On behalf of Vision Expo, we sincerely thank you for being with us this year.

Vision Expo Has Gone Green!

We have eliminated all paper session evaluation forms. Please be sure to complete your electronic session evaluations online when you login to request your CE Letter for each course you attended! Your feedback is important to us as our Education Planning Committee considers content and speakers for future meetings to provide you with the best education possible.

vision expo

1

ABO Advance Review

Thomas Neff MA, LDO, ABO-AC, NCLE-AC
Thomasneffldo@gmail.com

Presented By:

UOA United Opticians ASSOCIATION

Visit the Opticon Hub for more information on joining and helping the UOA with there mission to improve Opticianry!

www.Opticians.org

2

Conflict of interest

- The speaker, Thomas Neff MA LDO, ABO-AC, NCLE-AC, has no conflicts of interest to disclose.
- Part of the Speaker Bureau with Mitsui Chemicals

3

Conflict of interest

- The speaker, Thomas Neff MA LDO, ABO-AC, NCLE-AC, has no conflicts of interest to disclose.

4

ABO Advance Test Specifications New for 2024

- **1. Optics**
  - **30%**
- **2. Ocular Anatomy, Physiology, Pathology, and Refraction**
  - **33%**
- **3. Ophthalmic Products**
  - **10%**
- **4. Instrumentation**
  - **9%**
- **5. Dispensary Protocols and Procedures**
  - **10%**
- **6. Laws, Regulations, and Standards**
  - **8%**

5

ABO Masters Program

- The ABO Master in Ophthalmic Optics designation demonstrates to the public and colleagues that an individual has attained a superior level in ophthalmic dispensing.
- Any Optician who is currently Advanced Certified by the American Board of Opticianry for at least one complete three-year renewal cycle and satisfies one of two additional qualifications is eligible to apply for this designation.
- Today 10:30am: Panel discussion: Masters Designation hosted by Cira Collins in the OptiCon Hub

6

ABO Masters Program

Have written two published ABO-approved Advanced Level III articles

OR

An ABO-approved speaker with two ABO-approved Advanced Level III Courses, or

OR

Have one published ABO-approved Advanced Level III article AND one ABO- approved Advanced Level III Course for which you are the ABO-approved Speaker.

7

ABO Advance Review Domain 1 Part 2

Thomas Neff MA, LDO, ABO-AC, NCLE-AC

Presented By:

United Opticians ASSOCIATION

www.Opticians.org

8

Domain 1 Tasks
Ophthalmic Optics Part 2

I. Optics - 30%
   i. Various lens materials
   ii. Effect of changes in base curve and thickness
   iii. Calculating prismatic effects
   iv. Effect of lens materials and design on thickness, weight, and dispersion (e.g., aspheric, digital surfacing)
   v. Lens options for various occupations and other lifestyle activities
   vi. Usable accommodation and the range of vision with various lens powers
   vii. Neutralization of lenses
   viii. Ophthalmic Formulas

9

- **Focal Length**

$$D = \frac{1}{f\ meters}$$

- **Horizontal Decentration**

$$\frac{FPD}{2} - Mono\ PPD = HD$$

- **Vertical Decentration**

$$OC - \frac{B}{2} = VD$$

- **Minimum Blank Size**

$$MBS = ED + (2 \text{ x Mono Dec})$$

- **Nominal Lens Power**

$$F_T = F_1 + F_2$$

- **Index Formula**

$$N = \frac{Speed\ of\ light\ in\ air\ (186{,}000mps)}{speed\ of\ light\ in\ medium}$$

- **Vertex Compensation**

$$Dc = \frac{dD^2}{1000}$$

- **Prentice Rule**

$$\Delta = \frac{dD}{10} \qquad d = \frac{\Delta x 10}{D} \qquad D = \frac{\Delta x 10}{d}$$

10

- **Sagittal Formula For Thickness**

$$\text{Sag} = \frac{n-1}{D} - \sqrt{\left(\frac{n-1}{D}\right)^2 - \left(\frac{d}{2}\right)^2}$$

- **Sagittal Formula for Thickness Approximation**

$$\text{Sag} = \frac{(d/2)^2 x D}{2000\,(n-1)}$$

- **Resolving Prism**

$$V = (P)(\sin a)$$

$$H = (P)(\cos a)$$

- **Resultant Prism**

$$P = \sqrt{H^2 + V^2}$$

$$a = tan^{-1}\left(\frac{V}{H}\right)$$

- **Martins Lens Tilt**

2 Degrees for every 1 mm is lowered

$$S' = S\left[1 + \frac{(sin\ \alpha)^2}{2n}\right] \quad C' = S'(\tan \alpha)^2$$

- **Oblique Powers at 90 & 180**

$$Power\ @\ 90 = (sin(AXIS)^2 * CYL + SPH)$$

$$Power\ @\ 180 = (sin(AXIS)^2 * CYL + SPH)$$

- **Specular Magnification**

$$SM = \left[\frac{1}{1 - \frac{t}{n} D_1}\right]\left(\frac{1}{1 - hD}\right)$$

11

History of Spherical Lens Design

- Biconvex
- Biconcave
- Plano Convex
- Plano Concave
- **Meniscus**

12

Aberrations

Chromatic VS monochromatic

Chromatic

Chromatic Abberation

Dispersion of white light into individual colors

Through prism

13

Aberrations

More dispersion for some materials than others

Inverse of the amount of Dispersion = abbe

Therefore, for Abbe, HIGH number is less dispersion

Low number is MORE dispersion

14

Abbe Value

White light is composed of the visible spectrum of wavelengths each corresponding to a different color. When light enters a prism it is bent toward the base of the prism

Shorter wavelengths (e.g., violet) are bent at a greater angle than longer wavelengths (e.g., red)

Since a lens can be likened to two prisms (apex to apex for a minus lens and base to base for a plus lens), light passing through a lens has a tendency to separate into its respective colors as its varying wavelengths are focused at differing points.

15

Index of Refraction and Abbe Value

MATERIAL	INDEX	ABBE VALUE
Crown Glass	1.523	59
High Index Glass	1.60	42
High Index Glass	1.70	39
Plastic CR-39	1.49	58
Mid Index Plastic	1.54	47
Mid Index Plastic	1.56	36
High Index Plastic	1.60	36
High Index Plastic	1.66	32
Trivex	1.53	43
Polycarbonate	1.58	30

16

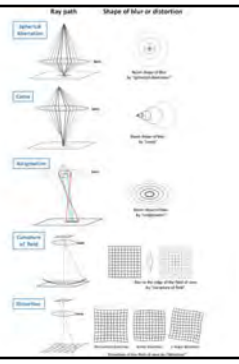
Aberrations

Chromatic aberration is a function of MATERIAL

17

Achromatic Abberations

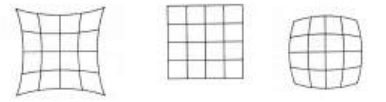
- 5 seidel abberations
  - Spherical Abberation
  - Coma
  - Marginal/Oblique Astigmatism
  - Curvature of Field
  - Distortion



18

Achromatic Abberations

- 5 seidel abberations
  - Spherical Abberation
    - Not generally a big deal due to pupil size
  - Distortion



Pincushion
Plus lenses

Barrel
minus lenses

19

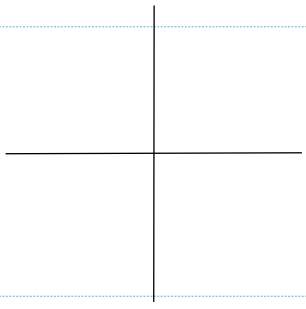
Nominal Power Formula (Thin Lens)

$$F_T = F_1 + F_2$$

- F_T = The effective, vertex or lensometer power of the lens in diopters
- F_1 = The power of the front curve (BC) in diopters
- F_2 = The power of the back surface power in diopters

- Example:
  - Front surface (BC) = +6.00D
  - Back Surface = -4.00D
  - Nominal Power = +6.00 + (-4.00) = +2.00D

20

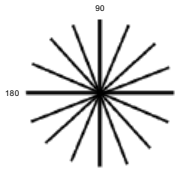


21

Oblique Cylinder Power

- TO DETERMINE THE PORTION OF CYLINDER POWER AWAY FROM THE AXIS
- 90 DEGREES = FULL CYLINDER POWER
- 60 DEGREES = 75%
- 45 DEGREES = 50%
- 30 DEGREES = 25%
- 0 DEGREES (at axis) = 0%
- Works in either direction

-2.50 -2.00 @ 030



1. Use axis to know percentage of cylinder power to use
2. Use percentage and multiply into cylinder power.
3. Take percentage of cylinder power and add to sphere power.

22

Oblique Cylinder Power

What is the power at 180 and 90 for following Rxs:

-3.00 -1.00 x 055

Power @ 90

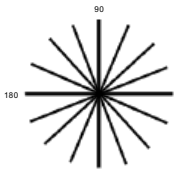
$Power\ @\ 90 = (sin(35)^2 x 1.00 + 3.00)$

Power @ 90 = 3.33 (3.37)

Power @ 180

$Power\ @\ 180 = (sin(55)^2 x 1.00 + 3.00)$

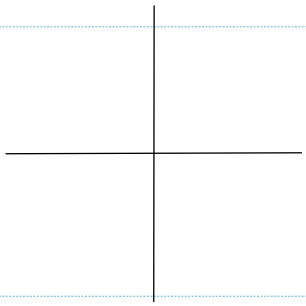
Power @ 180 = 3.67 (3.62)



$Power\ @\ 90 = (sin(AXIS)^2 * CYL + SPH)$

$Power\ @\ 180 = (sin(AXIS)^2 * CYL + SPH)$

23



24

Prism

- Measurement
- Patient Problems
  - Base Down
  - Base Up
  - Base In or Out
- Decentration to obtain prism
- Slab Off
- Image Jump

25

Prism

Excessive Base Down:
- Bottom of bowl
- Floor looks concave
- Looking / Walking UP hill
- Objects TALLER/looking up at objects

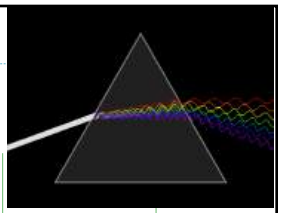
Excessive Base Up:
- Top of ball/mound
- Floor is convex
- Looking / Walking DOWN hill
- Objects SHORTER/ looking down at objects

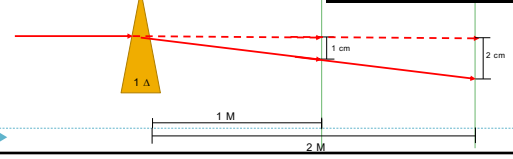
Excessive Base In or Base Out:
- May cause the wearer to see horizontal objects as high at one end and low on the other
- The too high side will always be towards the apex.

26

Prism Measurements

- One prism diopter = Deviate light by 1cm over1m
- Think triangles

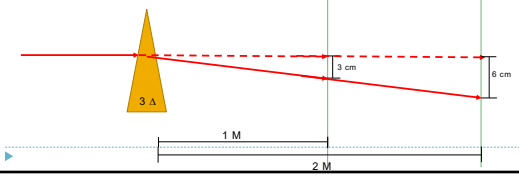




27

Prism Measurements

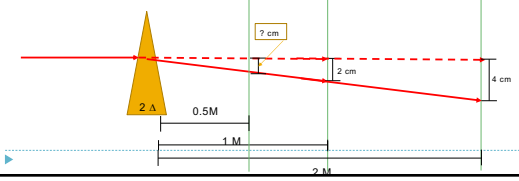
- One prism diopter = Deviate light by 1 cm over 1 M
- Think triangles
- So if NOT 1 PD



28

Prism Measurements

- **One prism diopter = Deviate light by 1 cm over 1 M**
- **Think triangles**
- **So if NOT 1 PD**



29

Prism Measurements

How much does a 3 Δ deviate light at:

1 M = 3cm

2 M = 6cm

3 M = 9cm

0.5M = 1.5 cm

30

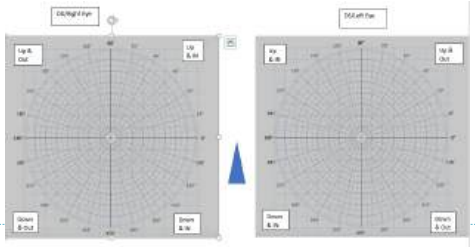
So simply put your Prism diopters in a Fraction form (over 1)

3 Δ = 3/1

- That is essentially your fraction/ or ratio. (3cm/1M)

If a question asks how much is deviated:

31



32

Prentice's Rule

- The prismatic effect of a lens on rays of light that pass through it at points other than it's optical center is equal to the product of the the dioptric power of the lens and the distance in centimeters from the optical center to the point of passage.

$$\Delta = \frac{dD}{10} \qquad d = \frac{\Delta x 10}{D} \qquad D = \frac{\Delta x 10}{d}$$

- Δ = prismatic effect
- D = Lens BVP (in D)
- d = distance from OC (in mm)

33

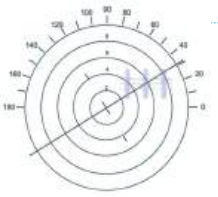
Examples

$$\Delta = \frac{dD}{10} \qquad d = \frac{\Delta x 10}{D} \qquad D = \frac{\Delta x 10}{d}$$

34

RESULTANT PRISM

EXAMPLE:
Based on the following parameters OD PL 3Δ BU & 5Δ BI
What is the resultant prism?



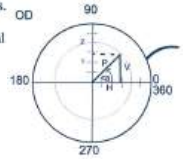
$$P = \sqrt{H^2 + V^2}$$

$$a = tan^{-1}\left(\frac{V}{H}\right)$$

In this example:
a. H = 5, V = 3, $P^2 = 5^2 + 3^2 = 34$, and $P = \sqrt{34} = 5.8^{\Delta}$, tan a = 3/5 = 0.6, and a = 31°
(Use the tan⁻¹ key.)
b. Since 31° is between 0 and 90, which is what we wanted, the resultant prism is 5.8^{Δ} @ 031, or 5.8^{Δ} BU & I @ 031°. In the lensmeter the target will look like this:

35

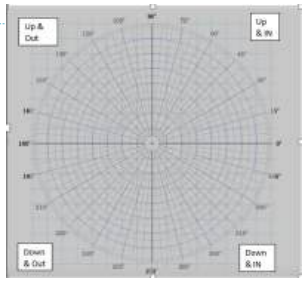
4-35. The prism found in the lensmeter for a pair of glasses is 2.0^{Δ} @ 045, and the lens is a right lens. Resolve this prism into its component parts.
On the diagram the long side P of the triangle is 2.0 and the angle ∠a that the prism makes with the axis is 45 degrees. The angle 45° is quadrant I, which is U and I for the right lens.
V = (P)(sin a) = (2.0)(sin 45) = (2)(0.707) = 1.4^{Δ} BU, since V is vertical
H = (P)(cos a) = (2.0)(cos 45) = (2)(0.707) = 1.4^{Δ} BI, since H is horizontal
The prism resolves to **1.4^{Δ} BI & 1.4^{Δ} BU.**



$$V = (P)(\sin a)$$
$$H = (P)(\cos a)$$

36

Resolving and Resultant Prism Trick



37

Bi-Centric Grinding

- Figuring out Slab Off or Reverse Slab Off

1. Find Power at 90 for both eyes
2. Find "drop" (how much do the eyes move down from Dist to Near VERTICALLY)
3. Use prentices rule to determine Prism induced in each eye
4. Find difference, and that is amount of slab off to order at near

SLAB-OFF AND REVERSE SLAB-OFF		
	SLAB-OFF	REVERSE SLAB-OFF
Two minus lenses	Highest minus	Lowest minus
Two plus lenses	Lowest plus	Highest plus
One plus, one minus	The minus lens	The plus lens

38

Bi-Centric Grinding

OD -4.00 -2.00 x 180
OS -2.50 -0.50 x 180 +2.50 Add OU
ST 28 bifocal
Looking 4 mm above seg at distance
Looking 5 mm below seg while reading
Total 9mm drop

OD: Power at 90= -6.00 Drop = 9mm prism = 5.4
OS: Power at 90 = -3.00 Drop = 9mm prism = 2.7

Difference = 2.7 Prism diopters…will require that much Slab off in OD to eliminate vertical imbalance

39

Bi-Centric Grinding

- Slab Off

Note…can also take DIFFERENCE in distance power at 90 between OD and OS and multiply by amount eye drops vertically and will come up with same difference (as long as ADDs are similar)

40

Prism Problems

Decentration to obtain prism problem

How far must a +2.00 +2.00 x 135 lens be moved to create 2^ ?

41

Prism Problems

Decentration to obtain prism problem

How far must a +2.00 +2.00 x 135 lens be moved to create 2^ ?

42

Induced Prism

- How much prism and what base direction is created if a -5.00 -1.00 @ 060 is decentered 5mm nasally to much

43

Induced prism due to decentration error.

How much prism and what base direction is created if a -5.00 -1.00 x 60 is decentered 5mm too much?

$\Delta = P \times d(cm)$

$\Delta = 5.75 \times .5cm = 2.875^{\Delta}$

44

- Make sure you understand Oblique Axes
- Power at 90 and or 180
- ANSI standards (vertical and horizontal)
- Prims (induced/decentered)
- Slab off
  - find diff in vertical meridian/90 OD vs OS
  - Find diff vertical
  - Use prentices rule to find amount of prism

45

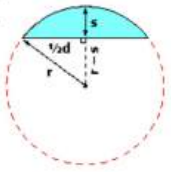
Sagittal Depth Formula (Lens Thickness)

$r^2 = (\frac{1}{2}d)^2 + (r - s)^2$

$(r - s)^2 = r^2 - (\frac{1}{2}d)^2$

$r - s = \sqrt{r^2 - (\frac{1}{2}d)^2}$

$s = r - \sqrt{r^2 - (\frac{1}{2}d)^2}$



www.Opticampus.com

46

Sagittal Depth Formula Example

5-12. A surface made of polycarbonate has a true power of −6.00D and a diameter of 60 mm. What is the sag of the surface?

n = 1.586

r = (n − 1)/D = (1.586 − 1)/(6)
= 0.0977 m = 97.7 mm

d = 60

$sag = r - \sqrt{r^2 - \left(\frac{d}{2}\right)^2}$

$sag = 97.7 - \sqrt{97.7^2 - \left(\frac{60}{2}\right)^2}$

$sag = 97.7 - \sqrt{9545.29 - 900} = 97.7 - \sqrt{8645.29}$
$= 97.7 - 93.0 = \mathbf{4.7\ mm}$

$Sag = \frac{n-1}{D} - \sqrt{\left(\frac{n-1}{D}\right)^2 - \left(\frac{d}{2}\right)^2}$

$Sag = \frac{(d/2)^2 x D}{2000\,(n-1)}$

47

Sagittal Depth Formula (Lens Thickness)Example

5-18. What is the approximate edge thickness of a −6.00D polycarbonate lens, n = 1.586, if the center thickness is 1.5 mm and the lens diameter is 60 mm?

EDGE THICKNESS = SAG + CENTER THICKNESS

$sag = \frac{(d/2)^2 D}{2000(n-1)}$

$sag = \frac{(30)^2 6.00}{2000(0.586)} = 4.6$ mm

EDGE THICKNESS = 4.6 mm + 1.5 mm = 6.1 mm

In Example 5-13 the exact formula gave us 6.2 mm for this edge thickness in a flat form lens, and Example 5-14 gave an edge thickness of 6.5 mm for the same lens made on a +3.00 base curve.

48

Sagittal Depth Formula (Lens Thickness)

- Thickness = $\frac{\text{Radius}^2 \times \text{Power}}{2000\ (n - 1)}$
  - N = Index of refraction of lens material used
  - Thickness is mm
- Step # 1 Decentration x 2 + ED
- Step # 2 Radius = ½ of amount in Step # 1
- Step # 3 Calculate thickness using formula
- Step # 4 Add minimum thickness to answer (1.5 to 2.0mm)

49

Sagittal Depth Formula (Lens Thickness)Example

- Rx = -5.00 A= 54 DBL = 20 Frame GCD = 74 ED = 62mm
- Mono P.D. O.D. = 30mm Material = CR-39 Index 1.49
- Thickness = $\frac{\text{Radius}^2 \times \text{Power}}{2000\ (N - 1)}$
- Step # 1 54 + 20 = 74/2 = 37- 30 = 7 x 2 + 62 = 76mm
- Step # 2 Radius = ½ of amount in Step # 1 = 38mm
- Step # 3 Calculate thickness using formula
- Thickness = $\frac{38^2 \times -5.00}{2000\ (1.49 - 1)} = \frac{1444 \times 5}{2000 \times .49} = \frac{7220}{980} = 7.36\text{mm}$
- Step # 4 Add minimum thickness to answer (1.5 to 2.0mm)

50

On behalf of Vision Expo, we sincerely thank you for being with us this year.

Vision Expo Has Gone Green!

We have eliminated all paper session evaluation forms. Please be sure to complete your electronic session evaluations online when you login to request your CE Letter for each course you attended! Your feedback is important to us as our Education Planning Committee considers content and speakers for future meetings to provide you with the best education possible.

vision expo

51