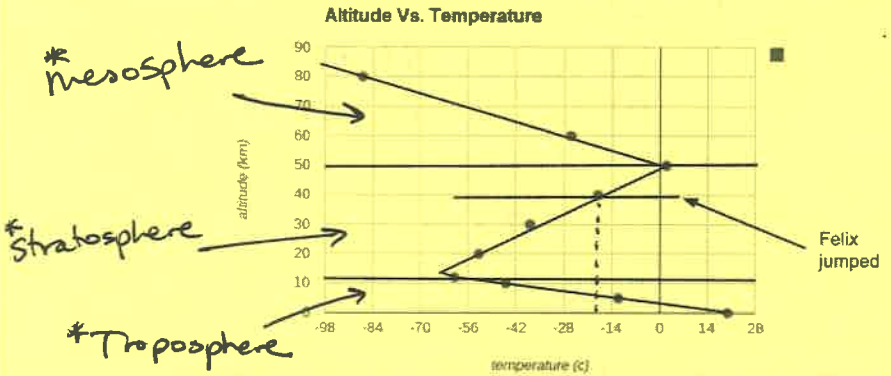
ChemCom Topic 7: Atmosphere Practice Test Name: Key

Structure of the Atmosphere
Use the graph below to answer the following questions:



1. Label each layer of the atmosphere in the graph above.

2. What was the temperature outside of the hot air balloon when Felix jumped?

   about -18°C

3. What is the highest altitude that will get to a temperature of 0 deg C?

   50 km

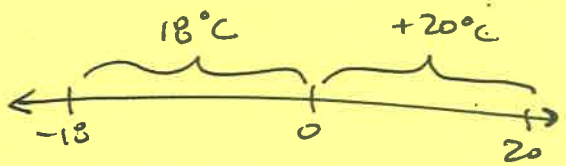
   What is the lowest altitude that will get to a temperature of 0 deg C?

   about 3 km

4. What is the most abundant gas in the atmosphere? N_2

5. What are the three most abundant gases in the atmosphere? Rank them and provide the percent of each. N_2 78.08% O_2 20.95% and Ar 0.93%

6. What is the name layer of the atmosphere that
   a. you live in? Troposphere
   b. planes fly in? at the boundary between the troposphere and the stratosphere
   c. felix jumped from? stratosphere

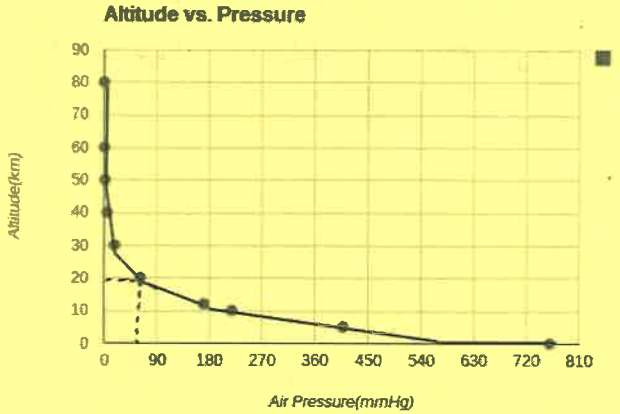


7. What is the difference in the temperature of the atmosphere when you compare where Felix jumped to the surface of the Earth? (These types of calculation questions will be worth two points!)

   Temp at surface is about 20°C
   Temp where Felix jumped -18°C
   18 + 20 = 38°C difference

8. What happens to the temperature of the atmosphere when you descend from 10 km flying across the country in a plane and land at ground level?

   Temp rises as the plane lands.



9. Write a sentence that describes the relationship between air pressure and the altitude above the Earth?

   Pressure decreases as altitude increases (inverse)

10. If Felix did not wear a spacesuit, what would have happened to him when he stepped outside of the capsule to jump?

    His blood would have boiled due to low atmospheric pressure.

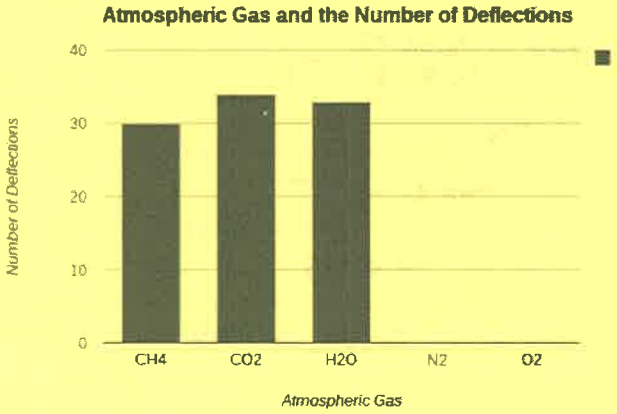
11. At the surface of the Earth standard air pressure is 760 mm of Hg. What percent of the atmospheric pressure is surrounding you when you fly in an airplane at an altitude of 20 km? About 60 mmHg outside a plane

    $\frac{60}{760} \times 100\% = 7.89\%$

12. Planes fly at around 10 km above the Earth. What was the approximate pressure around a plane?

    About 180 mmHg.

Changes in the Earth's Atmosphere
Use the graph below to answer the following questions:



13. Based on the graph, rank the gasses from the gas that traps the least infrared radiation, to the gas that traps the most infrared radiation.

Least O_2, N_2, CH_4, H_2O, CO_2 most

14. Which of the greenhouse gases tested above are produced when hydrocarbons like coal, gasoline and natural gas are burned?

CO_2

Which greenhouse gas leaks from the ground from storage zones used to hold fuel used to heat our homes?

CH_4

15. How many total photons were deflected by the water (H_2O) and carbon dioxide (CO_2)?

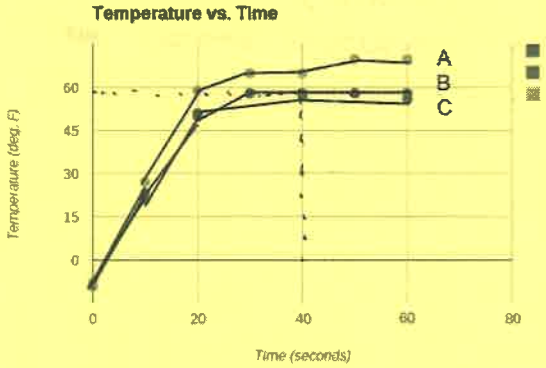
CO_2 about 34

H_2O about 33

34
+ 33
67

Use the graph below to answer the following questions:

Settings	Run #1	Run #2	Run #3
Atmosphere Year	1750	Today	Lots
Temperature units	Fahrenheit	Fahrenheit	Fahrenheit
Run Speed	Fast	Fast	Fast
Greenhouse Gas Composition	H_2O 70% rel. humidity CO_2 280ppm CH_4 0.730ppm N_2O 0.270ppm	H_2O 70% rel. humidity CO_2 388ppm CH_4 1.843ppm N_2O 0.317ppm	"Lots"



16. Which set of data would show the temperature of the Earth's atmosphere if the amount of greenhouse gasses in the atmosphere was a lot lower than today's levels?

Run #1 1750 Line C on graph.

17. Based on the data table, how much has the methane increased "today" compared to the methane level in 1750?

1.843 today
− 0.730 1750
0.113 increase

18. Based on the graph above, what was the approximate stable temperature of the Earth's atmosphere in the past before we began burning fossil fuels?

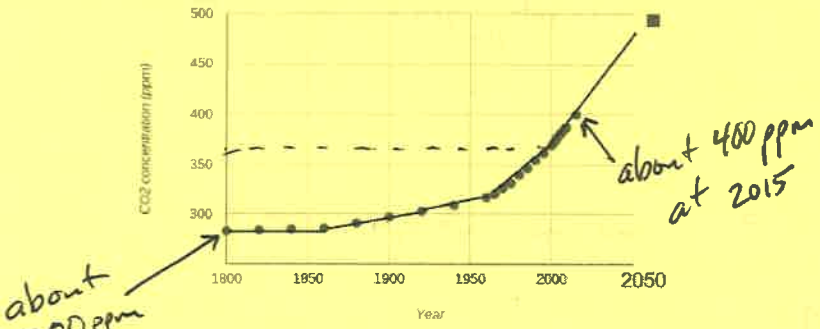
about 55°C

19. What was the approximate temperature of the Earth's atmosphere 40 seconds into running the simulation during trial B?

about 59°C

Use the data table and graph of the Carbon Dioxide levels from Mauna Loa to answer the following questions.

Approximate Carbon Dioxide Levels in the Atmosphere, 1800-2009 and 2015



20. What was the level of carbon dioxide in the atmosphere in 1890 before people during the industrial revolution began burning gasoline in cars?

about 290 ppm

21. How much did the level of carbon dioxide in the atmosphere increase between 1800 and 2015?

400
− 280
120 ppm increase

22. In 2015 the carbon dioxide level in the atmosphere hit 400 ppm. How much CO_2 has been added to the atmosphere since you were born?

about 365 ppm in year 2000

400
− 365
35 ppm increase

23. Make each statement below into a true statement by circling the correct word.
    a. The amount of carbon dioxide added to the atmosphere in the last 15 years is more/less than between 1980 and 1995.
    b. The amount of carbon dioxide added to the atmosphere in the last 15 years is more/less than between 1980 and 1995.
    c. The amount of carbon dioxide added to the atmosphere in the last 15 years is the more/less/the same as the 15 years between 1980 and 1995.

24. Rank the types of electromagnetic radiation from the one with the least energy, to the one with the most energy.

least Energy: radio waves, micro waves, (IR) Infrared, visible ROYGBIV, (UV) Ultraviolet, x-ray, gamma ray most energy

25. The chemical equation for burning gasoline is below. Why does burning fossil fuels like gasoline and coal contribute to global warming?

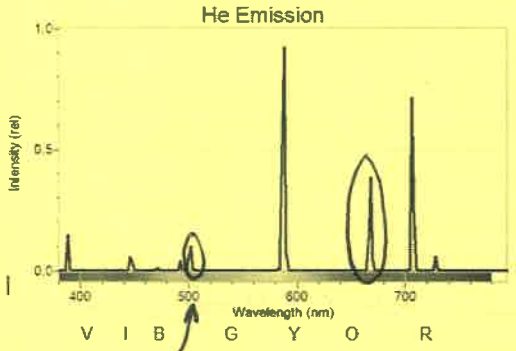
$$2\ C_8H_{18} + 25\ O_2 = 18\ H_2O + 16\ CO_2$$

produces CO_2 which is a greenhouse gas.

26. Which of the following gases do not absorb and deflect photons of infrared radiation in the atmosphere?

N_2 and O_2

Use the graph below to answer the following questions:



Energy = $\frac{M}{\lambda}$

E= the energy carried by the wave in calories

M is McKittrick's constant = 4.76×10^{-17} nm * calories

λ is the wavelength in nanometers measured on your graph

27. Which color photons of light on the spectrum above would have the lowest energy?

red

28. Estimate the wavelength of the photons of light making the peak between the blue and green zones.

500 nm

29. The photons captured by the spectrovis were generated by exciting the atoms of the different chemicals with energy. Which subatomic particle gets pushed up to higher energy levels, then falls emitting photons of light during the experiments?

electrons

30. (2 points) Calculate the energy of the most intense peak of photons in the orange zone of the spectrum.

estimated wavelength 665 nm

$$E = \frac{4.76 \times 10^{-17} \text{ nm} \cdot \text{cal}}{665 \text{ nm}}$$

$$= 7.16 \times 10^{-20} \text{ cal}$$

31. (2 points) Calculate the energy in a photon of infrared light that has a wavelength of 2.0×10^6 nm.

$$E = \frac{4.76 \times 10^{-17} \text{ nm} \cdot \text{cal}}{2.0 \times 10^{6} \text{ nm}}$$

$$= 2.38 \times 10^{-23} \text{ cal}$$