

Q6 A universe has a density that is exactly equal to the critical density. Which *one* of the curves in Figure 1 most accurately describes that universe?

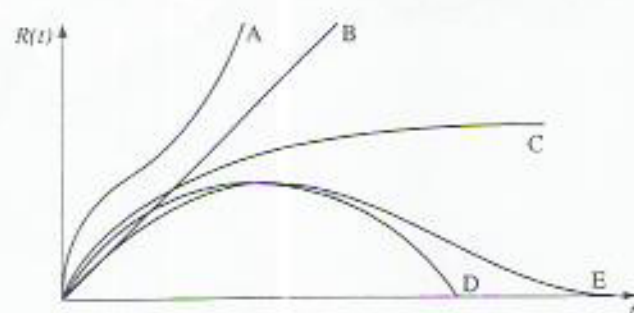


Figure 1 KEY for Q6.

Pencil across *one* cell in row 6.

Q7 What was the size, in Mpc, of the observable Universe just before the decoupling epoch (also known as the recombination epoch)? Could one see that far then? Select from the items A–D in the key the *one* nearest to your answer, and select *one* of E or F.

KEY for Q7

- A 1 Mpc
- B 0.1 Mpc
- C 0.01 Mpc
- D 0.001 Mpc
- E Yes
- F No

Pencil across *two* cells in row 7.

Q8 Which of the following factors did not have a major influence on the chemical composition of the early Universe? Select *two* items from the key.

KEY for Q8

- A The decoupling of neutrinos and antineutrinos from matter.
- B The density of material prior to inflation.
- C The relative numbers of neutrons and protons at the time of nucleosynthesis.

D The formation of atoms.

E The energy of collision of nuclear particles around the time of nucleosynthesis.

F The decay time of the neutron.

Pencil across *two* cells in row 8.

Q9 Which *one* of the statements in the key about the expansion of the Universe is correct?

KEY for Q9

- A The expansion of the Universe started from a point in space.
- B The period of inflation produced speeds of expansion through space greater than the speed of light.
- C All of space itself and everything within it is expanding.
- D Galaxies are flying apart through space.
- E The expansion of the Universe is not causing the space between the stars in a galaxy to expand.

Pencil across *one* cell in row 9.

Q10 Which *two* of the statements in the key about the size of the Universe are correct for any open universe? Select *two* items from the key.

KEY for Q10

- A The scale factor of an open universe continues to get larger as time increases.
- B The size of an open universe is determined by its age.
- C An open universe will keep expanding for ever, although the rate of expansion will slow, and its scale factor will reach infinite size at infinite time.
- D In an open universe, both the observable universe and the overall universe start infinitesimally small at time $t = 0$.
- E An open universe is infinite in size. An infinite universe is always infinite, even at $t = 0$.
- F An open universe has no boundaries and no centre and so it is meaningless to speak of its size.

Pencil across *two* cells in row 10.