9. Using notation similar to Rowan-Robinson:

$$K(z) = -2.5 \log \left[\frac{(1+z) \int_{band} \phi(\nu) P(\nu(1+z)) d\nu}{\int_{band} \phi(\nu) P(\nu) d\nu} \right],$$

and if $P(\nu) = A\nu^{-\alpha}$, then substituting this in the equation for $K(z)$, and taking $(1+z)^{-\alpha}$ outside the integral in the numerator, gives the result immediately.

The extra reduction in flux represented by the K-correction comes about because the flux at the low frequency end of the spectrum is redshifted out of the instrumental pass-band and is not counterbalanced by flux shifted into the band at the blue end, since there are typically fewer high energy photons in spectra. Clearly this effect will be stronger for a spectrum which falls steeply with frequency. In the limit of a flat spectrum, the K-correction would vanish.