

## Introductory Astronomy

NAME:

**Homework 20: The Nature of Stars:** Homeworks and solutions are posted on the course web site. Homeworks are **NOT** handed in and **NOT** marked. But many homework problems (~ 50–70 %) will turn up on tests.

## Answer Table

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001 qmult 00007 1 4 1 easy deducto-memory: reading done 2

1. Did you complete reading the intro astro web lecture before the **SECOND DAY** on which the lecture was lectured on in class?

a) YYYesssss!    b) Jawohl!    c) Da!    d) Sí, sí.    e) OMG no!

**SUGGESTED ANSWER:** (a),(b),(c),(d)

**Wrong answers:**

e) As Lurch would say AAAARGH.

**Redaction:** Jeffery, 2008jan01

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039 qmult 00100 1 1 4 easy memory: stellar surface temperature

**Extra keywords:** CK-286,296

2. The surface (i.e., photosphere) temperature of an ordinary star can be determined from:

a) the shape of its **NON-BLACKBODY** spectrum (particularly the location of the peak).  
 b) an analysis of its **EMISSION** line spectrum.  
 c) no known means.  
 d) the shape of its approximately **BLACKBODY** spectrum (particularly the location of the peak) and/or an analysis of its **ABSORPTION** line spectrum.  
 e) thermometers.

**SUGGESTED ANSWER:** (d)

**Wrong answers:**

e) As Lurch would say: “Aaaarh.”

**Redaction:** Jeffery, 2001jan01

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039 qmult 00200 1 1 3 easy memory: spectral type temperature

3. The surface (i.e., photosphere) temperature of an ordinary star can be determined by:

a) measuring its mass.    b) identifying its luminosity class.    c) identifying its spectral type.  
 d) any means at all.    e) no means.

**SUGGESTED ANSWER:** (c)

**Wrong answers:**

e) As Lurch would say: “Aaaarh.”

**Redaction:** Jeffery, 2001jan01

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039 qmult 00210 2 1 3 moderate memory: OBAFGKM spectral types

**Extra keywords:** CK-286,295

4. The main sequence spectral star types are:

a) ABCDEFGHIJKLMNOP.    b) OBIWANKEN.    c) OBAFGKM.    d) OBGKMAF.  
 e) OAGKMAO.

**SUGGESTED ANSWER:** (c)

Remember the mnemonic: “Oh be a fine girl/guy kiss me.” Sometimes it is the only sensible thing to say.

**Wrong answers:**

a) This was apparently the original old spectral type sequence (CK-286).  
 b) Say it.

**Redaction:** Jeffery, 2001jan01

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039 qmult 00220 1 4 5 easy deducto-memory: spectral subtypes

5. “Let’s play *Jeopardy!* For \$100, the answer is: Each stellar spectral types is divided into these subtypes.”

What are \_\_\_\_\_, Alex?

- a) 0 Ia, Ib, II, III, IV, V, VI, VII      b) Chico, Groucho, Gummo, Harpo, Karlo, Zeppo  
 c) Larry, Curly, and Moe      d) abcde...xyz      e) 0, 1, 2, ..., 9

**SUGGESTED ANSWER:** (e)

**Wrong answers:**

- a) These are the luminosity classes.  
 b) These are the Marx brothers. Well Karlo actually never performed with the other brothers, but he was a well known writer on economic theory and used to supply his brothers with subversive subtexts for their gags.  
 c) They were low, very low.

**Redaction:** Jeffery, 2001jan01

039 qmult 00230 1 4 1 easy deducto-memory: Sun spectral type

**Extra keywords:** CK-286

6. The Sun's spectral type is:

- a) G2.      b) red giant.      c) A-.      d) Z9.      e) unknown.

**SUGGESTED ANSWER:** (a)

**Wrong answers:**

- e) As Lurch would say: "Aaaarh."

**Redaction:** Jeffery, 2001jan01

039 qmult 00300 2 4 2 moderate deducto memory: hydrogen line strength

**Extra keywords:** CK-285

7. The hydrogen Balmer lines in main sequence stars:

- a) always increase in strength with increasing temperature.  
 b) are strongest at surface temperature of order 10,000 K.  
 c) always decrease in strength with increasing temperature.  
 d) cannot be seen at all.  
 e) have constant strength with varying temperature.

**SUGGESTED ANSWER:** (b)

**Wrong answers:**

- d) As Lurch would say: "Aaaarh."

**Redaction:** Jeffery, 2001jan01

039 qmult 00310 2 4 2 moderate deducto-memory: Balmer line colors

8. The approximate colors of the hydrogen Balmer lines  $H\alpha$ ,  $H\beta$ ,  $H\gamma$ , and  $H\delta$  are, respectively:

- a) blue-green, red, violet, and blue-violet.      b) red, blue-green, blue-violet, and violet.      c) red, white, blue, and mauve.      d) rouge, mauve, lime, and tangerine.      e) rot, nasal, grunge, and exhaust.

**SUGGESTED ANSWER:** (b)

**Wrong answers:**

- e) Nail polish colors: as Captain Queeg would say "I kid you not."

**Redaction:** Jeffery, 2001jan01

039 qmult 00400 1 4 5 easy deducto-memory: Hertzsprung-Russell diagram

**Extra keywords:** CK-295

9. "Let's play *Jeopardy!* For \$100, the answer is: It is a plot of stellar luminosity (or absolute magnitude) versus star temperature (or spectral type)."

What is a \_\_\_\_\_, Alex?

- a) butterfly diagram      b) Hertz-Avis (HA) diagram      c) mass-luminosity diagram  
 d) Feynman diagram      e) Hertzsprung-Russell (HR) diagram

**SUGGESTED ANSWER:** (e)

**Wrong answers:**

- a) This is used to plot sunspots.
- d) I never really figured these out.

**Redaction:** Jeffery, 2001jan01

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039 qmult 00420 1 1 1 easy memory: main sequence curve on HR diagram

**Extra keywords:** CK-295

10. The main sequence on a Hertzsprung-Russell (HR) diagram is a curve (actually a narrow band) of \_\_\_\_\_ luminosity with increasing \_\_\_\_\_.
- a) increasing; surface temperature
  - b) decreasing; surface temperature
  - c) constant; surface temperature
  - d) increasing; hydrogen content
  - e) decreasing; hydrogen content

**SUGGESTED ANSWER:** (a)

**Wrong answers:**

- d) The hydrogen content is pretty constant for main sequence stars.

**Redaction:** Jeffery, 2001jan01

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039 qmult 00430 1 1 1 easy memory: star types on HR diagram

11. Main sequence stars, giants, supergiants, and white dwarfs all give rise to easily identifiable groups on a:

- a) Hertzsprung-Russell (HR) diagram.
- b) butterfly diagram.
- c) Zipf plot.
- d) Harley-Davidson (HD) diagram.
- e)  $x$ - $y$  diagram.

**SUGGESTED ANSWER:** (a)

**Wrong answers:**

- c) There is a Zipf's law—or so I recall.
- d) As Lurch would say: "Aaaarh."

**Redaction:** Jeffery, 2001jan01

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039 qmult 00500 2 4 4 moderate deducto-memory: HR diagram stellar radii

12. On a Hertzsprung-Russell diagram contours of constant radii run:

- a) linearly **UPWARD** to the right.
- b) horizontally across the diagram.
- c) vertically up the diagram.
- d) linearly **DOWNWARD** to the right.
- e) in a spiral to the center.

**SUGGESTED ANSWER:** (d)

**Wrong answers:**

- e) As Lurch would say: "Aaaarh."

**Redaction:** Jeffery, 2001jan01

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039 qmult 00510 1 4 5 easy deducto-memory: resolving stars

13. Stars:

- a) can always be resolved.
- b) can never be resolved.
- c) usually cannot be resolved, but with special techniques remote, small ones can be.
- d) usually are resolved.
- e) usually cannot be resolved, but with special techniques close, large ones can be.

**SUGGESTED ANSWER:** (e)

**Wrong answers:**

- a) As Lurch would say: "Aaaarh."

**Redaction:** Jeffery, 2001jan01

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039 qmult 00600 1 1 5 easy memory: luminosity classes

**Extra keywords:** CK-288,295

14. The luminosity classes of stars are:

- a) Chico, Groucho, Gummo, Harpo, Karlo, Zeppo.      b) bright, very bright, super-bright, unbelievable.      c) 1, 2, 3, 4, 5, 6.      d) OBAFGKM.      e) 0, Ia, Ib, II, III, IV, V, VI, VII.

**SUGGESTED ANSWER:** (e)

**Wrong answers:**

- a) These are the Marx brothers. Well Karlo actually never performed with the other brothers, but he was a well known writer on economic theory and used to supply his brothers with subversive subtexts for their gags.

**Redaction:** Jeffery, 2001jan01

039 qmult 00610 2 1 4 moderate memory: hypergiant luminosity class

**Extra keywords:** CK-288,289,296

15. They are the most luminous stars (i.e., luminosities of order  $10^6 L_{\odot}$ ) and put in luminosity class 0. They are called:

- a) giants.      b) dwarfs.      c) horizontal branch stars.      d) hypergiants.      e) red dwarfs.

**SUGGESTED ANSWER:** (d)

**Wrong answers:**

- e) As Lurch would say: “Aaaarh.”

**Redaction:** Jeffery, 2001jan01

039 qmult 00620 2 4 2 easy deducto-memory: white dwarf luminosity class VII

16. “Let’s play *Jeopardy!* For \$100, the answer is: These objects appear on Hertzsprung-Russell diagrams and they are assigned a luminosity class VII.”

What are \_\_\_\_\_, Alex?

- a) hypergiants      b) white dwarfs      c) black holes      d) green giants      e) green dwarfs

**SUGGESTED ANSWER:** (b)

**Wrong answers:**

- a) These at least are on HR diagrams, but they are luminosity class 0.

**Redaction:** Jeffery, 2001jan01

039 qmult 00700 1 4 4 easy deducto-memory: mass-luminosity relation

**Extra keywords:** CK-296-11

17. “Let’s play *Jeopardy!* For \$100, the answer is: They are the kind of stars to which the mass-luminosity relation applies.”

What are \_\_\_\_\_ stars, Alex?

- a) supergiant      b) red giant      c) red dwarf      d) main-sequence      e) Hollywood

**SUGGESTED ANSWER:** (d)

**Wrong answers:**

- e) Arguably true, but not a best answer in this context.

**Redaction:** Jeffery, 2001jan01

039 qmult 00710 1 1 1 easy memory: mass-luminosity relation behavior

18. On a log-log plot the mass-luminosity relation approximates a:

- a) straight line that increases with mass.      b) horizontal line.      c) vertical line.      d) quadratic curve.      e) straight line that decreases with mass.

**SUGGESTED ANSWER:** (a)

**Wrong answers:**

- e) Exactly wrong.

**Redaction:** Jeffery, 2001jan01

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039 qmult 00800 1 4 1 easy deducto-memory: binary system

**Extra keywords:** CK-295

19. Two stars gravitationally bound to each other and orbiting their mutual center of mass constitute a:
- a) binary star system.
  - b) triple star system.
  - c) single star.
  - d) galaxy.
  - e) universe.

**SUGGESTED ANSWER:** (a)

**Wrong answers:**

- e) As Lurch would say: “Aaaarh.”

**Redaction:** Jeffery, 2001jan01

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039 qmult 00810 1 4 4 easy deducto-memory: close binary system

**Extra keywords:** CK-295

20. The evolution of stars in a close binary systems have additional complexity beyond single single star systems because the binary stars:
- a) are always very massive.
  - b) are always very far apart.
  - c) are unbound gravitationally.
  - d) can interact.
  - e) cannot interact.

**SUGGESTED ANSWER:** (d)

**Wrong answers:**

- c) They cannot be gravitationally unbound if they form a close binary system.
- e) Exactly wrong.

**Redaction:** Jeffery, 2001jan01

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039 qmult 00820 1 4 3 easy deducto-memory: open clusters

21. “Let’s play *Jeopardy!* For \$100, the answer is: These are loosely-bound, irregularly-shaped groups of stars consisting of order 100 to 1000 stars and having size scales of order 4 to 20 pc.”

What are \_\_\_\_\_, Alex?

- a) singles
- b) binaries
- c) open clusters
- d) globular clusters
- e) galaxies

**SUGGESTED ANSWER:** (c)

**Wrong answers:**

- a) As Lurch would say: “Aaaarh.”

**Redaction:** Jeffery, 2001jan01

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039 qmult 00830 1 4 5 easy deducto-memory: Pleiades

22. “Let’s play *Jeopardy!* For \$100, the answer is: A physical group of stars in the constellation Taurus, sometimes called the Seven Sisters or, in Japan, Subaru, of which at least 6 stars are usually visible to the naked eye under reasonable seeing conditions.”

What are the \_\_\_\_\_, Alex?

- a) Toyotas
- b) Wives of Chauntecleer
- c) Brides of Dracula
- d) Hyades
- e) Pleiades

**SUGGESTED ANSWER:** (e)

**Wrong answers:**

- b) Actually Chauntecleer’s wives are symbolized by the Pleiades (No-233).
- d) The Hyades are the other famous star cluster in Taurus: they aren’t called the Seven Sisters or Subaru.

**Redaction:** Jeffery, 2001jan01

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039 qmult 00840 1 4 3 easy deducto-memory: star associations

23. “Let’s play *Jeopardy!* For \$100, the answer is: These are structures of a few to a few hundred stars and span of order 10 to 100 pc. They are generally gravitationally unbound though gravitationally interacting.”

What are \_\_\_\_\_, Alex?

- a) singles    b) binaries    c) associations    d) globular clusters    e) galaxies

**SUGGESTED ANSWER:** (c)

**Wrong answers:**

- a) As Lurch would say: “Aaaarh.”

**Redaction:** Jeffery, 2001jan01

039 qmult 00860 1 4 4 easy deducto-memory: globular clusters

24. “Let’s play *Jeopardy!* For \$100, the answer is: These are compact, dense, spherical, gravitationally-bound systems of stars. They can have from of order 20,000 to several million stars and their central concentrations have diameters of order to 5 to 25 pc.

What are \_\_\_\_\_, Alex?

- a) singles    b) binaries    c) associations    d) globular clusters    e) galaxies

**SUGGESTED ANSWER:** (d)

**Wrong answers:**

- a) Contact force: no way.

**Redaction:** Jeffery, 2001jan01

039 qmult 00870 1 1 1 easy memory: globular cluster ages

25. The ages of the stars in globular clusters put a lower limit on the age of the observable universe. The calculated ages of these stars are about:

- a) 12.5 Gyr.    b) 12.5 million years.    c) 100 million years.    d) 4.6 Gyr.    e) zero.

**SUGGESTED ANSWER:** (a)

**Wrong answers:**

- d) This is the age of the solar system.  
e) As Lurch would say: “Aaaarh.”

**Redaction:** Jeffery, 2001jan01

039 qmult 00900 1 1 1 easy memory: Population I and II

26. Although there is in fact a continuum of star age and metallicity, the distribution of core-hydrogen-burning stars for convenience breaks two main groups: 1) relatively young and metal rich (metallicity of order 2–4 % by mass) and 2) relatively old and metal poor (typical metallicity of order 0.1 % by mass, but with a huge range). These two groups are called, respectively:

- a) Population I and Population II.    b) Population A and Population B.    c) dwarfs and giants.  
d) white dwarfs and red giants.    e) giants and supergiants.

**SUGGESTED ANSWER:** (a) See FK-478 and HI-414

The two groups were first clarified by Walter Baade (1893–1960) working at Mt. Wilson Observatory during the World War II when Los Angeles was blacked-out, and so giving Mt. Wilson a good dark sky (No-504).

**Wrong answers:**

- e) As Lurch would say: “Aaaarh.”

**Redaction:** Jeffery, 2001jan01