AP Biology Equations and Formulas Review Sheet

1. Grasshoppers in Madagascar show variation in their back-leg length. Given the following data, determine the **standard deviation and standard error for this data.**

Length in cm: 2.0, 2.2, 2.2, 2.1, 2.0, 2.4 and 2.5

1. Initial mass of pumpkin cores was measured in grams. What is the **average** initial mass for the pumpkin cores? 29.15, 28.45, 30.92, 29.25, 32.09, 31.67.
2. In pea plants, smooth seeds are dominant to wrinkled, and purple flowers are dominant to white. In a dihybrid cross where a 9:3:3:1 ratio is expected, the following data was collected. Smooth and Purple= 223, Smooth and White= 84, Wrinkled and Purple= 89, Wrinkled and White= 33. Determine the **chi-square value.**
3. Two Wisconsin fast plants are crossed. One has the recessive dwarf trait, but the normal pigment anthocyanin, while the other has the recessive anthocyaninless trait, but is on normal height. Their offspring consist of 89 plants of normal height and pigment; 93 anthocyaninless plants and normal height; 96 dwarf plants and normal pigment; and 94 anthocyaninless, dwarf plants. A student proposes that the parent plants’ genotype must have been ddAa for the dwarf parent and Ddaa for the anthocyaninless parent. Calculate, to the nearest 0.01, the **chi square value** that would be used to confirm this hypothesis.
4. The following data were collected from a population of fruit flies. In this monohybrid cross where red eyes are dominant to white, determine **the chi square value.**

|  |  |
| --- | --- |
| Phenotype | # flies observed |
| Red Eyes | 134 |
| White Eyes | 66 |

1. If 250 people out of a population of 1,000 are born with sickle-cell anemia, how many people in the population will be more resistant to malaria because they are heterozygous for the sickle-cell gene? **(HW)**
2. In a population of 250 peas, 16% of the peas are homozygous recessive wrinkled and the rest are smooth. What is the frequency of the dominant allele for smooth peas? **(HW)**
3. In a population that is Hardy-Weinberg equilibrium, the frequency of the homozygous recessive genotype is 0.09. **(HW)**
   1. What is the p and q value for this population?
   2. What is the frequency of individuals that are homozygous for the dominant trait?
   3. What is the frequency of individuals that show the dominant trait?
4. A census of birds nesting on a Galapagos Island revealed that 24 of them show a rare recessive condition that affected beak formation. The other 63 birds in this population show no beak defect. If this population is in HW equilibrium, what is the frequency of the dominant allele? Give your answer to the nearest hundredth. **(HW)**
5. A chemical reaction is most likely to occur spontaneously if the
6. **Free energy** is negative
7. Entropy change is negative
8. Activation energy is positive
9. Heat of reaction is positive
10. A reaction will be **spontaneous** if it results in products that have
11. Lower potential energy and less randomness
12. Lower potential energy and more randomness
13. Greater potential energy and less randomness
14. Greater potential energy and more randomness
15. The change **in free energy** of a chemical reaction is represented by:
16. Four blocks or phenolphthalein agar are placed in a vinegar solution. Which block would the vinegar solution penetrate most thoroughly into after ten minutes? Which block would have the greatest volume of pink phenolphthalein remaining at the end of ten minutes? Justify your answer mathematically and relate your predicted results to the **surface area** of your blocks.
    * 1. Block 1: 2 cm x 4 cm x 4 cm
      2. Block 2: 2 cm x 8 cm x 4 cm
      3. Block 3: 1 cm x 8 cm x 8 cm
      4. 1 cm x 1 cm x 64 cm
17. Hydrogen peroxide is broken down to water and oxygen by the enzyme catalase. The following data were taken over 5 minutes. What is the **rate** of enzymatic reaction in mL/min from 2 to 4 minutes?

|  |  |
| --- | --- |
| Time (mins) | Amount of O2 produced (mL) |
| 1 | 2.3 |
| 2 | 3.6 |
| 3 | 4.2 |
| 4 | 5.5 |
| 5 | 5.9 |

1. There are 2,000 mice living in a field. If 1,000 mice are born each month and 200 mice die each month, what is the **per capita growth rate** of mice over a month?
2. As N approaches K for a certain population, what is predicted by the logistic equation?
3. In 2009, the US had a population of about 307 million people. If there were 14 births and 8 deaths per 1000 people, what was the country’s net **population growth** that year (ignoring immigration and emigration)?
4. Scientists are trying to determine under what conditions a plant can survive. They collect the following data and would like to know the water potential of the plant cell. The solute potential is -0.6 MPa and the pressure potential is -1.0 MPa. What is the **water potential**?
5. In a lab experiment, one enzyme is combined with its substrate at time O. The product is measured in micrograms at 20-second intervals and recorded on the data table.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Time (sec) | 0 | 20 | 40 | 60 | 80 | 100 | 120 |
| Product (mg) | 0.0 | 0.25 | 0.50 | 0.70 | 0.80 | 0.85 | 0.85 |

1. What is the initial **rate** of the enzyme reaction?
2. What is the **rate** after 100 seconds?
3. Why is there no increase in product after 100 seconds?
4. What would happen if you added only more enzymes after 100 seconds?
5. What would happen if you added only more substrate after 100 seconds?
6. A hypothetical population has a carrying capacity of 1,500 individuals and rmax is 1.0.
   1. Fill out the following table:

|  |  |
| --- | --- |
| Population size | Population **growth rate** |
| 1,600 |  |
| 1,750 |  |
| 2,000 |  |

* 1. What is happening to this population? Why?

1. Data taken to determine the effect of temperature on the rate of respiration in a goldfish is given in the table below. Calculate **Q10** for this data.

|  |  |
| --- | --- |
| Temperature C | Respirations/minute |
| 16 | 16 |
| 21 | 22 |

1. According to the Acid Rain Monitoring Project at the University of Mass, the pH measured at King Phillip Brook on April 10, 2012, was near 5, which the pH measured at Robbins Pond on that same date was near 9. Determine to the nearest whole number how many times greater the **hydrogen ion concentration** was at King Phillip Brook.
2. What is **the hydrogen ion** concentration of a solution of pH 8?