Astronomy 102A

Homework 20: The Nature of Stars Not to be handed in. Homework solutions are posted already.

---

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

Extra keywords: CK-286,296

1. 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

---

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

Extra keywords: CK-286,295

2. 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

---

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

3. "Let's play *Jeopardy*! For $100, the answer is: Each stellar spectral types is divided into these subtypes."

   What are _____, Alex?

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

   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

a) always increase in strength with increasing temperature.
b) are strongest at surface temperature of order $10,000\,\mathrm{K}$.
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

5. The approximate colors of the hydrogen Balmer lines Hα, Hβ, Hγ, and Hδ 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

6. "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

---

039 qmult 00410 1 1 2 easy memory: main sequence stars on HR diagram
Extra keywords: CK-287,295

7. Most obviously luminous stars, at least in stellar environments like that surrounding the Sun, burn hydrogen in their core and lie in a Hertzsprung-Russell (HR) diagram on a band called the:

a) horizontal branch. b) main sequence. c) sub-giant branch. d) asymptotic giant branch. e) secondary sequence.

SUGGESTED ANSWER: (b)

Wrong answers:
a) Horizontal branch stars burn helium in their cores.
c) The sub-giant branch stars are burning hydrogen in a shell around a non-burning helium core (CK-327).

Redaction: Jeffery, 2001jan01

---

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

8. 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

---

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

9. 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: (a)

   Wrong answers:
   e) All things are wrong.
   e) As Lurch would say: "Aaaarh."

   Redaction: Jeffery, 2001jan01

---

039 qmult 00600 1 1 5 easy memory: luminosity classes

Extra keywords: CK-288,295

10. The luminosity classes of stars are:

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

    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: supergiant luminosity class

Extra keywords: CK-288,289,296

11. They are usually the most luminous stars (i.e., $L \gtrsim 3 \times 10^3\, L_\odot$) and put in luminosity classes Ia and Ib. They are called:

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

    SUGGESTED ANSWER: (d)

    Wrong answers:
    e) All things are wrong.
    e) As Lurch would say: "Aaaarh."

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

12. "Let's play *Jeopardy*! For $100, the answer is: These objects appear on Hertzsprung-Russell diagrams and they are not assigned a luminosity class though reasonably they could be assigned to class VI."

    What are _____, Alex?

    a) luminous supergiants 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 Ia.

    Redaction: Jeffery, 2001jan01

---

039 qmult 00700 1 4 4 easy deducto-memory: mass-luminosity relation
Extra keywords: CK-296-11

13. "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 00800 1 4 1 easy deducto-memory: binary system
Extra keywords: CK-295

14. 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

---

039 qmult 00810 1 4 4 easy deducto-memory: close binary system
Extra keywords: CK-295

15. 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.

16. "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 _____, Alex?

    a) the Toyotas b) Wives of Chauntecleer c) the Brides of Dracula d) the Hyades e) the 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 arn't called the Seven Sisters or Subaru.

Redaction: Jeffery, 2001jan01

---

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

17. "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 00870 1 1 1 easy memory: globular cluster ages

18. 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

19. Although there is in fact a continuum of star age and metallicity, the distribution of 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 %, 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

e) As Lurch would say: "Aaaarh."

Redaction: Jeffery, 2001jan01