# Review
# Exam 2

# Key questions

- The Sun will be on the main sequence for another 6 billion years. How will it change (luminosity and size) during that time?
- During the next 6 billion years what will happen to the Earth due to the Sun?
- What is the greenhouse effect?
- Name two possible mitigation techniques for the Sun's evolution over the next 6 billion years.
- In 6 billion years the Sun moves off the main sequence. What is happening in the core?
- The Sun becomes a red giant. What is happening in the core? Around the core?

# Key questions

- Why are we uncertain of what will happen to the Earth (swallowed?) when the Sun turns into a red giant, assuming the Earth isn't moved.
- In about 7.7 billion years, the Sun will turn into a Horizontal Branch star (a blue star). What is happening in the core? What is happening around the core?
- In about 7.8 billion years, the Sun will turn into an Asymptotic Giant Branch star (a red star). What is happening in the core? What is happening around the core?
- The last stage of our Sun will be a planetary nebula and a white dwarf. What happens to the Sun's envelope?
- What is the habitable zone? Why will the Sun's change?

# Key questions

- What keeps a white dwarf from collapsing?
- What is the maximum mass of a white dwarf?
- What are the layers of the Sun now?
- What causes granulation on the Sun?
- What is a sunspot? Why is it dark? Compare the temperature to the Sun's surface. What makes sunspots?
- What is the sunspot cycle? What causes it?
- How does the Sun rotate? How does that affect the magnetic field of the Sun?
- What is an aurora?
- What is a prominence, solar flare, and CMEs? How do they differ?

# Key questions

- Why don't most CMEs hit the Earth?
- The most dangerous CMEs have magnetic fields that are opposite the Earth's. Why does that make a difference?
- What are some effects of a CME impact on the Earth?
- What is the best mitigation technique for a CME event?
- What is light? What is wavelength? What is frequency?
- What are the differences between the various wavelengths of light?
- Why is the Sun currently yellow colored?
- What is thermal emission?
- The hotter/cooler an object is at a constant radius, what happens to the object's color, brightness, and energy output?

# Key questions

- Why do further objects look dimmer? What is luminosity?
- What is parallax?
- How can we measure the masses of stars?
- What is the property of a star on the main sequence? How does the luminosity compare with the mass?
- What does the spectrum of the Sun look like? Why?
- What are the different types of spectra?
- Why makes different elements have a distinct spectrum?
- What are the different spectral classes of stars and what do the mean?

# Key questions

- What is the stellar relationship between luminosity, temperature, and size? How does luminosity (absolute brightness) depend on a star's radius? How can a cool star be bright?
- Compare the luminosity of a massive star and a low-mass star on the main sequence. Compare the time it takes to evolve.
- A massive star has much more hydrogen fuel in it, yet it lives much less time on the main sequence. Why?
- Briefly explain the core and layers in a massive star as it evolves off the main sequence. What does it look like?
- What is the HR diagram?
- What are the axes?

# Key questions

- At the end a massive star has a pure iron core, and it will collapse. It is too heavy for electron degeneracy and it collapses how quickly/fast?
- What happens to the core as it collapses?
- What happens to the envelope of the star when the core collapses?
- What are the 2 possible leftovers after a supernova (compact objects)?
- The rebound of the envelope is not enough to cause a supernova by itself. What energy input kicks the explosion?
- Where are the giants/supergiants/white dwarfs on the HR diagram, roughly?

# Key questions

- Why are we star stuff?
- What triggers a supernova? What happens right before the collapse? What happens right after?
- How are star cluster useful? How can we determine the age of a star cluster?
- What is the death distance for a supernova? Roughly..
- What are some effects on the Earth of a nearby supernova?
- Could you breathe Earth's first atmosphere?
- Where did the oxygen in our atmosphere come from?
- What is ozone? Why is it (when in the stratosphere) good for life?

# Key questions

- What are some effects on life on Earth when the ozone layer is damaged?
- What made the Crab Nebula?
- Any supernova candidates nearby?
- What is the evidence of nearby supernova explosions (Earth evidence)?
- What are mitigation techniques for nearby supernova?
- What is a gamma-ray? Particle? Light?
- Why do we have go to space to detect gamma rays?
- How were Gamma-Ray Bursts first detected?

# Key questions

- What is the distribution of GRBs on the sky? Uniform? Lumped? Skewed?
- What do we think is the origin of long time GRBs?
- What do we think is the origin of short time GRBs?
- What is the main reason GRBs are so bright?
- What causes the jet in a hypernova?

# Key questions

- What is the common feature (i.e. mechanism) for both long and short time GRBs?
- What are some affects of a nearby GRB on the Earth?
- What is Eta Carinae? WR 104? Which one might be pointed at us?
- Why are neutron star/neutron star or black hole/ neutron star mergers a less dangerous type of GRB?
- Which extinction event may have been caused by a GRB? What were some of the effects?
- GRB mitigation?