Math Diagnostic

This math paper will help you discover your weaknesses and strengths in the types of math found on the AP Environmental Science Exam.  
**YES CALCULATORS!** This is the AP exam will THIS YEAR will allow you to use your calculator. These review topics will help prepare you for harder word problems on the AP Exam.

Do your set up calculations here and on scratch paper, but place your answers on the answer sheet. You may use a calculator.

## Part 1: Decimals

1. 25.5 + 5.025 =
2. 100.25 – 50.2 =
3. 25.5 x 3.25 =

## Part 2: Long Division

1. Divide 45.5 by 10
2. Divide 530.4 by 3.4
3. Divide 900 by 36,000
4. An old Honda Civic can go 348 miles on average before it runs out of gas. its tank holds 12 gallons of gas. What is the car’s mpg? (miles per gallon)
5. Find the average of the following numbers: 124, 456, and 785

## Part 3: Percentages

1. What is 45% of 1800?
2. A gas engine is 6% efficient. What portion of a 12-gallon tank of gas is wasted?
3. 667 BTUsIn a pasture of grass and other plants, the biomass of insects makes up 5000 kilograms. This is 5% of the total biomass of the pasture. What is the total biomass of the pasture?

## Part 4: Scientific Notation

*Write the following numbers in scientific notation:*

1. 550,000,000,000
2. 15 million

*Solvex 1092.3 x 1047 x 10133 x 102*

1. (2.96 x 10 7) **+** (1.0 x 10 7)
2. (2.96 x 10 7) **+** (1.0 x 10 8)
3. (6.0 x 10 6) **÷** (3.0 x 10 4)
4. (2 x 10 5) x (3 x 1010)

1. (8 x 10 12) **-** (1.2 x 10 12)

## Part 5: Percent Change

1. If cyanide in a stream next to a gold mine increases from 240 ppm to 360 ppm, what percent increase is this?
2. A toxin increases from 12 ppm to 48 ppm. What percent increase is this?

## Part 6: Metric Conversions

1. 1200 watts = \_\_\_\_\_\_\_\_\_\_\_\_ kw (kilowatts)
2. 500 km = \_\_\_\_\_\_\_\_\_\_\_\_\_ meter
3. 60 gram = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ milligram
4. 14,000 milliliter = \_\_\_\_\_\_\_\_\_\_\_\_ liter
5. Convert 5 km2 to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m2

## Part 7: Half-Life Calculations

1. A 50g sample of radioactive Iodine-131 has a half-life of 8.0 days.  After 32 days, how much is left?
2. A 48g sample of Germanium-66 is left undisturbed for 10 hours.  At the end of that period, only 3.0g remain.  What is the half-life of this material?

## Part 8: Basic Word Problems

1. A Family of five recently replaced its 5-gallon-per-minute showerheads with water-saving 2-gallon per minute showerheads. Each member of the family averages 8 minutes in the shower per day.
   1. How many gallons will each person use each day?
   2. How many gallons will the entire family (5 people) save per day?
   3. In a 30-day period, how many fewer gallons of water will the family use with the new showerheads?
2. Burning one gallon of gasoline in a car releases approximately 20 pounds CO2 into the atmosphere.

One person drives 50,000 miles in a hybrid car that averages 50 miles per gallon (mpg), while another person drives 50,000 miles in an SUV that averages 20 mpg. Over the course of the 50,000 miles, how many fewer pounds of CO2 are released by the 50-mpg car than by the 20-mpg car?

1. Americans recycle about 35% of their solid waste (trash). If an average American generates about 2 kg of waste every day, how much of that waste is recycled per **year**?

## APES Math Diagnostic Answer Sheet Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Decimals | 1 | 2 | 3 |  |  |
| Long Division | 4 | 5 | 6 | 7 | 8 |
| Percentages | 9 | 10 | 11 |  |  |
| Scientific Notation | 12 | 13 | 14 | 15 | 16 |
|  | 17 | 18 |  |  |  |
| Percent Change | 19 | 20 |  |  |  |
| Metric Conversions | 21 | 22 | 23 | 24 | 25 |
| Half Life | 26 | 27 |  |  |  |
| Word Problems | 28a | 28b | 28c | 29 | 30 |

We will grade these in class during the first few weeks in school. Circle the topics that you need to review to do well on math problems this year in APES.

**Practice Making Graphs:**

*Use the following steps to create graphs and answer questions for each of the problems below. All your work will go on the separate answer sheet.*

1. *Identify the variables. The independent variable is controlled by the experimenter. The dependent variable changes as the independent variable changes. The independent variable will go on the X axis and the dependent on the Y axis.*
2. *Determine the variable range. Subtract the lowest data value from the highest data value.*
3. *Determine the scale of the graph. The graph should use as much of the available space as possible. Each line of the scale must go up in equal increments. For example, you can go 0, 5, 10, 15, 20, etc. but you cannot go 1, 3, 9, 34, 50, etc. Increments of 1, 2, 5, 10, or 100 are commonly used but you should use what works best for the given data.*
4. *Number and label each axis.*
5. *Plot the data. If there are multiple sets of data on one graph, use a different color for each.*
6. *Draw a smooth, best-fit line for each data set.*
7. *Title the graph. Titles should explain exactly what the graph is showing and are sometimes long. Don’t be afraid of a long title!*
8. *Create a key to the graph if there is more than one set of data.*

Problem 1

|  |  |  |
| --- | --- | --- |
| **Age of the tree in years** | **Average thickness of the annual rings in cm. Forest A** | **Average thickness of the annual rings in cm. Forest B** |
| 10 | 2.0 | 2.2 |
| 20 | 2.2 | 2.5 |
| 30 | 3.5 | 3.6 |
| 35 | 3.0 | 3.8 |
| 50 | 4.5 | 4.0 |
| 60 | 4.3 | 4.5 |

*The thickness of the annual rings indicate what type of environmental situation was occurring at the time of its development. A thin ring, usually indicates a rough period of development. Lack of water, forest fires, or a major insect infestation. On the other hand, a thick ring indicates just the opposite.*

1. Make a line graph of the data.
2. What is the dependent variable?
3. What is the independent variable?
4. What was the average thickness of the annual rings of 40 year old trees in Forest A?
5. Based on this data, what can you conclude about Forest A and Forest B?

Problem 2

|  |  |
| --- | --- |
| **pH of water** | **Number of tadpoles** |
| 8.0 | 45 |
| 7.5 | 69 |
| 7.0 | 78 |
| 6.5 | 88 |
| 6.0 | 43 |
| 5.5 | 23 |

1. Make a line graph of the data.
2. What is the dependent variable?
3. What is the independent variable?
4. What is the average pH in this experiment?
5. What is the average number of tadpoles per sample?
6. What is the optimum water pH for tadpole development?
7. Between what two pH readings is there the greatest change in tadpole number?
8. How many tadpoles would you expect to find in water with a pH reading of 5.0?

Problem 3

|  |  |  |  |
| --- | --- | --- | --- |
| **Amount of ethylene in ml/m2** | **Wine sap Apples: Days to Maturity** | **Golden Apples: Days to Maturity** | **Gala Apples: Days to Maturity** |
| 10 | 14 | 14 | 15 |
| 15 | 12 | 12 | 13 |
| 20 | 11 | 9 | 10 |
| 25 | 10 | 7 | 9 |
| 30 | 8 | 7 | 8 |
| 35 | 8 | 7 | 7 |

Ethylene is a plant hormone that causes fruit to mature. The data above concerns the amount of time it takes for fruit to mature from the time of the first application of ethylene by spraying a field of trees.

1. Make a line graph of the data.
2. What is the dependent variable?
3. What is the independent variable?