APES Mathematics Review

The APES Examination will require you to do mathematical calculations. Occasionally these calculations may be somewhat esoteric, and you may find it possible to do them in your head; nonetheless, it is mandatory to show all work for all calculations on the free-response section of the APES exam. This worksheet is designed help to prepare you for the type of calculations you may encounter on this year's APES exam.

Use a separate piece of paper, and for each problem, show every step of your work, and indicate the cancellation of all units…No Calculators!!

Scientific Notation—All APES students should be able to work comfortably with numbers in scientific notation.

- Place the following numbers into scientific notation.

1. one billion
2. twenty three thousand
3. 70 trillion
4. three hundred

- Do the following calculations in scientific notation.

5. five hundred billion times thirty five thousand
6. six thousand divided by 300 billion
7. one ten thousandth of three million
8. 6 billion divided by 35 trillion

Unit conversions—All APES students should be able to convert from one system of units to another.

- Use Appendix C to complete the following. Show all of your work including the canceling of all units.

9. A 100 square mile area of national forest is how many acres? how many hectares?
10. A city that uses ten billion BTUs of energy each month is using how many kilowatt-hours of energy?
11. Fifty eight thousand kilograms of solid waste is equivalent to how many metric tons?
12. If one barrel of crude oil provides six million BTUs of energy, how many BTUs of energy will one liter of crude oil provide? How many calories of energy will one gallon of crude oil provide?
13. For crude oil, if 150 pounds of CO_2 is released per million BTUs of energy, how much CO_2 is produced by each barrel of crude oil? (use information from the previous problem)

Percentages—All APES students should be able to work comfortably with percentages.

14. A natural gas power plant is 60% efficient. If one cubic meter of natural gas provides 1000 BTUs of electricity. How many BTUs of waste heat were produced?
15. If 35% of a natural area is to be developed, leaving 500 acres untouched, how many acres are to be developed?
16. Calculate the percentage growth rate for a country with a population of 6 million: in a year in which it had 100,000 births, 70,000 deaths, 30,000 immigrants, and 50,000 emigrants.
17. If the concentration of mercury in a water supply changes from 65 ppm to 7 ppm in a ten-year period, what is the percentage change of the mercury concentration?

Energy—The APES exam always has questions about energy use. Be prepared!

- One BTU is the energy required to raise the temperature of one pound of water by one degree Fahrenheit.
- The density of water is 1 gram/milliliter or approximately 8 pounds/gallon (U.S.).

18. How much energy is required to raise the temperature of one thousand gallons of water by 25°F?
19. By how many degrees Fahrenheit can the temperature of one metric ton of water be raised with the addition of 110 thousand BTUs of heat?
20. If 500 thousand BTUs of energy are available to raise the temperature of a water boiler from 20°F to 100°F, how many gallons of water can be added to the boiler?