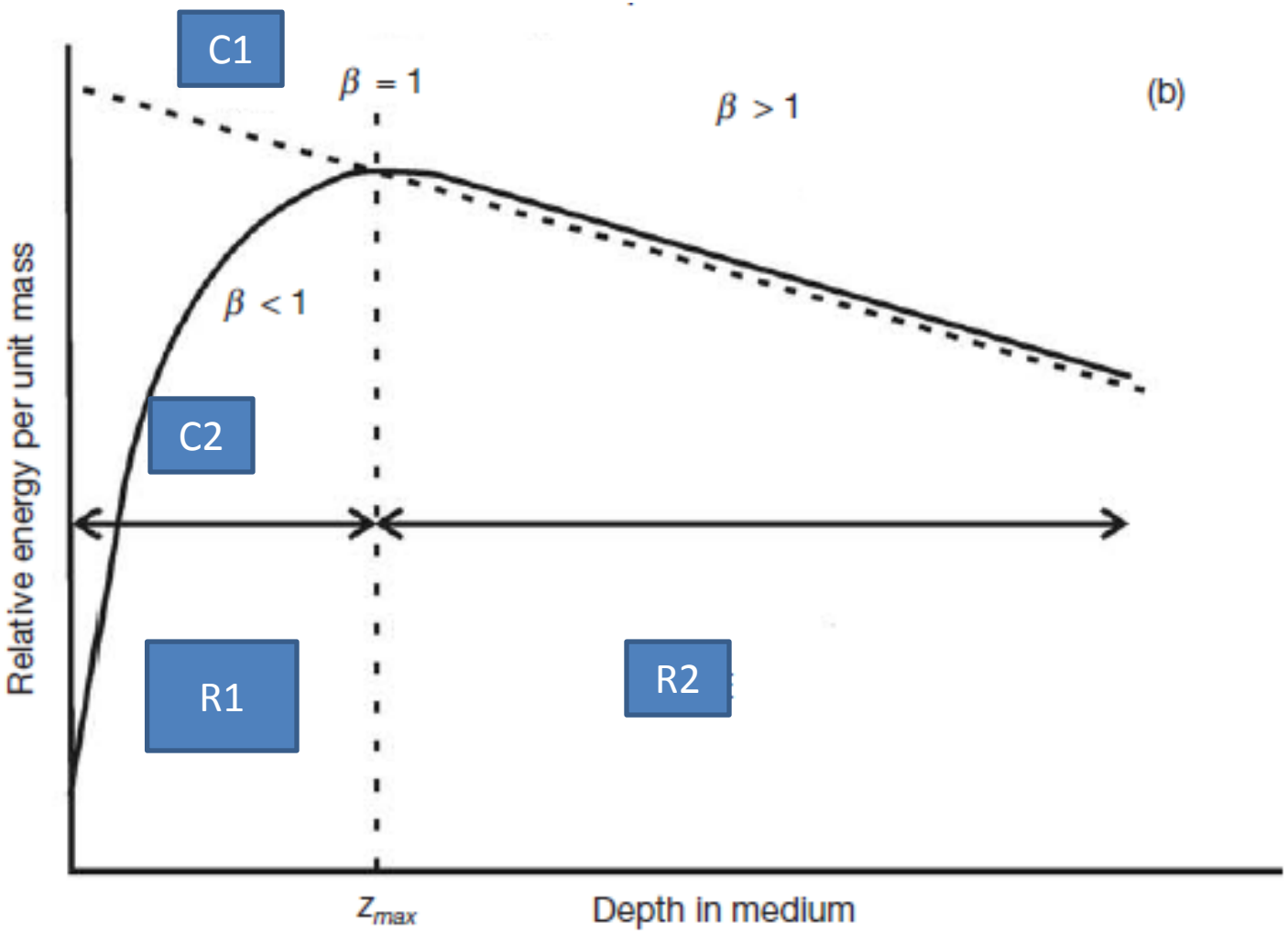
KERMA v. Dose

- Define KERMA and relationship to dose
- Identify curves (C1,C2) and regions (R1,R2)
- How would plot change for increasing energies?



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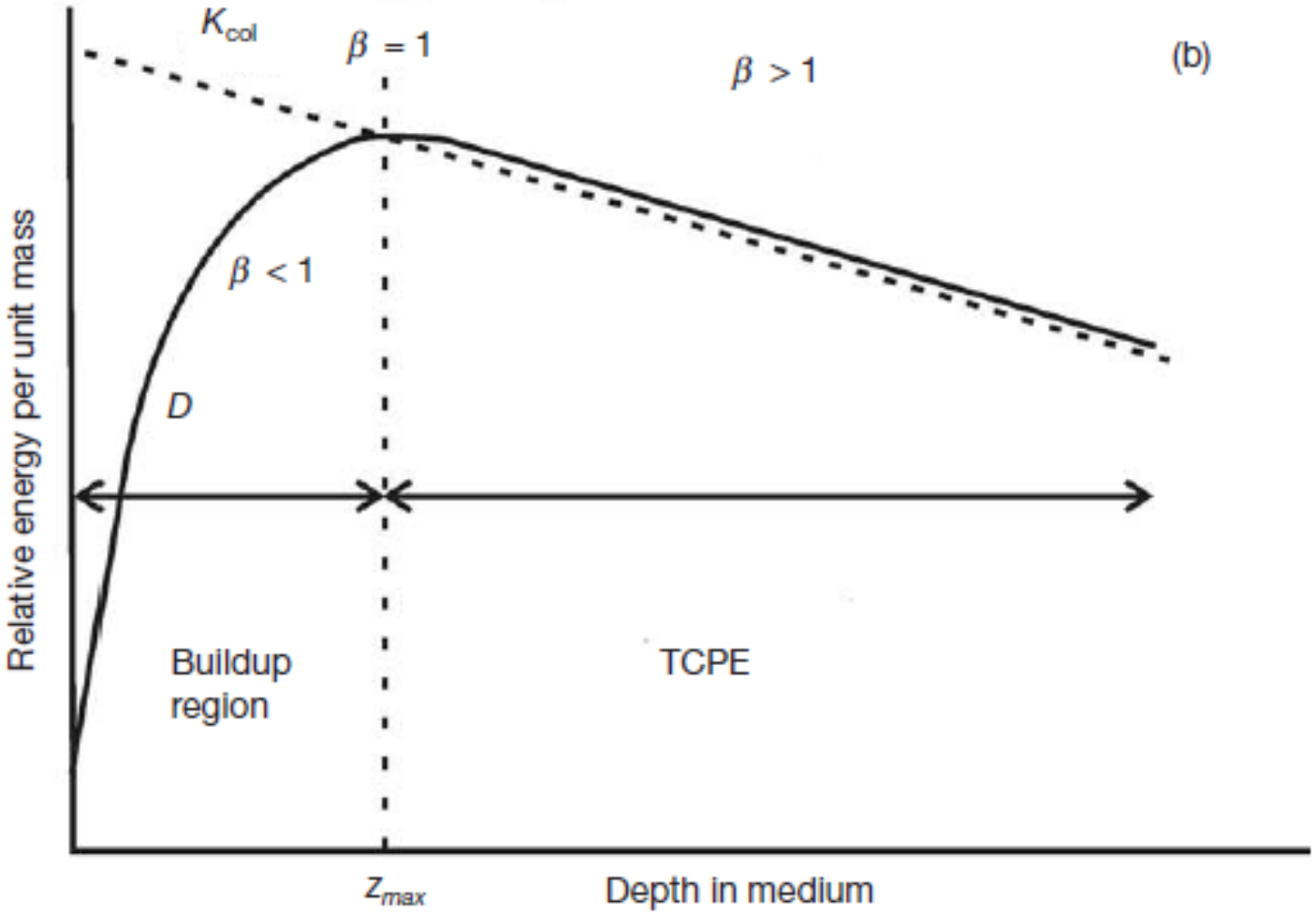
- Define KERMA and relationship to dose
- Identify curves and regions
- How would plot change for increasing energies?



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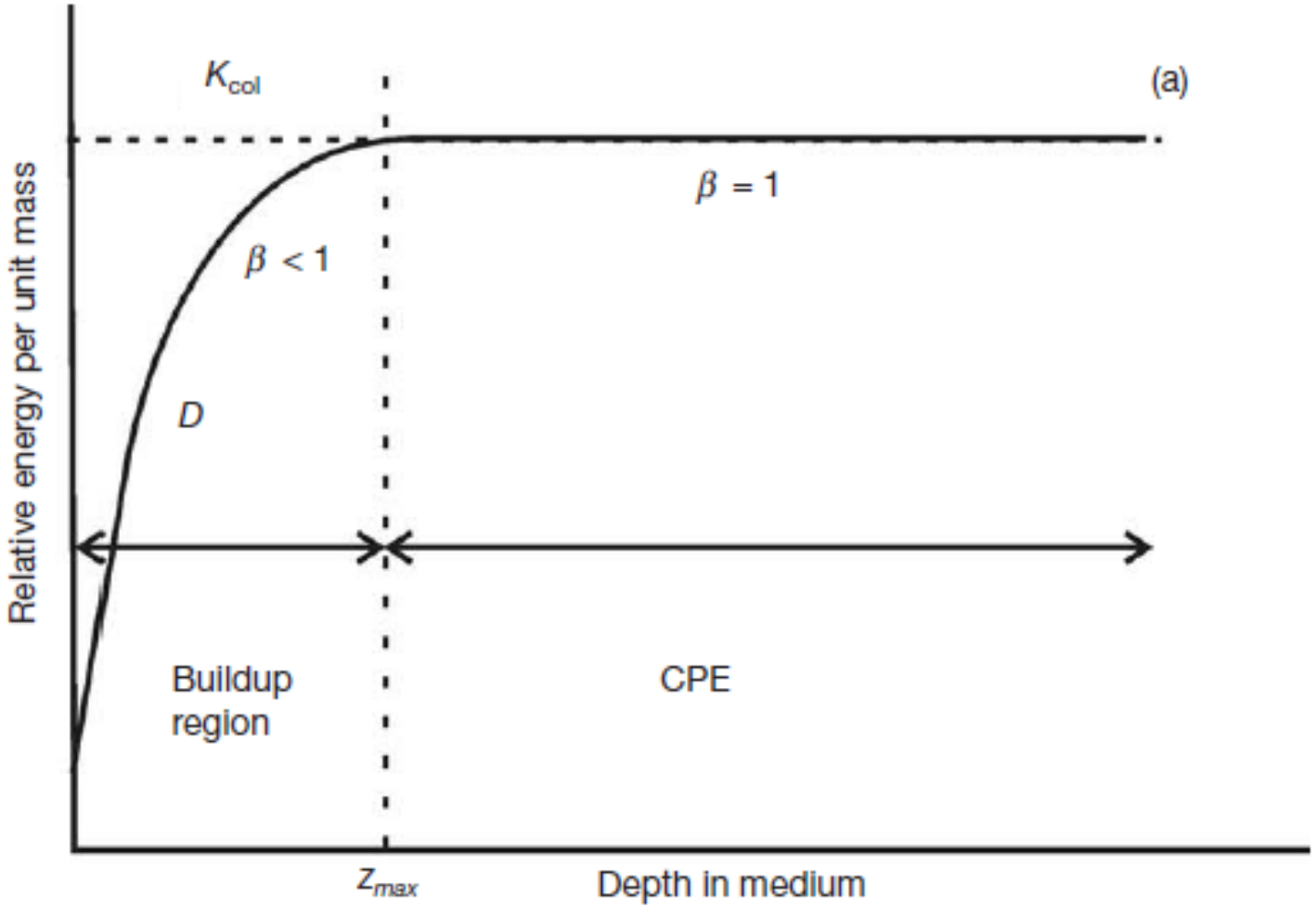
- Under what assumptions would alter the KERMA-Dose relationship to the plot below?



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- Describe Air Kerma based calibration protocol

$$K_{air} = X\left(\frac{W_{air}}{e}\right)\frac{1}{1-\bar{g}}$$

$$D = K_{col} = K(1-\bar{g})$$

$$D_{air} = \frac{Q}{m_{air}}\left(\frac{W_{air}}{e}\right)$$

$$D_{air} = (K_{air})_{air}(1-g)k_m k_{att} k_{cel} \tag{9.16}$$

where

g is the fraction of the total transferred energy expended in radiative interactions on the slowing down of secondary electrons in air;
k_m is a correction factor for the non-air equivalence of the chamber wall and buildup cap needed for an air kerma in air measurement;
k_{att} is a correction factor for photon attenuation and scatter in the chamber wall;
k_{cel} is a correction factor for the non-air equivalence of the central electrode of the cylindrical ionization chamber.

$$N_{D,air} = \frac{D_{air}}{M_Q} = \frac{1}{m_{air}}\frac{W_{air}}{e} = \frac{1}{\rho_{air} V_{eff}}\frac{W_{air}}{e} \tag{9.20}$$

where

(W_{air}/e) is the average energy required to produce an ion pair in air;
m_{air} is the mass of air in the chamber cavity;
ρ_{air} is the air density at standard conditions of temperature and pressure;
V_{eff} is the effective air volume in the chamber collecting ions.

$$D_{w,Q} = D_{air,Q}(s_{w,air})_Q p_Q = M_Q N_{D,air}(s_{w,air})_Q p_Q \tag{9.21}$$

where

$(s_{w,air})_Q$ is the ratio of restricted collision stopping powers of water to air;
p_Q is a perturbation correction factor accounting for perturbations caused by the chamber inserted into the medium, as discussed in detail in Section 9.7.

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- Describe differences between Air Kerma based and Absorbed Dose based calibration protocols

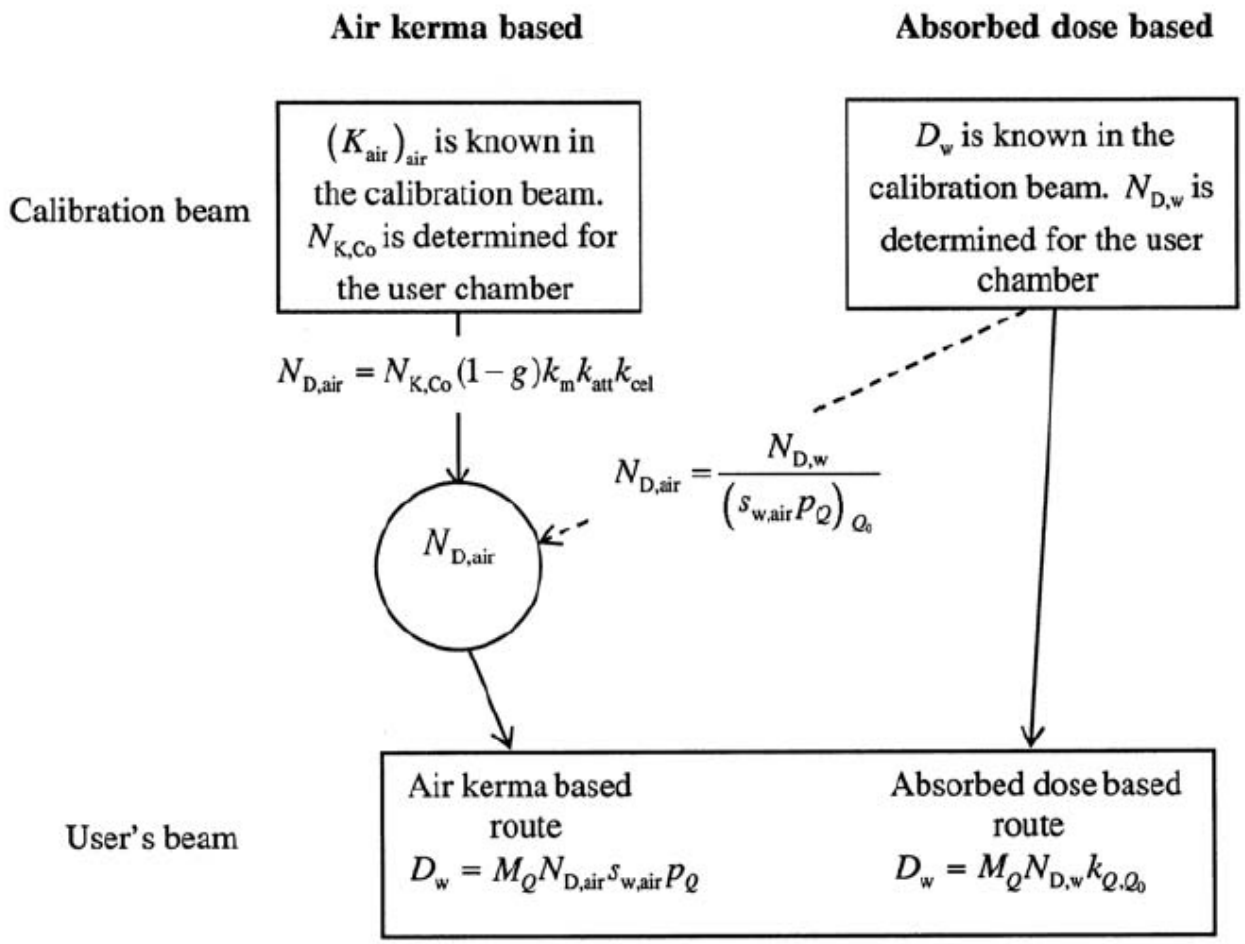

FIG. 9.4. Steps involved in ionization chamber based reference dosimetry: (a) air kerma in air based, (b) absorbed dose to water based.

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