Reference Book:

Q1. A farsighted person cannot see objects placed closer to 50cm. Find the power of the lens needed to see the objects at 20cm.

Solution:

For sighted person, lens formula is

$\frac{1}{v}-\frac{1}{u}=\frac{1}{f} \Rightarrow \frac{1}{-50}-\frac{1}{-20}=\frac{1}{f}$

f = ⅓ m

Power, P = 1/f =3D

Q2. A nearsighted person cannot clearly see beyond 200cm.
Find the power of the lens needed to see objects at large distance?

Solution:
For near sighted person, formula is

$$\Rightarrow \frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\Rightarrow \frac{1}{-2}-\frac{1}{\text{infinity}}=\frac{1}{f}$$

f = -2

Power P = 1/f = -0.5D

Q3. A professor reads a greeting card received on his 50th birthday with + 2.5 D glasses keeping the card 25cm away. Ten years later, he reads his farewell letter with the same glasses but he has 'to keep the letter 50 cm away. What power of lens should he now use?

Solution:

After 10 years,

$$f=\frac{1}{P}=-\frac{1}{2.5}$$

f= -40cm u = -50

and by lens formula

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{u}+\frac{1}{f}=\frac{1}{v}$$

$$\frac{1}{40}+\frac{1}{-50}=\frac{1}{v}$$

v = 200cm

Now to read letter at u = -25cm and v = 200 focal length is:

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{200}-\frac{1}{-25}=\frac{1}{f}$$

f = 2/9m

Power P = 1/f = 9/2 = 4.5 D

Q4. A normal eye has retina 2 cm behind the eye-lens. What is the power of the eye-lens when the eye is

(a) fully relaxed (b) most strained?

Solution:

(a) When lens of eyes is relaxed,

u = ∞

v = 0.02m

and

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{0.02}-\frac{1}{\infty}=\frac{1}{f}$$

f = 0.02m= 50 D

(b) When lens is in strained position,

u = -0.25

v = 0.02m

and

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{0.02}-\frac{1}{-0.25}=\frac{1}{f}$$

f = 54D

Power P = 1/f = 54D

Q5. A person has near point at 100cm. What power of lens is needed to read at 20cm if he/she uses (a) contact lens, (b) spectacles having glasses 2'0 cm separated from the eyes?

Solution:

(a) When contact lens is used,

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{-1}-\frac{1}{-0.2}=\frac{1}{f}$$

f = 1/4m

P = 4D

(b) When we use spectacles,

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{-1}-\frac{1}{0.18}=\frac{1}{f}$$

$$f=\frac{1}{4.5}m$$

$$P=\frac{1}{f}=4.5D$$