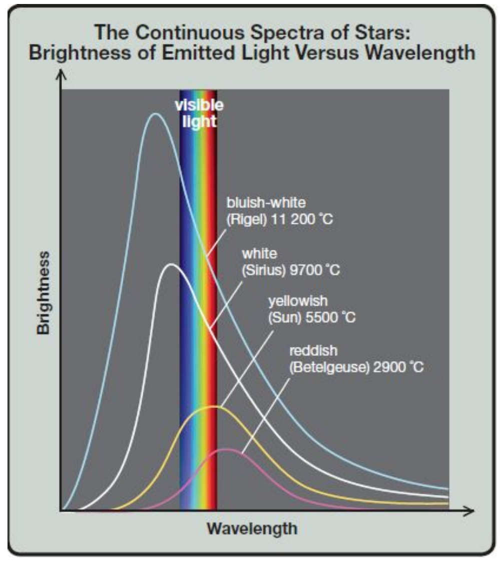
Science 30	Unit C: Physics
Lesson 13 - Astronomy	84 mins

Temperature vs. Colour of Gases (Stars)



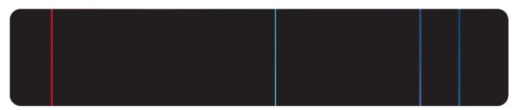
Spectroscopy

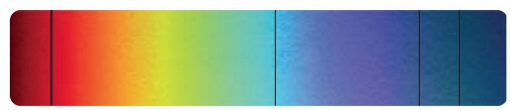
absorption spectrum or dark-line spectrum: a spectrum that has a pattern of dark lines due to the light passing through an absorbing medium; can be used to identify a material.

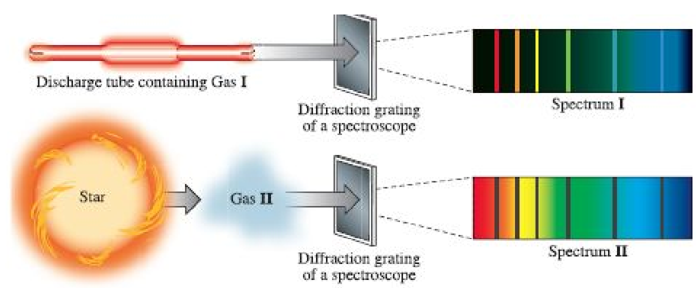
emission spectrum or bright-line spectrum: a spectrum that has a pattern of separate bright lines that is emitted from an excited gas under low pressure; can be used to identify a material

spectra: plural form of spectrum

spectrometer: an optical instrument that is used to measure the wavelengths of light


bright-line spectrum of hydrogen


dark-line spectrum of hydrogen



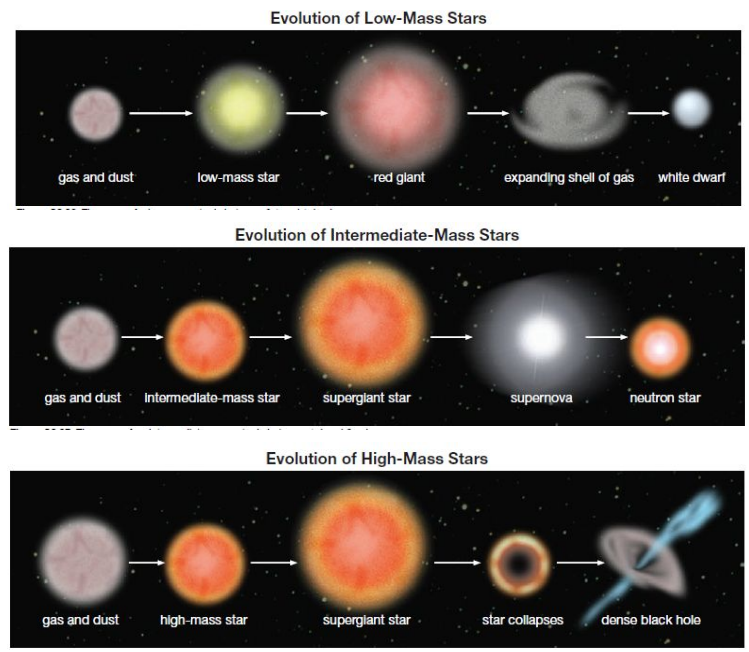
Doppler Effect

VRRRRROOOOOMMM! The compression of waves in the front of a moving object and the stretching of waves off the back. ***(The String Example)*** Light can be shifted as well. Use the same Black-lines RedShifting (Moving Away) BlueShifting (Moving Toward)	Draw Draw Sun Draw H redshifted/blueshifted

Stars

Stars are massive balls of gas undergoing **fusion** **Closest Star?** The sun (Sol) EMR Emitted by the sun	Fusion - the process where two smaller nuclei join to form a larger nucleus, releasing energy DRAW $^{2}_{1}H + ^{2}_{1}H \rightarrow ^{3}_{2}He + ^{1}_{0}n$

Classification of Stars

red giant: a star of great size and age that has a relatively low surface temperature **nebula**: an interstellar cloud of gas and dust white dwarf: a compact star found as the last stage in the evolution of low-mass stars **supernova**: a stellar explosion that produces a very bright cloud of ionized gas that remains a very bright object in the sky for weeks or months **neutron star**: a super-dense star consisting mainly of neutrons formed as the last stage in the stellar evolution of intermediate-mass stars **pulsar**: a rotating neutron star that emits radiation in regular pulses **black hole**: an area in space with a gravitational field so strong that neither matter nor EMR can escape; formed as the last stage in the evolution of high-mass stars	**Life and Death of Stars** 

Science 31 - Lesson 36 - Unit C - Astronomy

Name: ______________________________________

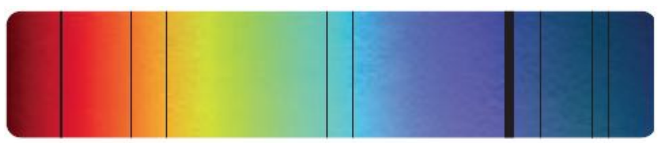
Practice

1) Suppose two new stars are discovered. One star appears to emit light that is slightly less yellow and more white than the light emitted by the Sun. The other star appears to emit light that is more orange than the light emitted by the Sun. Use this information to compare the temperature of each star to the Sun.

2) The final object that a star becomes in stellar evolution is either a white dwarf, a neutron star, or a black hole. Identify the feature of a star that determines what its endpoint will be in stellar evolution.

3) Explain why it is impossible to view a black hole through a optical telescope.

4) Often a spectrum will contain the lines of more than one excited gas. Identify the two gases that produced the following spectrum.



5) Describe the effect on the pattern of spectral lines observed on Earth if a star is moving away from Earth and if a star is moving toward Earth.

6) One way to analyze EMR is to pass the radiation through a prism or a diffraction grating. This causes the radiation to separate into its component wavelengths, producing a spectrum. Depending upon the source, three types of spectra can be observed. For each of the following types of spectra, describe a possible source and indicate how this information could be used by astronomers.
    a. continuous spectrum

b. absorption spectrum (dark-line spectrum)

c. emission spectrum (bright-line spectrum)

7) Sketch a series of diagrams to show the main steps in the evolution of stars like the Sun.

8) A black hole is one of the most intriguing regions of space studied by astronomers.
   a. Describe some of the characteristics of a black hole.

   b. Describe how a black hole is formed.

9) The world's largest airborne astronomical observatory is NASA's Stratospheric Observatory for Infrared Astronomy, or SOFIA for short. In the figure below, the black square near the tail shows where the open cavity for the telescope is located.
   a. Explain why it is necessary to go more than 10 km above Earth's surface to make observations in the infrared and microwave regions of the electromagnetic spectrum.

   b. What specific astronomical phenomena is SOFIA designed to study?You can answer this question by using the Internet as a research tool to find out the key objectives on NASA's SOFIA website.