PROBLEM SET 1

1. A titration is carried out 5 times and the titre values obtained are 10.13, 10.44, 10.81, 10.50, and 10.72. Based on these values, the best way to report the titre value is

   A. 10 B. 11 C. 10.5 D. 10.52

   Answer C.

2. An experiment is repeated several times and the readings are recorded. The readings are 10.12, 10.25, 10.38, 10.55, 10.70. Based on this data, we infer that the type of error in the measurement is most likely to be a

   A. Systematic Error B. Random Error C. Gross Error D. Cannot infer the type of error

   Answer A.

3. Use of statistics like average and standard deviation are valid for
   A. Systematic Errors B. Random Errors C. Gross Errors D. All errors

   Answer B.

4. Given a probability distribution
   $p(x) = A e^{-|x|}$ *for* $-1 \leqslant x < 2$
   $= 0$ *otherwise*

   The value of *A* such that *p(x)* is normalized is closest to
   A. 1.0 B. 0.67 C. 1.5 D. 0.33

   Answer B.

5. A quantum mechanical particle in a 2D box has a probability distribution given by
   $p(x) = A \sin^2(\pi x) \sin^2(2\, pi\, y)$ *for* $0 \leqslant x < 2 \quad 0 \leqslant y < 2$
   $= 0$ *otherwise*
   where *A* is some constant and we can assume $\pi = 3.14$. The value of A so that *p(x)* is normalized is equal to
   A. 1 B. ½ C. $1/\sqrt{2}$ D. $\sqrt{2}$

   Answer A.

6. A quantum mechanical particle in a 1D box has a probability distribution given by
   $p(x) = A \sin^2(2\pi x)$ *for* $0 \leqslant x < 1$
   $= 0$ *otherwise*
   where *A* is a constant that normalizes the distribution and we can assume $\pi = 3.14$. The average value of *x* for this distribution is equal to
   A. 0 B. ½ C. ¼ D. $\sqrt{2}$
   Answer B.

7. A quantum mechanical particle in a 1D box has a probability distribution given by
   $p(x) = A \sin^2(\pi x)$ *for* $-1 \leqslant x < 1$
   $= 0$ *otherwise*
   where A is a constant that normalizes the distribution and we can assume $\pi = 3.14$. The

average value of x^2 for this distribution is closest to
A. 0 B. 0.50 C. 67 D. 0.28
Answer D.

8. The average speed of a certain gas at some temperature is 200 m/s. The gas molecules follow a Maxwell-Boltzmann distribution of speeds we can assume $\pi = 3.14$. The probability distribution of of speeds *u* (expressed in m/s) is proportional to
A. $u^2 e^{-u^2/15700}$ B. $e^{-u^2/15700}$ C. $u^2 e^{-u^2/31400}$ D. $u^2 e^{-u^2/31400}$
Answer D.

9. The Gaussian distribution given by
$p(x) = Ae^{-x^2/8} \quad for \quad -\infty \leqslant x < \infty$
where *A* is a constant, has a standard deviation of
A. 1 B. 2 C. 4 D. 8
Answer B.

10. A Gaussian distribution is given by
$p(x) = Ae^{-x^2/32} \quad for \quad -\infty \leqslant x < \infty$
where *A* is a constant we can assume $\pi = 3.14$. The value of *A* so that the distribution is normalized is closest to

A. 0,32 B. 0.50 C. 0.10 D. 1.32
Answer C.