① Active medium, Pump & pair of mirrors are the essential requirements for laser action.

Three steps (processes) are involved for producing laser action viz absorption, Spont. emiss. & Stim. emiss.

② Ruby crystal i.e. Al_2O_3 doped with Cr^{3+} ions at a concentration of about 0.05% by weight is the active material in Ruby laser.

Energy level diagram → See lecture notes

③ Ne atoms are much heavier & could not be pumped up efficiently without the He atoms. The role of He atoms is thus to excite Ne atoms and cause population inversion. However, lasing action is occured in Ne energy levels.

working of He-Ne laser → See lecture notes

④ 694.3 nm i.e. 6943 Å

⑤ Energy level diagram of He-Ne laser → See lecture notes

⑥ No

⑦ Due to the absence of various effects such as crystalline imperfection, thermal distortion and scattering (present in solid state lasers), gas lasers emit more unidirectional and monochromatic light.

⑧ E_2 level is very close to the ground level E_1 in CO_2 energy levels and tends to be populated through thermal excitations. It becomes therefore necessary to keep the temp. of CO_2 low. 'He' has a high thermal conductivity and conducts heat away to the walls and keep CO_2 cold. This, while N_2 helps to increase the population of the upper laser level, 'He' depopulates the lower laser level.

⑨ Strong blue (4881 Å) and green (5145 Å) lights are provided by Argon ion laser while strong red (6764 Å) light is emitted by Krypton ion laser. Thus, lasers based on the mixture of Ar and Kr gases are used for multicolour displays.