**PART B**

*This part relates to Book 1 Chapter 5, and carries 40% of the marks for this assignment.*

**Q9** By what factor does the mass density (kg m$^{-3}$) of an average dense cloud exceed the mass density of an average region of hot intercloud medium? Select from the key the value closest to yours, and pencil across *one* cell in row 9.

KEY for Q9

A $10^2$

B $10^4$

C $10^6$

D $10^8$

E $10^{10}$

F $10^{12}$

**Q10** A space pirate trawls a typical dense cloud for water, and gathers 1 000 kg of the cloud, with the gas and dust being collected in the same proportion as they are present in the cloud. Well over half the oxygen in the cloud is combined as $H_2O$, some of the $H_2O$ being in gaseous form and the rest being an icy mantle component of the dust grains. Estimate how many kilograms of water in total the pirate can expect to obtain. Select from A–E in the key the answer closest to yours, and pencil across *one* of the A–E cells in row 10. If, from the 1 000 kg, the pirate discards the gas, and retains only the dust (with the icy mantles intact) how much $H_2O$ would have then been collected? Select *one* option from F–H in the key, and pencil across *one* of the F–H cells in row 10. (NB The table in the Appendix of Book 1 Chapter 2 will be of help.)

KEY for Q10

A 0.01 kg

B 0.1 kg

C 1 kg

D 10 kg

E 100 kg

F A lot less

G About 99% of the original amount

H A lot more

**Q11** Which *two* of the statements in the key, regarding ionization in some or all of the various types of region in the ISM, are TRUE? Select *two* options from the key, and pencil across *two* cells in row 11.

KEY for Q11

A UV flux is the main cause of ionization in all regions.

B High temperature is the main cause of ionization in all regions.

C UV flux is the main cause of ionization in HII regions and diffuse clouds.

D Cosmic rays are the main cause of ionization in dense clouds.

E UV flux is the main cause of ionization in a young supernova remnant.

F High temperature is the main cause of ionization in planetary nebulae and HII regions.

G Cosmic rays are the main cause of ionization in diffuse clouds and dense clouds.

**Q12** If a region of warm intercloud medium is compressed by a shock front, what mechanism is chiefly responsible for causing it to cool? Select *one* option from the key, and pencil across *one* cell in row 12.

KEY for Q12

A More frequent collisional excitation of *atoms*, followed by the emission of radiation on de-excitation, the radiation having a high probability of escaping from the region.

B More frequent collisional excitation of *molecules*, followed by the emission of radiation on de-excitation, the radiation having a high probability of escaping from the region.

C More frequent collisions between *electrons and ions*, with enhanced synchrotron radiation, the radiation having a high probability of escaping from the region.

D The creation of neutrinos, which escape from the region.

E The greater density shielding the interior from the heating by cosmic rays, so the interior cools.

$6.9 \times 10^{-4} \times 1/2 = 3.45E-4 \times$