

**Questions your Classmates Submitted**  
**Earth Science**  
**Some of these *will* appear on the test.**

I give you these without comment – they are unedited (except for clarity). This is what your fellow students think might make good test questions.

1. Calculate the frequency of red light. The wavelength is  $7.5 \times 10^{-7}$  meters.
2. Name 2 types of EM radiation with energy less than visible light.
3. What is the wavelength of a photon with energy  $3.9 \times 10^{-22}$  Joules.
4. Which emits more energy? Mercury or Jupiter?
5. A human's body temperature is close to 310K. What is your blackbody wavelength peak?
6. What is the frequency of light that has an energy of  $3.058 \times 10^{-19}$  Joules.
7. What happens to wavelength as you move from violet to red light?
8. What is blackbody radiation, and who was the first scientist to make a substantial contribution to the study of it?
9. In what form does EM radiation travel?
10. The water you are boiling for mac 'n' cheese is at 373K. What is its blackbody wavelength peak?
11. What is the energy that a 120 W light bulb produces in 1 minute?
12. List two types of EM radiation with wavelength shorter than visible light.
13. Write the colors of the visible spectrum in order of increasing wavelength.
14. Assuming a frog has a surface area of 100 square inches and an internal temperature of 6 degrees Celcius, how much energy does it give off?
15. What is the peak wavelength of the frog's blackbody spectrum?

16. What are some characteristics of an inner planet?
17. Draw a wave and label its crest and trough.
18. What are the three main ingredients for a star?
19. Although water waves are neither transverse or longitudinal, which of the two are they closer to?
20. Do inner planets have (in general) more or fewer natural satellites than outer planets?
21. What are the four fundamental forces in the universe?
22. What are the relationships between wavelength, frequency, and energy?
23. What happens to the speed of a wave as frequency increases?
24. What is a blackbody?
25. How large is our sun?
26. What did Wien get right in his formulation of the blackbody spectrum?
27. What school developed the new blackbody standard?
28. In the HR diagram, as the star moves \_\_\_\_\_, the temperature rises.
29. Where are the blue giants found on the HR diagram?
30. Name the four primary scientists that contributed to the historical development of the blackbody problem?
31. What is spectroscopy, and what is one application/use of it?
32. Which emits more energy – Venus or Jupiter?
33. By what process does a microwave heat?
34. What is the wavelength of green light? The frequency of green light is approximately  $5.45 \times 10^{14}$  Hz.
35. Give a short explanation as to how microwaves work. What kind of heating is used?
36. How can we use the light generated via a supernova to determine how far away the original star was?

37. Which visible color has the shortest wavelength?
38. What is the “red shift”?
39. Of the 0.001% of the universe that is not empty space, approximately what percentage is Hydrogen?
40. Almost everything in the universe is \_\_\_\_\_-shifted.
41. If a radiation emitting object is moving toward an observer, will he/she see a higher or lower frequency than the object is actually emitting?
42. 10 nm is equal to \_\_\_\_\_ Angstroms and \_\_\_\_\_ meters.
43. Find the power that Jupiter is emitting, assuming it is a perfectly spherical blackbody.
44. What is the energy of a photon of green light?
45. What is Wien’s Displacement Law?
46. What would you say could have happened if you view a spectral line of 430.4 nm? (A Hydrogen spectral line is 410.2 nm).
47. What is one difference between a transverse and a longitudinal wave?
48. How are frequency and wavelength related?

The following are questions previous years’ students asked. They might be helpful as well.

1. There is a perfect spherical blackbody floating in space that has a radius of 1 meter and is expelling 1 million Watts of power. What is its temperature?
2. Who coined the term “blackbody radiation”?
3. Do all the people on Earth radiate more energy combined than Pluto, a rock at the very edge of our Solar System?
4. What are the four fundamental forces of the universe?
5. What possible explanations can you give as to why everything in the universe is moving away from us?

6. What is the wavelength of yellow light if the energy given off per photon is approximately  $3.37 \times 10^{-19}$  Joules?
7. List all components of the EM spectrum in order of increasing frequency.
8. How much energy does a 200 W lightbulb consume in 3 minutes?
9. Estimate the energy of a gamma ray.
10. The radius of an object is 593 meters. The temperature of the object is 280K. Find how many Joules the object emits in a year.
11. Name types of EM radiation with energy higher than visible light.
12. If a perfect spherical blackbody has a radius of 3000 meters and expels  $1.23 \times 10^8$  Watts of power, what is its temperature in Kelvin?
13. A new spectral line has been discovered at 454.742 nm. Then you notice a star not on the main sequence that has a spectral line at 550.681 nm (which, for other reasons, should correspond to the 454.742 nm line). How fast is it moving, and is it towards or away from us?
14. What are the ingredients for a star?
15. A star is travelling toward you at 5.2 million miles/hr. You expect it to be emitting 415.000 nm. Where will you see the spectral line?
16. Given the sun's radius is  $9.95 \times 10^8$  meters and its temperature is approximately 6000 K, how much power does the sun emit?
17. What assumption, made by Planck, solved the blackbody riddle?
18. What is the velocity of a star on the main sequence with an observed spectral line at 663.125 nm when its expected spectral line is at 661.573 nm? Is the star moving towards Earth or away from Earth?
19. If we see a star that we know to be a main sequence star, what is it doing?
20. What is the power output of the planet Mars?
21. What is the appropriate type of scattering for visible light scattering off a dust particle?

22. What is the appropriate type of scattering for microwave radiation scattering off a water molecule?
23. Why is the sky blue?
24. What equation is most responsible for why the sky is blue?
25. What is the definition of a blackbody?
26. Why is it that we can “see” at night using infrared radiation technology?
27. As you move from violet to red on the visible light spectrum, what happens to the wavelength, frequency, and energy?
28. A child with radius 0.2 m is sitting 0.5 m away from a TV with a temperature of 85 F (29.5C). What is the child’s radiative equilibrium temperature assuming the only energy input is radiation from the TV?
29. Calculate the size parameter for this question and state the kind of scattering; microwave radiation scattering off a bowling ball.
30. Given the wavelength of red light (750 nm) and violet (375 nm) light, is violet closer to that of UV rays or is red closer to that of IR rays?
31. If Earth’s radius is  $6.4 \times 10^6$  m and its temperature is 287K, what is the total power (in Watts) radiated by Earth?
32. Scientists have recently found planet X. It has many components that suggest that it could sustain life. Planet X has clouds (30%), oceans (20%), sand (35%), grass (10%), and snow (5%). Find the albedo of planet X and reflect on whether you think it could sustain life. Relevant albedos –  $A_{\text{ocean}} = 0.04$ ,  $A_{\text{grass}} = 0.25$ ,  $A_{\text{sand}} = 0.40$ ,  $A_{\text{clouds}} = 0.60$ ,  $A_{\text{snow}} = 0.85$ .
33. Calculate the size parameter and state what kind of scattering theory applies. Microwave radiation scattering off a basketball.
34. Planet Hugo has a radius of  $9 \times 10^{18}$  m and is  $9 \times 10^{31}$  m away from the Larsen star. Larsen star has a radius of  $8 \times 10^{23}$  m and a temp of 10000K. What is the solar constant for Hugo assuming Hugo and Larsen are perfect blackbodies?
35. What is the energy of a red photon ( $\lambda = 700\text{nm}$ ).

36. What is the wavelength of red light? The frequency is approximately  $4 \times 10^{14}$  Hz.
37. What is the wavelength of green light? The frequency is approximately  $5.45 \times 10^{14}$  Hz.
38. What are the 4 fundamental forces?
39. Given the radius of Pluto ( $1.2 \times 10^6$  m) find the surface area of Pluto. Then find the energy flux  $\Phi$  with Pluto's temperature (44K). Then find the total power radiated by Pluto.
40. What is the albedo of a non-blackbody object?
41. What are the three primary methods of thermal energy transfer?
42. What are the colors of the visible spectrum in order of increasing frequency.