bone in water using chemical treatment (method A) following by EDTA chelation. Another determines it directly from powdered bone (method B). The values obtained from method B were validated to be correct, with method A always yielding higher values than that from method B. Pick all possible scenarios that could result in such an observation: ***1 point***

- [ ] The chemical treatment did not completely dissolve the entire bone
- [ ] Hard water might have been used to dissolve the bone sample
- [ ] Pure water might have been used to dissolve the bone sample
- [ ] Likely presence of other cations that bind EDTA
- [ ] Aqueous solution methods tend to always have more error than solid phase methods
- [ ] Small amount of scandium might have gotten converted to calcium during the chemical processing step
- [ ] EDTA might have not been standardized before the start of the experiment
- [ ] Some amount of solid might have been lost during the solution preparation

No, the answer is incorrect.
Score: 0

Accepted Answers:
*Hard water might have been used to dissolve the bone sample*
*Likely presence of other cations that bind EDTA*
*EDTA might have not been standardized before the start of the experiment*

7) In the fluorimeter estimation of critical micelle concentration of sodium dodecyl sulfate experiment explained in the lecture, an experimenter observes that for a cuvette containing given concentration of the dye results in varying values that fluctuates significantly from the mean value. Pick all the statements that could possibly be reason for such an observation ***1 point***

- [ ] The lamp might require longer time equilibration
- [ ] The dye used in this study could be unstable (i.e. might be getting photo- bleached easily)
- [ ] Voltage fluctuations might be causing such an effect
- [ ] The instrument might have been miscalibrated
- [ ] The solution might be evolving a gas that results in bubbles
- [ ] The sample probed might be heterogeneous such that it might require stirring for homogenization
- [ ] Temperature of the solution might be fluctuating
- [ ] None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
*The lamp might require longer time equilibration*
*The dye used in this study could be unstable (i.e. might be getting photo- bleached easily)*
*Voltage fluctuations might be causing such an effect*
*The instrument might have been miscalibrated*
*The solution might be evolving a gas that results in bubbles*
*The sample probed might be heterogeneous such that it might require stirring for homogenization*
*Temperature of the solution might be fluctuating*

8) Method errors can be minimized ***1 point***

- [ ] by following a new method every time the experiment is performed
- [ ] by following a comprehensive protocol
- [ ] without deviating from a known working protocol
- [ ] by deviating from a known working protocol
- [ ] by altering the protocol after the experiment has begun
- [ ] by calibrating required instruments before usage
- [ ] when the experiment is performed in the day time

No, the answer is incorrect.
Score: 0

Accepted Answers:

*by following a comprehensive protocol*
*without deviating from a known working protocol*
*by calibrating required instruments before usage*

9) Personal errors can be minimized **1 point**

- the experiment is performed in the day time
- there is no bias from prior knowledge of the outcome of the experiment
- there is prior knowledge of the outcome of the experiment
- the experiments are completed within a short period of time
- when the instruments are calibrated before measurements begin

No, the answer is incorrect.
Score: 0

Accepted Answers:
*there is no bias from prior knowledge of the outcome of the experiment*

10) In the United States of America, breathalyzer tests are performed to evaluate the blood alcohol content in blood of motorists suspected of driving under influence. The equipment made by a certain company resulted in “false positives”, i.e. motorists who were marked as under influence but did not have alcohol. Pick which of the scenarios could have resulted in this situation **1 point**

- poor accuracy resulting from lack of enough training datasets
- poor precision due to
- lack of proper calibration protocols
- lack of rigorous validation of results
- all of the above
- none of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
*all of the above*