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Matter & Measurement Review

Matter

Reminders:

- *Elements – on the periodic table. If it is not on the periodic table, it is not an element.*
- *Compounds – you will see a chemical formula that has two+ elements chemically combined*
- *Solution = homogeneous mixture – Remember, every sip, bite, sample is the same*
- *Suspension = heterogeneous mixture*

	Classify the following materials as (SU)spension, (S)olutions, (C)ompounds or (E)lements.	*Classify the following materials as (Homo)geneous or (Hetero)geneous.*
1. Sodium	element	homogeneous
2. Sodium bicarbonate ($NaHCO_3$)	compound	homogeneous
3. Soda (no ice)	solution	homogeneous
4. Puply OJ	suspension	heterogeneous
5. Kool-aid beverage (no ice)	solution	homogeneous
6. Aluminum	element	homogeneous

Classify the following properties as chemical or physical.

7. heat conductivity physical
8. combustibility chemical
9. resistance to acids chemical
10. length physical
11. brittleness physical
12. malleability physical

Classify the following changes as chemical or physical.

Reminders:

- *All phase changes are physical – boil, melt, freeze, evaporate, condensate, sublime, etc.*
- *Chemical changes to matter are generally irreversible*

13. boiling alcohol physical
14. melting ice cream physical
15. making salt water physical
16. frying an egg chemical
17. burning wood chemical
18. baking a cake chemical

Identify the physical separation method you would use to separate the mixture and retain its parts.

Reminders:

- *All methods of separation that we have discussed in this class are PHYSICAL methods!*
- *Note that the problem asks you to retain the parts. That is why distillation is preferred for 19 and 22 over evaporation.*

19. salt + water distillation

20. sand + water filtration

21. iron filings + water panning/filtration

22. Sugar + water distillation

Measurement

Determine the number of significant digits in each of the following.

Reminders:

- *All integers 1-9 are significant*
- *Zeros in between integers are significant. (ALL zeros in between!)*
- *Trailing zeros, zeros to the right of the right most integer are significant if there is a decimal point*
- *Zeros to the left of the left most integer are place holders and are not signficant*

23.	3	1.00 K	26.	2	0.050 mm	29.	3	1050 g
24.	3	1150 kg	27.	1	0.005 s	30.	2	0.000 000 55 g
25.	7	1 562 003 000 kg	28.	4	10.55 m	31.	4	2.056 g/cm^3

Convert the following and write your answers in scientific notation.

Reminders:

- *KHDUDCM - - μ*
- *Scientific notation: a negative exponent means that the value is less than one. A positive exponent means that the value is 1 or greater.*
- *Scientific notation: the mantissa is a number that is 1 or greater than 1 but less than 10.*

32. How many centimeters are in 0.003 meters? (0.3 cm) 3×10^{-1} cm

33. How many kilometers are in 125.1 millimeters? (0.0001251 km) 1.251×10^{-4}km

34. How many milliliters are in 55.0 liters? (55000 mL) 5.50×10^{4} mL

35. How many micrograms are in 3 kilograms? (3000000000) 3×10^{9} μg

36. Assuming 1g = 1 mL = 1 cm^3 for water, how many grams of water are in 9 liters of water?

9 liters = 9000 mL = g

*** You must first convert the liters to mL to use the conversion 1g=1mL=1cm^3*

9000 g

Perform the following calculations. Express your answers to the correct number of significant figures.

37. 201 + 4.23 = 205

Adding – count decimal places
(205.23 in calculator, round to 0 d.p.)

38. 7.2 – 7.14 = 0.1

Subtracting – count decimal places
(0.06 in calculator, round to 1 d.p.)

39. 101 x 60.235 6080

Multiplying – count significant figures
(6083.735 in calculator, round to 3 s.f.)

40. 500.0 / 909 0.550

Dividing – count significant figures
(0.550055006 in calculator, round to 3 s.f.)

41. A 16.1 g of sample of platinum has a volume of 0.750 cm^3. What is its density?

Density = Mass / Volume

= 16.1 g / 0.750 cm^3 = 21.4666 → round to 3 s.f.

21.5 g/cm^3

42. What is the area of an index card that measures 12.70 cm by 7.6 cm?

*Area = Length * Width*

*= 12.70 cm * 7.6 cm = 96.52 → round to 2 s.f.*

97 cm^2

43. What is the percent error in a measurement of the boiling point of naphthalene ($C_{10}H_8$) as 231.0°C, given that the literature reports the value as 217.9°C?

*Percent Error = (Measured – Actual) / Actual * 100*

*= (231.0 – 217.9) = 13.1 **Do this first and round your answer to the correct number of decimal places and then plug it in to the rest of the equation*

*= 13.1 / 217.9 * 100 = 6.01193 → round to 3 s.f. (from the 13.1)*

6.01 % error

44. A student measures the mass of a sample of metal to be 46.98 g. The student places the sample into a graduated cylinder containing 40.0 mL of water. The water level in the cylinder rises to 44.2 mL. Calculate the density of the metal.

Mass = 46.98 g

Volume = 44.20 mL – 40.00 mL = 4.20 mL (water displacement)

Density = 46.98 g / 4.20 mL = 11.1857 → round to 3 s.f.

11.2 g/mL

45. Using the following table of densities, determine the possible identity of the metal and calculate the percent error for your choice.

Element	Density (g/cm^3) (25°C, 1 atm)	Element	Density (g/cm^3) (25°C, 1 atm)
Copper	8.9	Lead	11.3
Gold	19.3	Nickel	9.9
Iron	7.9	Tin	7.3

Identity Lead *(11.2 is closest to 11.3 in the table)*

Percent Error -0.9 % error

*Percent Error = (Measured – Actual) / Actual * 100*

*= (11.2 – 11.3) = -0.1 **Do this first and round your answer to the correct number of decimal places and then plug it in to the rest of the equation*

*= -0.1 / 11.3 * 100 = -0.8849 → round to 1 s.f. (from the -0.1)*

46. Position the elements in order from top to bottom if they were put in a graduated cylinder together.

Top – tin, iron, copper, nickel, lead, gold *– Bottom*

Reminders:

- *Most dense substances on the bottom, least dense on the top*
- *Be sure to read what the question is asking – top to bottom, or bottom to top!*

47. What is the density of a piece of wood that has a mass of 25.0 grams and a volume of 2.82 cm^3?

Mass = 25.0 g

Volume = 2.82 cm^3

Density = 25.0 g / 2.82 cm^3 = 8.8652 → round to 3 s.f.

8.87 g/cm^3

48. A cup of gold colored metal beads was measured to have a mass 425 grams. By water displacement, the volume of the beads was calculated to be 48.0 cm^3.

Gold: 19.3 g/mL
Copper: 8.86 g/mL
Bronze: 9.87 g/mL

a. Given the above densities, identity the metal: copper

Mass = 425 g

Volume = 48.0 cm^3

Density = 425 g / 48.0 cm^3 = 8.85416

b. Provide the order that these metals would "stack-up" in a graduated cylinder from top to bottom.

Top – copper, bronze, gold – *Bottom*

49. A group of chemistry students found the density of a wooden block in lab. Each student completed three trials, and found the following results for density. The actual density was 6.00g/mL.

	Density (g/ml) Trial 1	Density (g/ml) Trial 2	Density (g/ml) Trial 3
Student 1	6.00	6.01	5.99
Student2	6.20	6.19	6.20
Student 3	5.94	5.92	5.80

According to the student's data, which student…

a. Collected the most precise data? Student 2

Precision is how reproducible your results are. Student 2 measured 6.20 two times. The other students did not repeat any of their data.

b. Collected the most accurate date? Student 1

Accuracy is how close the measured value is to the actual, accepted, theoretical value. When you average student 1's data it equals 6.00 which is the actual value reported in the problem.

50. Identify the equipment used to perform each task:

a.	2 Volume displacement	1. Magnet
b.	1 Panning	2. Graduated cylinder
c.	5 Distillation	3. Hot plate, pan
d.	3 Evaporation	4. Filter paper, collection beaker
e.	4 Filtration	5. Condenser tube, distilling & collection beakers, Bunsen burner

One more time – these are ALL PHYSICAL methods of separation!