Venus is near the Sun, as viewed from Earth, but is hard to see at mid-day. At dawn or dusk, when the Sun has set, but Venus is still visible, it is quite bright. The situation is more extreme for Mercury, which is very close to the Sun, and can only be seen just before sunrise or just after sunset.

16. Kepler was a Christian and believed that God created the Universe 6000 years ago.

20. Two competing theories can match the known data, and this is very common in physics. In fact, much of physics is about eliminating one or another competing theory by getting new data.

An example is geocentric vs. heliocentric solar system models before Tycho Brahe. Both were about equal in matching planetary data. Tycho gathered better data which gave geocentric models a problem, and later Galileo gathered new types of data (phases of Venus) which simply ruled out the geocentric models.
CH 1 24. Experiment: attempt to grow a plant in the absence of any material but soil:

- no water
- vacuum no air
- include sunlight (not material)

If a plant may keep growing this way, then Aristotle is correct.

30. (B)

(A) When Mars is aligned with Earth on same side of Sun, it is 0.5 AU from Earth. This is closest distance. Mars is seen at night.

(B) When Mars is opposite Earth, it is 2.5 AU from Earth. This is greatest distance. Mars is not seen at night since it is in the daytime sky.
Ch 2. 4. \[ C : H = 12 : 1 \] by weight \implies \text{C}_6\text{H}_{12}\text{O}_6\text{ gives}
\[ C : H = 16 : 1 \]
\[ \text{C}_6\text{H}_{12}\text{O}_6\text{ C} : \text{H} : \text{O} = 6 \times 12 : 12 : 6 + 16 \]
\[ = 72 : 12 : 96 \text{ by weight} \]
\[ = 6 : 1 : 8 \]
So, 6 grams of carbon plus 1 gram of hydrogen plus 8 grams of oxygen combine to make 15 grams of glucose.

16. 1 ton of coal = 1 ton of C
\[ \text{carbon dioxide is } \text{CO}_2 \]
\[ \implies \text{if } \text{O weight } = \text{C weight}, \text{ need 2 tons of oxygen} \]
\[ \implies 3 \text{ tons of } \text{CO}_2. \]

(\text{It's even worse: } 0 : C = 16 : 12 \text{ so you need} 2 \times \frac{16}{12} = 2 \frac{2}{3} \text{ tons of O} \implies 3 \frac{2}{3} \text{ tons of } \text{CO}_2. )

(\text{Lecture demo: Magdeburg Sphere})

Typical lid area = 17 in\(^2\)
\[ \implies \text{ force of air pressure } \approx 15 \frac{1}{2} \text{ lbs/in}^2 \times 17 \text{ in}^2 \approx 180 \text{ lbs!} \]

28. \text{If all molecules had overall eastward collective motion, they'd combine to make an eastward wind which we would feel.}
CH2 32. Milky Way $= 400 \times 10^9$ stars $= 4 \times 10^{11}$ stars
Suppose $0.05\% = 5 \times 10^{-4}$ have Earth-like planet
$\Rightarrow$ total Earth-like planets $= 4 \times 10^{11}$ stars $\times 5 \times 10^{-4}$
$= 20 \times 10^7$
$= 2 \times 10^8$
$= 200,000,000$
$= 200$ million

38. each atom $= 10^{-26}$ kg $\Rightarrow$ # atoms $= \frac{90\text{ kg}}{10^{-26} \text{ kg/atom}}$
my mass is 90 kg
$= 9 \times 10^{24}$ atoms
$= 9 \times 10^{27}$ atoms
$= 10^{28}$ atoms

* I'm working on it. I should be 82 kg.