

Q11 A star sheds material and becomes surrounded by a dusty shell that is so dense that the shell is opaque to the radiation from the star. Assume that the shell reaches an equilibrium temperature, and that the process of shedding the shell does not cause any significant change in either the star's luminosity or its photospheric temperature (though some subsequent changes occur because of the new environment that the star finds itself in). Which *two* statements in the key are *true*?

KEY for Q11

- A The *luminosity* of the shell is the *same* as the original luminosity of the star.
- B The *luminosity* of the shell is *lower* than the original luminosity of the star.
- C The *luminosity* of the shell depends on the nature of the material between the shell and the star.
- D The *temperature* of the shell is the *same* as the original photospheric temperature of the star.
- E The *temperature* of the shell is *lower* than the original photospheric temperature of the star.
- F The *temperature* of the shell depends on the nature of the material between the shell and the star.

Pencil across *two* cells in row 11.

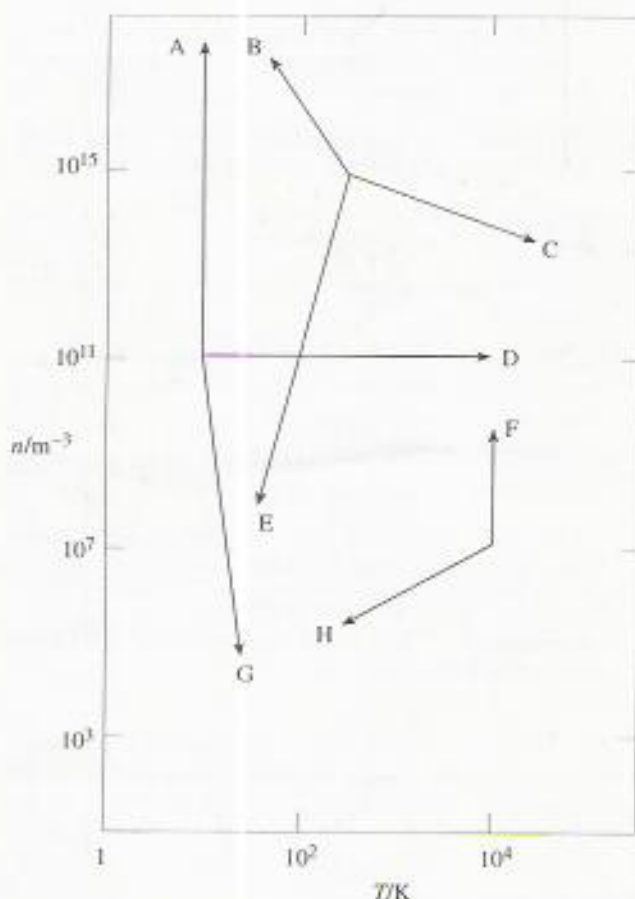


Figure 2 Tracks across a number density–temperature diagram of the ISM.

Q12 and Q13 Figure 2 shows tracks across a diagram of number density versus temperature of regions in the interstellar medium (ISM). These tracks are labelled A–G and constitute the key for Q12 and Q13.

Q12 Which track most closely corresponds to the initial stage in the formation of a protostar from a dense cloud fragment? Pencil across *one* cell in row 12.

Q13 Which track most closely corresponds to the formation of interstellar cirrus from circumstellar dust shells? Pencil across *one* cell in row 13.

Q14 Which *one* event in the key, acting on a diffuse cloud, does *not* normally lead to an increase in the density of the region?

KEY for Q14

- A An increase in the ultraviolet radiation from young stars.
- B The impact of shock fronts from OB associations.
- C The impact of shock fronts from supernovae.
- D Violent collisions between denser regions in a GMC complex.
- E A decline of the cosmic ray flux.
- F The onset of a gravitational instability.

Pencil across *one* cell in row 14.

$$L = 4\pi R^2 \sigma T^4$$