26. # of micrograms $= 80\text{ Mg} \times \frac{10^6\text{ g}}{1\text{ Mg}} \times \frac{1\ \mu g}{10^{-6}\text{ g}} = \mathbf{8 \times 10^{13}\ \mu g}$

27. # of $\frac{\text{kilolitres}}{\text{second}} = \frac{2\text{ cL}}{\text{ms}} \times \frac{10^{-2}\text{ L}}{1\text{ cL}} \times \frac{1\text{ kL}}{10^{3}\text{ L}} \times \frac{1\text{ ms}}{10^{-3}\text{ s}} = \mathbf{2 \times 10^{-2}\ \frac{kL}{s}}$

28. # of $\frac{\text{microlitres}}{\text{second}} = \frac{50.0\text{ mL}}{\text{min}} \times \frac{10^{-3}\text{ L}}{1\text{ mL}} \times \frac{1\ \mu L}{10^{-6}\text{ L}} \times \frac{1\text{ min}}{60\text{ s}} = \mathbf{833\ \frac{\mu L}{s}}$

29. (a) $c = \frac{n}{V} = \frac{0.250\text{ mol}}{0.500\text{ L}} = \mathbf{0.500\ \frac{mol}{L}}$

(b) i) $R = \frac{P \cdot V}{n \cdot T} = \frac{1\text{ atm} \times 22.4\text{ L}}{1\text{ mol} \times 273\text{ K}} = \mathbf{0.0821\ \frac{atm \cdot L}{mol \cdot K}}$

ii) $R = \frac{P \cdot V}{n \cdot T} = \frac{202.6\text{ kPa} \times 24.45\text{ L}}{2\text{ mol} \times 298\text{ K}} = \mathbf{8.31\ \frac{kPa \cdot L}{mol \cdot K}}$

(c) $\Delta S = \frac{\Delta H}{T} = \frac{44.0\text{ kJ}}{373\text{ K}} = \mathbf{0.118\ \frac{kJ}{K}}$

(d) $KE = \frac{1}{2} m \cdot v^2 = \frac{1}{2}(3.35 \times 10^{-27}\text{ kg}) \times (1692\ \frac{m}{s})^2 = \mathbf{4.80 \times 10^{-21}\ \frac{kg \cdot m^2}{s^2}}$

30. $d = \frac{m}{V} = \frac{(g)}{(L)}$, and the units of d are g/L.

31. $d = \frac{m}{V} = \frac{8.19\text{ g}}{3.50\text{ mL}} = \mathbf{2.34\ \frac{g}{mL}}$, or: $d = \frac{8.19\text{ g}}{3.50 \times 10^{-3}\text{ L}} = \mathbf{2.34 \times 10^3\ \frac{g}{L}}$

32. $V = \frac{m}{d} = \frac{125\text{ g}}{7.86 \times 10^3\text{ g/L}} = \mathbf{0.0159\ L}$

33. $m = d \cdot V = 961\ \frac{g}{L} \times 0.2000\text{ L} = \mathbf{192\ g}$

34. $V = \frac{m}{d} = \frac{46\text{ g}}{789\text{ g/L}} = \mathbf{0.058\ L}$

35. $m = d \cdot V = 0.900\ \frac{g}{L} \times 22.4\text{ L} = \mathbf{20.2\ g}$

36. $V_{SPHERE} = \frac{m}{d} = \frac{70.0\text{ g}}{7.20 \times 10^3\text{ g/L}} = 0.00972\text{ L} = 9.72\text{ mL}$

$V_{TOTAL} = V_{SPHERE} + V_{START} = 9.72 + 54.0 = \mathbf{63.7\ mL}$

37. Since less dense liquids float on more dense liquids, the least dense layer will be at the top and the most dense layer will be at the bottom, as shown below. The order is: Z, Y, W and X on the bottom.

$d_Z = \frac{m}{V} = \frac{74.8\text{ g}}{115.0\text{ mL}} = 0.650\ \frac{g}{mL}$ $d_W = \frac{m}{V} = \frac{107.3\text{ g}}{55.0\text{ mL}} = 1.95\ \frac{g}{mL}$

$d_Y = \frac{m}{V} = \frac{46.8\text{ g}}{42.5\text{ mL}} = 1.10\ \frac{g}{mL}$ $d_X = \frac{m}{V} = \frac{51.8\text{ g}}{12.0\text{ mL}} = 4.32\ \frac{g}{mL}$

38. Although the density of iron is greater than the density of water, the fact that the boat floats means the density of the boat must be less than the density of the water. Since $d = m/V$, then in order for the density of the boat to be less than 1 g/mL (water's density), the volume occupied by the boat must be quite large, relative to its mass. This situation is obtained by having a shape which keeps water out of

the center of the boat, allowing most of the interior volume to be air (and other stuff inside the boat). The AVERAGE density of the entire boat, including iron hull, air, etc. is then less than 1 g/mL.

39. $V_{COPPER} = \frac{m}{d} = \frac{100.0\ g}{8.92 \times 10^3\ g/L} = 0.01121\ L = V_{MAGNESIUM}$

$m_{MAGNESIUM} = d \cdot V = 1.74 \times 10^3 \frac{g}{L} \times 0.01121\ L = \mathbf{19.5\ g}$

40. mass of sun $= d \cdot V = 1.407 \frac{g}{mL} \times \frac{1\ kg}{10^3\ g} \times \frac{1\ t}{10^3\ kg} \times \frac{1\ mL}{10^{-3}\ L} \times 1.41 \times 10^{30}\ L = 1.98 \times 10^{27}\ t$

time required $= 1.98 \times 10^{27}\ t \times \frac{1\ s}{4.0 \times 10^6\ t} \times \frac{1\ y}{3.15 \times 10^7\ s} = 1.6 \times 10^{13}\ y$

41. $V_{SODIUM} = \frac{m}{d} = \frac{90.0\ g}{970.0\ g/L} = 0.0928\ L = 92.8\ mL$

After inserting the cube, the remaining volume is less.

$V_{REMAINING} = V_{START} - V_{SODIUM} = 250.0 - 92.8 = 157.2\ mL$; $d_{ARGON} = \frac{m}{V} = \frac{4.60\ g}{157.2\ mL} = \mathbf{0.0293\ \frac{g}{mL}}$

42. (a) 3 (b) 4 (c) 2 (d) 2 (e) 4 (f) 6 (g) 1 (h) 4

43. The balanced has been damaged or mis–calibrated in such a way that all the readings are a few grams too high or too low, for example.

44. (a) A, B (b) A, D (c) A

45. (a) A time reading with lots of digits, most of which are incorrect; for example: 75.987 654 s
(b) A time reading with few digits, but the digits are close to the correct time; for example: 121.3 s
(c) A time reading with few digits, most of which are incorrect; for example: 88 s
(d) A time reading with lots of digits, and a value which is quite close to the accepted value; for example: 121.315 593 s

46. (a) 2 (b) 4 (c) 2 (d) 5

47. (a) C (b) M (c) M (d) C (e) M

48. (a) Numbered division difference = 1 cm ; Unnumbered subdivision difference $= \frac{1\ cm}{10} = 0.1\ cm$

Reading A: Pointer is $^4/_{10}$ of the way from one subdivision to the next: $^4/_{10} \times 0.1$ cm = 0.04 cm
The reading is 15.20 + 0.04 = **15.24 cm.**

Reading B: Pointer is $^7/_{10}$ of the way from one subdivision to the next: $^7/_{10} \times 0.1$ cm = 0.07 cm
The reading is 15.80 + 0.07 = **15.87 cm.**

(b) Numbered division difference = 10 cm ; Unnumbered subdivision difference $= \frac{10\ cm}{5} = 2\ cm$

Reading A: Pointer is $^3/_{10}$ of the way from one subdivision to the next: $^3/_{10} \times 2$ cm = 0.6 cm
The reading is 10.0 + 0.6 = **10.6 cm.**

Reading B: Pointer is $^5/_{10}$ of the way from one subdivision to the next: $^5/_{10} \times 2$ cm = 1.0 cm
The reading is 14.0 + 1.0 = **15.0 cm.**

(c) Numbered division difference = 1 cm ; Unnumbered subdivision difference $= \frac{1\ cm}{2} = 0.5\ cm$

Reading A: Pointer is $^5/_{10}$ of the way from one subdivision to the next: $^5/_{10} \times 0.5$ cm = 0.25 cm
The reading is 5.50 + 0.25 = **5.75 cm.**

Reading B: Pointer is $^3/_{10}$ of the way from one subdivision to the next: $^3/_{10} \times 0.5$ cm = 0.15 cm
The reading is 7.00 + 0.15 = **7.15 cm.**