Planet formation

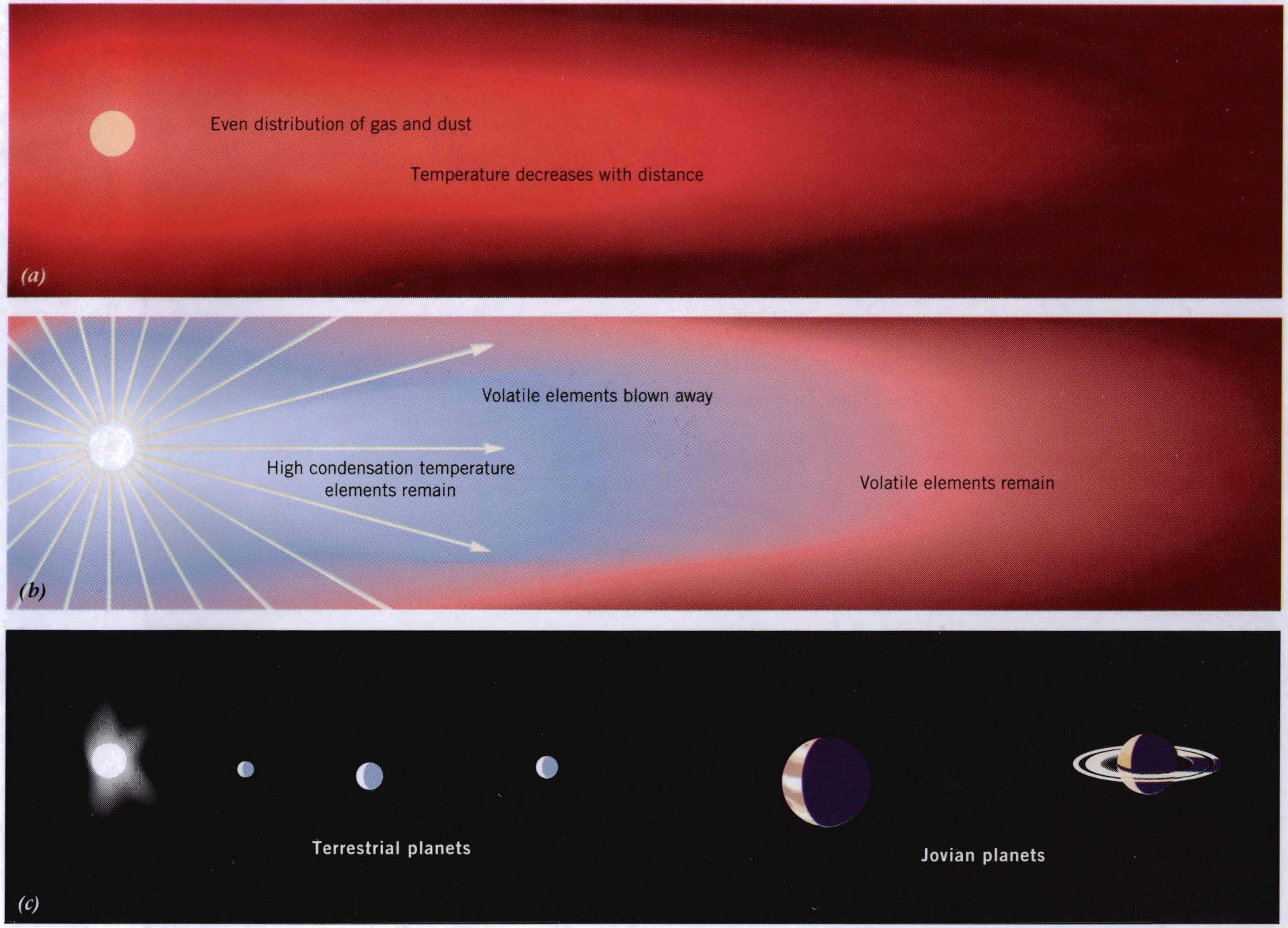
Planets & stars form differently: stars simply by the collapse of a large enough mass of gas & dust; planets start with the formation of a solid core.

Planetismal hypothesis

- start with the solar nebula, a disk of gas & dust surrounding the Sun, with a temperature gradient.

- microscopic grains condense out of nebula as temperature allows:
  - silicates and iron compounds
  - H_2O & other ices

size of grains ~ μm



- grains settle to midplane of nebula; collide, agglomerate, grow

- In of order 10^4 years, end up with km-size objects — "planetismals"

- Velocity distribution & orbits of planetismals determine how they grow; collisions can either fragment or agglomerate

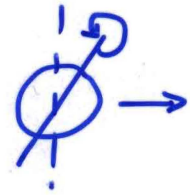
  Evidence for collisions : at current meteor impact rate, over life of Solar System, Moon & Mercury would not be so very cratered

Q Which orbits would favor planetismal growth? Which orbits would favor destruction?

- in late stages of formation, have
  - giant impacts
  - catastrophic destructions
  - large radial migrations

- simulations often produce planets at regular intervals of radius

Question

6 of 8 major planets have obliquity  less than 30°, which is unlikely to occur randomly; but it is rarely zero.

How would you explain this in terms of the above theory?