

## Introductory Astronomy

**Homework 31: Cosmology** Not to be handed in. Homework solutions are posted already.

049 qmult 00100 1 1 5 easy memory: cosmology defined

**Extra keywords:** physci

1. The science of the universe as a whole is called:
  - a) proctology.
  - b) universology.
  - c) cosmetology.
  - d) inflation.
  - e) cosmology.

**SUGGESTED ANSWER:** (e)

**Wrong answers:**

- a) A very important science which is difficult to discuss in polite society.
- d) Inflation is an idea in modern cosmology; we stole the word from economics.
- c) Many people say this. Actually, both cosmetics and cosmos are derived from the same Greek word meaning something like ornamentation.

**Redaction:** Jeffery, 2001jan01

049 qmult 00200 1 1 3 easy memory: big bang loosely defined

**Extra keywords:** physci KB-668-27

2. The big bang is:
  - a) the explosion of a supernova.
  - b) the explosion of a star.
  - c) a theoretical origin of the observable universe.
  - d) the explosion of a quasar.
  - e) a theoretical end of the observable universe.

**SUGGESTED ANSWER:** (c)

**Wrong answers:**

- e) Exactly wrong. The big crunch is theoretical end of the universe.

**Redaction:** Jeffery, 2001jan01

049 qmult 00300 1 1 3 easy memory: Hubble law

**Extra keywords:** physci

3. Given  $v$  as expansion velocity and  $d$  as distance, Hubble's law is:
  - a)  $d = Hv$ .
  - b)  $d = H/v$ .
  - c)  $v = Hd$ .
  - d)  $v = H/d$ .
  - e)  $v = Hd^2$ .

**SUGGESTED ANSWER:** (c)

**Wrong answers:**

- e) As Lurch would say: "Aaaarh." But someone if I recall correctly thought they had found evidence for such a law.

**Redaction:** Jeffery, 2001jan01

049 qmult 00302 1 4 3 easy deducto-memory: discoverer of Hubble's law

**Extra keywords:** physci

4. "Let's play *Jeopardy!* For \$100, the answer is: He/she is the observational discoverer of Hubble's law." Who is \_\_\_\_\_, Alex?

- a) Henrietta Swan Leavitt (1868–1921)      b) Knut Lundmark (1889–1958)      c) Edwin Hubble (1889–1953)  
 d) Georges Lemaître (1894–1966)      e) Adriaan van Maanen (1884–1946)

**SUGGESTED ANSWER:** (c)

**Wrong answers:**

- a) She was the discoverer of the period-luminosity relation for Cepheid variable stars (No-488) while working at Harvard College Observatory. Distance determinations by Hubble using this relation established the extragalactic nature of the galaxies.
- b) Lundmark deduced some kind of law connecting distances and velocities of galaxies in 1925, but my source fails to say what it was (No-523).
- d) Lemaître had theoretically deduced Hubble's law prior to the observational discovery (No-524). He may not even have been the first to notice that such a law must hold in simple general relativity cosmology.
- e) His mistaken observations of movement of the spiral arms of the spiral nebulae worked against the acceptance of the extragalactic nature of these objects (No-495).

**Redaction:** Jeffery, 2001jan01

049 qmult 00310 1 4 1 easy deducto-memory: Hubble time

**Extra keywords:** physci KB-668-26

5. The current value of the Hubble time and the concordance model value for the age of the universe are both about:
- a) 14 Gyr.      b)  $10^{100}$  yr.      c) 10 years.      d) 4.6 Gyr.      e) 0.

**SUGGESTED ANSWER:** (a)

**Wrong answers:**

- d) This is the age of the solar system as determined by radioactive dating.
- e) As Lurch would say: "Aaaarh."

**Redaction:** Jeffery, 2001jan01

049 qmult 00320 1 1 4 easy memory: Hubble length observable universe

**Extra keywords:** physci KB-670-22

6. The Hubble distance with current value of 4200 Mpc defines the characteristic size scale of the:
- a) quantum of the inflaton.      b) Galaxy.      c) total universe.      d) observable universe.  
 e) solar system.

**SUGGESTED ANSWER:** (d)

**Wrong answers:**

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

**Redaction:** Jeffery, 2001jan01

049 qmult 00400 1 1 5 easy memory: accelerating universe

**Extra keywords:** physci KB-668-28 but note their answer is wrong.

7. According to observations of several kinds beginning in 1998, it seems that the universal expansion is currently:
- a) decelerating.      b) stopped.      c) negative: i.e., the universe is contracting.      d) in doubt.  
 e) accelerating.

**SUGGESTED ANSWER:** (e)

**Wrong answers:**

- a) Exactly wrong, but this is what was believed to be the case before 1998.

**Redaction:** Jeffery, 2001jan01

---

049 qmult 00420 1 4 2 easy deducto-memory: dark matter

**Extra keywords:** physci KB-669-34

8. After the dark energy (whatever that is) the most abundant form of energy in the universe is apparently some form of matter known only through its gravitational effects. We call this matter the:
- a) luminous matter.    b) dark matter.    c) squishy matter.    d) invisible matter.  
e) mirror matter.

**SUGGESTED ANSWER:** (b)

**Wrong answers:**

- e) There is something called mirror matter, but I forget what and it probably doesn't exist anyway.

**Redaction:** Jeffery, 2001jan01

---

049 qmult 00600 1 1 2 easy memory: H and He from big bang

**Extra keywords:** physci KB-669-29

9. In big bang nucleosynthesis, the major products were:
- a) hydrogen and iron in about a 1:1 mass ratio.    b) hydrogen and helium in about a 3:1 mass ratio.  
c) hydrogen and helium in about a 1:1 mass ratio.    d) hydrogen and iron in about a 3:1 mass ratio.  
e) helium and iron in equal amounts by mass.

**SUGGESTED ANSWER:** (b)

**Wrong answers:**

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

**Redaction:** Jeffery, 2001jan01

---

049 qmult 00610 1 4 1 easy deducto-memory: heavy elements

**Extra keywords:** physci KB-669-30

10. Most of the heavy elements (those for carbon and up certainly) in the universe were formed in:
- a) stars and supernovae.    b) black holes.    c) the big bang.    d) nuclear reactors.  
e) planets.

**SUGGESTED ANSWER:** (a)

**Wrong answers:**

- c) Exactly wrong.  
e) As Lurch would say: "Aaaarh."

**Redaction:** Jeffery, 2001jan01

---

049 qmult 00700 1 4 4 easy deducto memory: CMB question

**Extra keywords:** physci KB-669-33

11. The relic primordial electromagnetic radiation field from the early universe is usually called the:

- a) Cosmic Gamma-ray Background (CGB).      b) Cosmic X-ray Bare Ground (CXBG).  
 c) Cosmic X-ray Foreground (CXF).      d) Cosmic Microwave Background (CMB).      e) Cosmic  
 X-ray Background (CXB).

**SUGGESTED ANSWER:** (d)

**Wrong answers:**

- b) As Lurch would say: “Aaaarh.”

**Redaction:** Jeffery, 2001jan01

049 qmult 01000 1 4 5 easy deducto-memory: inflation defined

**Extra keywords:** CK-446

12. “Let’s play *Jeopardy!* For \$100, the answer is: It the concept that the early observable universe (and perhaps a good deal more) underwent a period of super-expansion.”

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

- a) inoculation      b) infestation      c) hybridization      d) hydration      e) inflation

**SUGGESTED ANSWER:** (e)

**Wrong answers:**

- d) Hydration is to chemically combine with water (Ba-591).

**Redaction:** Jeffery, 2001jan01

049 qmult 01100 1 4 4 easy deducto-memory: problems solved by inflation

**Extra keywords:** CK-446

13. “Let’s play *Jeopardy!* For \$100, the answer is: This concept offers possible solutions to three problems of cosmology: the magnetic monopole, horizon, and flatness problems.”

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

- a) the cosmological constant  $\Lambda$       b) the Einstein universe      c) big bang cosmology  
 d) inflation      e) perdition

**SUGGESTED ANSWER:** (d)

**Wrong answers:**

- e) As Lurch would say: “Aaaarh.”

**Redaction:** Jeffery, 2001jan01