Chemistry 11

DA-GRASP Conversion Problems
(Dimensional Analysis – Given, Required, Analyze, Solve, Present)

EXERCISES:

3. An old barometer hanging on the wall of a mountain hut has a reading of 27.0 inches of mercury. If 1 inch of mercury equals 0.0334 atm ("atmospheres") and 1 atm = 101.3 kPa ("kilopascals"), what is the pressure reading of the barometer, in kilopascals?

4. It requires 334 kJ of heat to melt 1 kg of ice.
   (a) The largest known iceberg had a volume of about 3.1×10^{13} m^3. How much heat was required to melt the iceberg if 1 m^3 of ice has a mass of 917 kg?
   (b) The explosive "TNT" releases 1.51×10^4 kJ of energy for every kilogram of TNT which explodes. Provided that all the energy of an explosion went into melting the ice, how many kilograms of TNT would be needed to melt the iceberg in part (a) of this question?

5. Sugar costs $0.980/kg. 1 t = 1000 kg. How many tonnes ("t") of sugar can you buy for $350?

6. The Cullinan diamond, the largest diamond ever found, had an uncut volume of 177 mL. If 1 mL of diamond has a mass of 3.51 g and 1 carat = 0.200 g, how many carats was the Cullinan diamond?

7. How many kilometres ("km") will a car travelling at 120 km/h go in: (a) 0.25 h? (b) 12 min?

8. Solve the following, using the fact that beakers cost $8.40 per dozen.
   (a) Harry drops 3 dozen beakers. How much will the Chemistry teacher charge Harry?
   (b) Harry drops another 5 dozen beakers (clumsy!). If Burger Bob's hamburgers cost $1.50 each, how many hamburgers could clumsy Harry have bought for the same amount of money as he has to pay for the second batch of beakers?
   (c) Harry does not learn very quickly, and breaks a third batch of beakers. If he has to pay $13.30, what is the number of beakers he breaks the third time? (Express your answer in actual numbers of beakers, rather than in "dozens of beakers".)

9. An ancient Celtic chicken farmer wished to purchase a gift for his wife. The gift was worth 2 horses. At the local market, 3 horses were worth 5 cows, 1 cow was worth 4 hogs, 3 hogs were worth 4 goats, and 1 goat cost 9 chickens. How much was the gift going to cost the farmer, who had to pay in chickens?

10. If 1 yard = 3 feet, 1 foot = 12 inches and 1 centimetre = 0.3937 inch, how many centimetres are there in 5 yards?

more practice problems on back

18. Light travels at a rate of 3.00×10^8 m/s.
    (a) It takes light 8.3 min to travel from the surface of the sun to the earth. What is the distance of the earth from the sun?
    (b) The moon is 3.8×10^5 km from the earth. What time will pass between the instant an astronaut on the moon speaks and the instant his voice is heard on earth? (His voice travels by modulated laser beam at the speed of light.)
    (c) A robot vehicle is travelling on the surface of Mars while Mars and Earth are at their closest approach (7.83×10^7 km). Suddenly, a video camera on the robot shows a yawning crevasse dead ahead! How many minutes will it take for an electronic signal travelling at the speed of light to go from Earth to Mars in order to tell the robot to stop immediately?

19. (Care: Nasty!) A measurement is given as 9.0 lb/in^3. If 1 kg = 2.2 lb and 1 m = 39 in, convert the measurement into kg/m^3.

OPTIONAL EXERCISES:

20. If sugar is $9.80 for 10 kg, what is the cost of: (a) 90.0 kg of sugar? (b) 6.00 tonnes of sugar?

21. If 1 inch = 2.54 cm, what is the length, in centimetres, of a 20.0 inch rod? What is the length, in metres, of a 36 inch ruler?

22. Express 90 μg in centigrams.

23. A car travels at a constant speed of 105 km/h.
    (a) How many hours does it take to go 450 km?
    (b) How many seconds does it take to go 2.0×10^2 m?
    (c) How many kilometres are traveled in 10.0 min?
    (d) How many centimetres are traveled in 1.00 ms?

24. If 1 L of granite has a mass of 5.50 kg,
    (a) what is the mass of 7.00 L of granite?
    (b) what is the volume occupied by 22 kg of granite?
    (c) what is the mass, in grams, of 5.00 mL of granite?

25. The SI unit of energy is the joule (unit symbol = J). If 0.334 kJ of energy is required to melt 1.00 g of ice and 1 kJ = 1000 J then:
    (a) what mass of ice can be melted by 10.0 kJ of heat?
    (b) how many kilojoules of heat are required to melt 50.0 g of ice?
    (c) how many joules of heat are required to melt 2.00 kg of ice?

26. Express 80.0 Mg in micrograms.

27. Express 2 cL/ms in kilolitres/second.

28. Express 50.0 mL/min in microlitres/second.