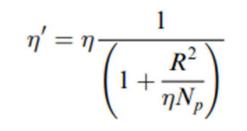
1 Explain the difference between QE and DQE. Produce additional entries in Table 9.1 for CCDs with 5 and 15 electrons of readout noise.

QE: determined in the laboratory with a stable welldesigned calibration system Influence of other optics are removed DQE: efficiency of an idealized imaging system

Read noise R(e ⁻)	Incident number of photons (N _p)					
	1	10	100	1,000	10,000	100,000
1	6.9	22.5	29.0	29.9	30.0	30.0
	(22.5)	(51.4)	(59.0)	(59.9)	(60.0)	(60.0)
10	0.1	0.9	6.9	22.5	29.0	29.9
	(0.4)	(3.4)	(22.5)	(51.4)	(59.0)	(59.9)
100	0.001	0.009	0.1	0.9	6.9	22.5
	(0.004)	(0.215)	(0.4)	(3.4)	(22.5)	(51.4)
5	0.36	3.21	16.36	27.69	29.75	29.98
	(1.41)	(11.61)	(42.35)	(57.6)	(59.75)	(59.98
15	0.04	0.39	3.53	17.14	27.91	29.78
	(0.16)	(1.56)	(12.63)	(43.64)	(57.83)	(59.78

Table 9.1. Detective quantum efficiency (DQE) as a function of readout noise R (electrons rms) and number of incident photons N_p for two values of the true QE (30% and 60%).



7 What is meant by the "zeropoint" of a magnitude scale?

$$m = m_0 - 2.5 \log F + 2.5 \log F_0$$
(9.16)
Zeropoint of magnitude

"magnitude" is relative variable=need reference point

Vega system: Vega is assigned 0 magnitudes in every bandpass