

1. The following spectra is from a star at rest.



Identify which spectra is redshifted and which is blueshifted.

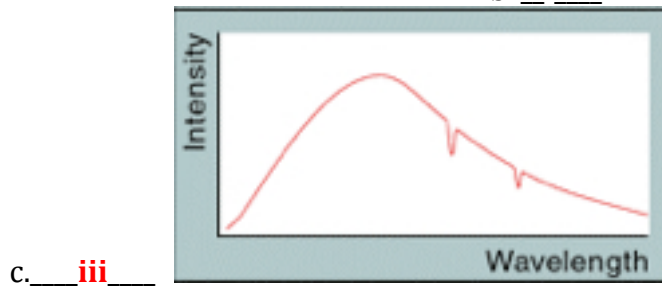
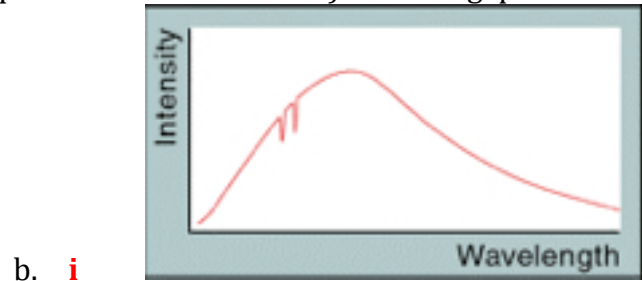
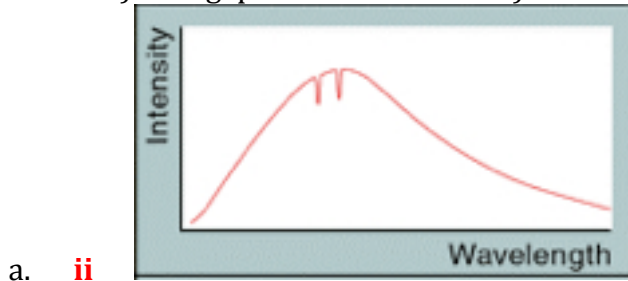


2. Match up the distances with the correct spectral curve. Remember the curve tells you how much of each type of light the object gives off and the absorption lines tell you what kind of elements the object is made of. A megaparsec is 3×10^{22} meters, a very big distance!

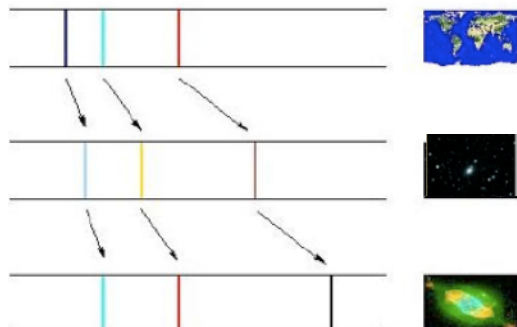
i.) 0 Megaparsecs

ii.) 300 Megaparsecs

iii.) 1000 Megaparsecs



3. Explain what the following diagram is showing about light.

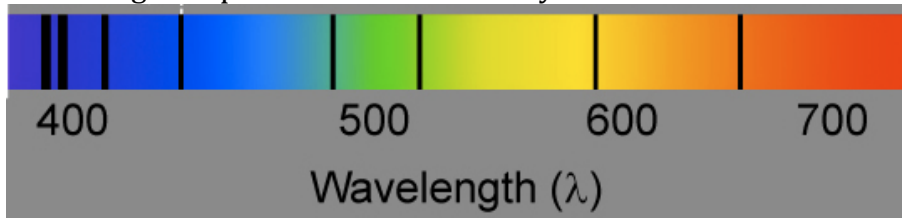


Spectral lines on Earth

Spectral lines from a star in our galaxy shows some redshift; source far from Earth

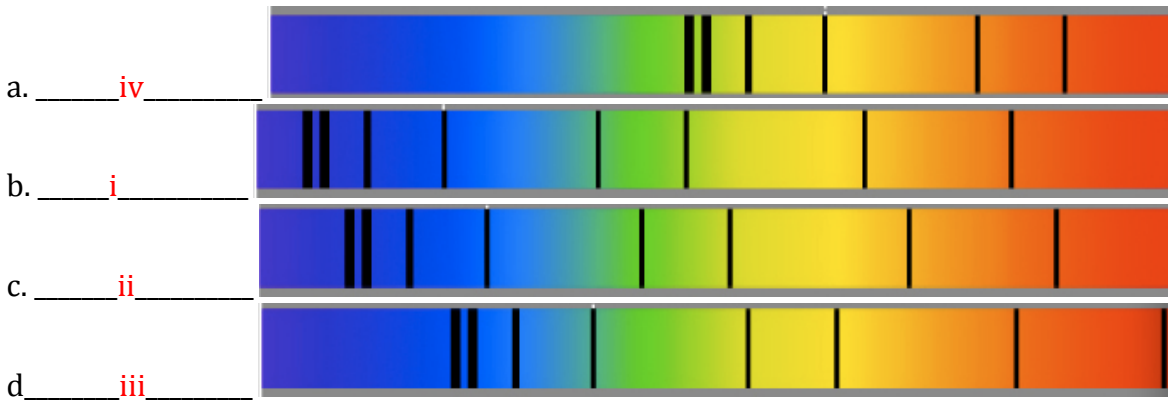
Spectral lines from a galaxy shows a lot of redshift; source very far from Earth

4. Following is a spectra from a laboratory reference.



Identify each spectra below as one of the following.

- i. a star ii. a nearby galaxy iii. A distant galaxy iv. A very distant galaxy



5. A star in our galaxy is observed to have all its spectral lines redshifted by a small fraction. What is the most obvious deduction you could make from this observation?

The star is moving away from Earth but it isn't too far from Earth, relatively speaking

6. Quasars or QSOs show Lyman α lines in the visible part of their spectra obtained on Earth. a) What does this suggest about them? b) Why do we not observe Lyman α lines in the visible region of stellar spectra even though stars have abundant hydrogen present?

- a) Lyman lines are usually in the ultraviolet range. If they are now in the visible region, they have been redshifted. This means the source, quasars, are moving away from Earth. To move to a whole new region of the electromagnetic spectrum, the quasars have to be far, far from Earth.
- b) Lyman lines are usually in the ultraviolet range. Stars are not far enough away from Earth for the lines to have been redshifted to the visible range.

7. Visit the *Runaway Universe Moving Target* web page and do the Moving Target animation. Record your answers for *Reading Reshifts*

http://www.pbs.org/wgbh/nova/universe/movi_flash.html

Moving Towards Us	
Fast	Slow
A	D

Stationary

Moving Away from Us	
Slow	Fast
C	B