PRACTICE EXAM 5

1. Which term names the unit of lens power?

A. The prism diopter

B. The diopter

C. The Abbe number

D. The radian

2. A lens that has the same power in every meridian is best described as:

A. Cylindrical

B. Spherical

C. Prismatic

D. Toric

3. The abbreviation "OS" in a prescription refers to which eye?

A. The right eye

B. Both eyes together

C. The left eye

D. The dominant eye

4. Which formula correctly states Prentice's rule?

A. Prism equals decentration in centimeters times power

B. Prism equals power divided by focal length

C. Prism equals index times curvature

D. Prism equals vertex distance times add

5. A lens material's tendency to disperse light and create chromatic aberration is quantified by its:

A. Abbe value

B. Index of refraction

C. Base curve

D. Specific gravity

6. Which describes the major reference point of a lens?

A. The thickest edge of a minus lens

B. The geometric center of the box

C. The point delivering prescribed power and prism to the eye

D. The bevel apex of the lens

7. The spherical equivalent of a prescription is found by taking the sphere and adding:

A. The full cylinder power

B. Twice the cylinder power

C. Half the cylinder power

D. The axis value in degrees

8. Which conversion is correct?

A. 1 inch equals 2.54 mm

B. 1 inch equals 10 mm

C. 1 inch equals 12.7 mm

D. 1 inch equals 25.4 mm

9. A plus lens, by its optical nature, does which of the following to parallel light?

A. Diverges it as from a virtual point

B. Leaves it unchanged

C. Converges it to a focal point

D. Splits it into polarized components

10. The frame PD is correctly calculated as:

A. Eye size plus DBL

B. Eye size minus DBL

C. Temple length plus DBL

D. The B measurement doubled

11. Which term describes the cylinder axis?

A. The amount of cylinder power in diopters

B. The total sphere power

C. The orientation of the cylinder in degrees

D. The near add power

12. A lens whose focal length is 0.50 m has a power of:

A. +0.50 D

B. +5.00 D

C. +2.00 D

D. +50.0 D

13. Which best describes a spherocylindrical lens?

A. It has two principal powers in two principal meridians

B. It has one uniform power throughout

C. It has only prism and no focal power

D. It has no measurable power

14. Transposition rotates the cylinder axis by exactly:

A. 90 degrees

B. 45 degrees

C. 180 degrees

D. 30 degrees

15. A minus lens is thickest at which location?

A. The optical center

B. The geometric center

C. Uniformly throughout

D. The edges

16. Which statement about index of refraction is correct?

A. A higher index yields a thinner lens for the same power

B. A higher index yields a thicker lens for the same power

C. Index has no effect on lens thickness

D. Index only affects lens color

17. A prism displaces the perceived image toward its:

A. Apex

B. Base

C. Optical center

D. Thickest edge

18. Which best defines the optical center of a lens?

A. The thickest point of a plus lens

B. The frame's geometric center

C. The widest part of the lens box

D. The point where no prismatic effect occurs

19. As index of refraction rises, Abbe value generally:

A. Rises proportionally

B. Stays constant

C. Falls

D. Doubles

20. A cylinder exerts zero power at which meridian?

A. The axis meridian

B. 90 degrees from the axis

C. 45 degrees from the axis

D. The vertical meridian always

21. Which describes dispersion in an ophthalmic lens?

A. The bouncing of light off the lens surface

B. The splitting of white light into colors

C. The bending of light toward the normal

D. The total reflection inside the lens

22. A higher-index lens reflects light at its surfaces:

A. Less than a lower-index lens

B. More than a lower-index lens

C. Identically to all materials

D. Only when tinted

23. Which is the correct three-step order of transposition?

A. Reverse cylinder, rotate axis 45°, combine sphere

B. Rotate axis 90°, combine sphere, reverse cylinder

C. Combine sphere, reverse cylinder, rotate axis 180°

D. Combine sphere with cylinder, reverse cylinder sign, rotate axis 90°

24. The power in an oblique meridian uses the formula F times:

A. Sine squared of the angle from the axis

B. Cosine of the vertex distance

C. The index of refraction

D. The tangent of the base curve

25. A diopter is defined as the reciprocal of the focal length expressed in:

A. Centimeters

B. Millimeters

C. Inches

D. Meters

26. Light entering a denser medium and slowing down bends:

A. Away from the normal

B. Parallel to the surface

C. Back toward its source

D. Toward the normal

27. A +2.00 cylinder is effective at what percentage at the meridian 45° from its axis?

A. 50%

B. 100%

C. 0%

D. 25%

28. Which lens minifies the apparent size of the wearer's eyes?

A. A plus lens

B. A minus lens

C. A plano lens

D. A prism-only lens

29. The total decentration needed equals:

A. Frame PD minus patient PD

B. Patient PD minus eye size

C. Eye size minus DBL

D. Temple length minus bridge

30. A +4.00 D lens at a point 5 mm below the OC induces:

A. 2.0 prism diopters

B. 20.0 prism diopters

C. 0.8 prism diopters

D. 4.0 prism diopters

31. Which term means unequal refractive error between the two eyes?

A. Emmetropia

B. Anisometropia

C. Presbyopia

D. Astigmatism

32. Which term means a difference in the retinal image size between the two eyes?

A. Anisometropia

B. Antimetropia

C. Aniseikonia

D. Emmetropia

33. Myopia is corrected with which lens?

A. A minus (concave) lens

B. A plus (convex) lens

C. A prism-only lens

D. A plano lens

34. Which structure provides the greatest share of the eye's refracting power?

A. The crystalline lens

B. The vitreous humor

C. The cornea

D. The aqueous humor

35. Presbyopia is best defined as:

A. A clouding of the crystalline lens

B. The age-related loss of accommodation

C. An unequal corneal curvature

D. Elevated intraocular pressure

36. Which photoreceptors handle color and fine detail in bright light?

A. Rods

B. Bipolar cells

C. Cones

D. Ganglion cells

37. A phoria differs from a tropia in that a phoria is:

A. A constant, manifest misalignment

B. A clouding of the lens

C. A loss of central vision

D. A latent tendency controlled by fusion

38. Hyperopia focuses parallel light:

A. Exactly on the retina

B. In front of the retina

C. Behind the retina

D. On the cornea

39. Which term means the absence of the crystalline lens with no implant?

A. Aphakia

B. Pseudophakia

C. Amblyopia

D. Emmetropia

40. The macula is responsible for which type of vision?

A. Sharp, detailed central vision

B. Dim-light peripheral vision

C. Production of aqueous humor

D. Tear drainage

41. Which prefix indicates an inward (toward the nose) eye deviation?

A. Exo-

B. Eso-

C. Hyper-

D. Hypo-

42. Glaucoma characteristically first affects which part of the visual field?

A. The central field

B. The reading zone only

C. The upper field only

D. The peripheral field

43. Accommodation is performed by which structure changing the lens shape?

A. The iris sphincter

B. The extraocular muscles

C. The lacrimal gland

D. The ciliary muscle

44. Diplopia is best defined as:

A. A clouding of the lens

B. An involuntary eye movement

C. Double vision from misaligned eyes

D. A localized blind spot

45. Which term describes the eye that has an artificial intraocular lens implant?

A. Aphakic

B. Pseudophakic

C. Amblyopic

D. Emmetropic

46. With-the-rule astigmatism, in minus-cylinder notation, has its axis near:

A. 045 degrees

B. 090 degrees

C. 180 degrees

D. 135 degrees

47. The far point of an uncorrected –2.00 D myope is located at:

A. Optical infinity

B. 2.0 meters in front of the eye

C. 0.25 meters in front of the eye

D. 0.5 meters in front of the eye

48. Which photoreceptors are responsible for dim-light and peripheral vision?

A. Cones

B. Bipolar cells

C. Rods

D. Ganglion cells

49. Convergence is the eyes' movement that occurs when viewing:

A. A distant object

B. With the eyes closed

C. A near object

D. The far periphery

50. Which material is the standard choice for impact-resistant children's eyewear?

A. Crown glass

B. Polycarbonate

C. Ultra-high index

D. Untempered glass

51. A semi-rimless nylon-cord mounting requires the lens edge to be:

A. Beveled for full-rim mounting

B. Drilled with holes

C. Left flat and unfinished

D. Grooved to seat the cord

52. A polarized lens most effectively reduces glare reflected from:

A. A vertical wall

B. Overhead lighting

C. The wearer's lashes

D. A flat horizontal surface like water

53. Which describes a gradient tint?

A. Darker at the top and lighter at the bottom

B. Uniform density throughout

C. Color-changing in sunlight

D. Blocking only horizontal glare

54. Which frame material is lightweight, strong, and hypoallergenic?

A. Titanium

B. Zyl acetate

C. Nickel silver

D. Untreated base metal

55. A trifocal adds a zone for which distance, compared with a bifocal?

A. The smallest near print

B. Distant road signs

C. Intermediate, such as a monitor

D. Peripheral motion only

56. Photochromic lenses typically darken in response to:

A. Infrared heat

B. Visible blue light only

C. The wearer's body temperature

D. Ultraviolet radiation

57. A patient with a metal allergy should receive a frame made of:

A. A nickel-rich alloy

B. Titanium or a hypoallergenic material

C. An untreated base metal

D. The same alloy with thin plating

58. Which lens enhancement reduces surface reflections and increases light transmission?

A. Anti-reflective coating

B. A solid sunglass tint

C. Edge polishing

D. A scratch coat alone

59. A rimless drill-mount frame is best fitted with which material?

A. Polycarbonate or Trivex

B. Crown glass

C. Standard CR-39

D. Untempered glass

60. Which describes a solid tint?

A. Darker at the top, lighter at the bottom

B. Color-changing in sunlight

C. Blocking only horizontal glare

D. Uniform density across the lens

61. OTC reading glasses are limited because both lenses share:

A. Different powers per eye

B. The same power and a fixed OC spacing

C. A built-in progressive corridor

D. Guaranteed UV protection

62. The executive bifocal is characterized by a near segment that:

A. Spans the full width of the lens

B. Is a small round shape

C. Is absent entirely

D. Changes power continuously

63. Which is a recognized low vision aid?

A. A routine scratch coat

B. A handheld magnifier

C. A standard distance lens

D. A basic anti-reflective coating

64. A dark sunglass lens without UV protection can be harmful because it:

A. Reflects all light away

B. Permanently corrects the Rx

C. Dilates the pupil while admitting UV

D. Increases impact resistance

65. Low vision aids primarily work through:

A. Surgical retinal repair

B. Reversal of the disease

C. Restoration of 20/20 acuity

D. Magnification and contrast enhancement

66. Which mounting-to-edge pairing is correct?

A. Full-rim frame requires a drilled hole

B. Semi-rimless frame requires a groove

C. Rimless frame requires a standard bevel

D. Full-rim frame requires a nylon cord

67. A frame offering the most adjustable bridge fit after dispensing is:

A. A fixed saddle-bridge plastic frame

B. A one-piece molded plastic frame

C. A fixed keyhole-bridge plastic frame

D. A metal frame with adjustable nose pads

68. Polycarbonate is notable for all of the following EXCEPT:

A. The highest Abbe value of common materials

B. High impact resistance

C. Inherent UV blocking

D. Light weight

69. A patient needing the widest near field for drafting is best served by:

A. A small round-segment bifocal

B. A progressive in a shallow frame

C. A pair of OTC readers

D. An executive-style bifocal

70. A high-index lens's increased surface reflection is best offset by:

A. A solid tint

B. An anti-reflective coating

C. Edge polishing

D. A photochromic treatment

71. A photochromic lens may underperform in which situation?

A. Driving behind a windshield

B. Standing in direct sun

C. Walking outdoors on a clear day

D. Being at high altitude

72. Which patient most needs impact-resistant polycarbonate?

A. A retiree wanting the thinnest lens

B. A patient seeking the cheapest frame

C. A patient wanting the highest Abbe value

D. A child who plays contact sports

73. A gradient tint is most often chosen for:

A. Correcting astigmatism

B. Eliminating reflections entirely

C. Cosmetic and sun applications

D. Increasing impact resistance

74. Which is true of preassembled OTC readers compared with a prescription pair?

A. They correct astigmatism reliably

B. They provide different powers per eye

C. They include a progressive corridor

D. They have a fixed optical-center spacing

75. A patient sensitive to peripheral color fringing may be better served by a material with:

A. The highest possible index

B. A higher Abbe value

C. The thinnest available profile

D. The greatest surface reflection

76. A lensmeter (focimeter) primarily measures:

A. The back vertex power of a lens

B. The lens surface curvature

C. The patient's pupillary distance

D. The vertex distance to the cornea

77. A lens clock measures a lens's:

A. Back vertex power

B. Pupillary distance

C. Surface curvature in diopters

D. Add power for near

78. The distometer measures:

A. Pupillary distance

B. Lens surface curvature

C. Lens size or perimeter

D. Vertex distance to the cornea

79. A corneal reflex pupillometer measures the patient's:

A. Vertex distance

B. Pupillary distance

C. Lens base curve

D. Temple length

80. When verifying a lens, the back surface is placed against the lensmeter stop because the standard is:

A. Front vertex power

B. Surface curvature power

C. Equivalent air power

D. Back vertex power

81. Prism in a lens is indicated on the lensmeter by:

A. A blurred, unfocusable target

B. Displacement of the target from the reticle center

C. The axis wheel failing to turn

D. A change in eyepiece magnification

82. A lens clock is calibrated to one index, so on a different-index lens its:

A. Curvature reading is impossible

B. Power reading is not perfectly accurate

C. Calibration permanently changes

D. Reading becomes a PD value

83. The add power of a multifocal is verified on the lensmeter by:

A. Reading only the near zone

B. Reading only the distance zone

C. Subtracting the distance reading from the near reading

D. Multiplying the two readings

84. A digital measurement system captures all of the following EXCEPT:

A. Pupillary distance

B. Pantoscopic tilt

C. Vertex distance

D. The material's Abbe value

85. A centered lensmeter target with no displacement indicates reading through the:

A. Optical center

B. Thickest edge

C. Segment line

D. Bevel apex

86. A circumference (lens) gauge measures a lens's:

A. Back vertex power

B. Size or perimeter

C. Surface curvature

D. Center thickness

87. Calipers are most appropriately used to measure:

A. Pupillary distance

B. Back vertex power

C. UV transmission

D. Lens thickness and small linear dimensions

88. An automatic lensmeter differs from a manual one in that it:

A. Measures only front vertex power

B. Displays the readings electronically

C. Cannot read cylinder or axis

D. Requires no lens inserted

89. Pad-adjusting pliers are used to:

A. Angle and position the nose pads

B. Cut the temple core wire

C. Read the lens base curve

D. Measure the segment height

90. Plastic (zyl) frames must be prepared for bending by:

A. Cooling in cold water

B. Freezing overnight

C. Warming with a frame heater

D. Bending while fully cold

91. Metal frames, unlike plastic frames, are generally adjusted:

A. Cold at room temperature

B. After warming with a heater

C. Only when frozen

D. Only after solvent soaking

92. Padded nylon-jaw pliers are used to:

A. Apply greater bending force

B. Heat the frame faster

C. Measure the frame dimensions

D. Protect the frame finish from marring

93. A monocular PD is preferred over a binocular PD for patients with:

A. A very low prescription

B. Facial asymmetry

C. A metal-frame preference

D. No prior eyewear

94. A millimeter ruler is most appropriately used to measure:

A. Total lens power

B. Pupillary distance

C. Surface curvature

D. Material dispersion

95. Round-nose pliers are used to:

A. Cut the nylon cord

B. Measure seg height

C. Form curves in metal components

D. Read the base curve

96. Which instrument measures surface curvature in diopters?

A. The distometer

B. The lens clock

C. The pupillometer

D. The circumference gauge

97. Which instrument-to-measurement pairing is correct?

A. Lens clock measures PD

B. Distometer measures lens thickness

C. Lensmeter measures back vertex power

D. Pupillometer measures base curve

98. A lensmeter target that stays displaced even at the lens's thickest point indicates:

A. A scratch coating

B. An anti-reflective coating

C. Prescribed prism

D. A photochromic treatment

99. A finished lens reading sphere power only, with no cylinder, is:

A. A purely spherical lens

B. A spherocylindrical lens

C. A prism-only lens

D. A bifocal lens

100. The instrument used to measure vertex distance for a high-powered Rx is the:

A. Lens clock

B. Pupillometer

C. Circumference gauge

D. Distometer

101. The fitting triangle's three points of support are:

A. The two lenses and the bridge

B. The two temples and the chin

C. The forehead and both cheeks

D. The nose and the two ears

102. A patient's frame slides down the nose. The optician examines which support of the fitting triangle?

A. The lens anti-reflective coating

B. The bridge or nose-pad fit and temples

C. The lens base curve only

D. The lens material index

103. Pantoscopic tilt is the angle at which:

A. The frame curves horizontally around the face

B. The temples bend behind the ears

C. The lower edge of the lens sits closer to the face

D. The lens rotates about its optical center

104. As pantoscopic tilt increases, the optical center should generally be:

A. Raised toward the top

B. Moved temporally

C. Lowered relative to the pupil

D. Left unchanged

105. For most flat-top bifocal fits, the segment top is set at the:

A. Lower eyelid margin

B. Center of the pupil

C. Upper frame edge

D. Eyebrow line

106. A progressive lens's fitting cross is aligned with the:

A. Center of the pupil in primary gaze

B. Lower eyelid margin

C. Top frame edge

D. Temporal canthus

107. The patient measurement that determines optical-center placement is the:

A. Vertex distance

B. Pupillary distance

C. Temple length

D. Base curve

108. A patient reports headaches in new glasses whose power verifies correct. The optician first checks the:

A. Lens tint density

B. Coating brand

C. Frame color

D. PD and optical-center placement

109. A patient says the floor "swims" in new glasses with verified-correct power. The likely cause is a change in the:

A. Lens tint

B. Temple length

C. Coating type

D. Base curve from the previous pair

110. A first-time progressive wearer's mild initial peripheral blur is best understood as:

A. A definite power error

B. Expected adaptation

C. A coating defect

D. A frame-material error

111. Face-form (wrap) angle refers to the frame's:

A. Vertical tilt of the lens plane

B. Distance between the lenses

C. Horizontal curvature around the face

D. Temple length

112. A patient's bifocal seg intrudes on distance vision. It was set:

A. At the correct lower-lid level

B. Too high relative to the lower lid

C. Within tolerance properly

D. Too low on the lens

113. Vertex distance most affects effective power when the prescription is:

A. Below 1.00 D

B. High (around 4.00 D or more)

C. Plano in both meridians

D. Purely cylindrical at low power

114. A lifestyle assessment guides product choice mainly because:

A. Only frame color depends on it

B. The Rx alone dictates all choices

C. Activities have no bearing on lenses

D. Working distances and tasks drive selection

115. A patient with a strong minus Rx wanting thin edges should, beyond high index, choose:

A. The largest fashionable frame

B. The widest bridge

C. A smaller, well-centered frame

D. A steeper base curve

116. Double vision in correctly powered glasses most likely indicates:

A. A defective scratch coat

B. An incorrect tint

C. A centration error inducing prism

D. An expired warranty

117. A patient with good distance and near vision but blurry arm's-length vision needs:

A. An intermediate zone (trifocal or progressive)

B. A darker near tint

C. A stronger distance lens

D. A larger frame only

118. The fundamental purpose of correct centration is to:

A. Increase scratch resistance

B. Darken the lens automatically

C. Raise the Abbe value

D. Place the OC before the pupil and avoid induced prism

119. A patient moving to a high-wrap frame with a strong Rx needs lenses that are:

A. Made thicker only

B. Optically compensated for the wrap

C. Left uncoated

D. Cut to a smaller blank

120. A patient needs a frame deep enough for a progressive's three zones. The optician ensures adequate:

A. Temple length

B. Bridge width only

C. Vertical (B) measurement depth

D. Effective-diameter reduction

121. Finished spectacle lenses are verified against the prescription using:

A. Front vertex power

B. Back vertex power

C. Surface curvature power

D. Equivalent air power

122. Under ANSI Z80, a finished lens is acceptable when each parameter is:

A. Exactly equal to every prescribed number

B. Within any deviation the optician prefers

C. Matched on sphere power only

D. Within the allowed tolerance for that value

123. Which agency requires that dress eyeglass lenses be impact resistant?

A. OSHA

B. EPA

C. HIPAA

D. FDA

124. ANSI Z87 governs which category of eyewear?

A. Dress prescription lenses

B. Contact lens solutions

C. Occupational safety eyewear

D. Patient privacy records

125. HIPAA chiefly protects:

A. The privacy of patient health information

B. The impact resistance of lenses

C. The disposal of lab chemicals

D. The workplace safety of employees

Answer Key & Full Explanations

1. B — The diopter. The diopter is the unit of lens power, defined as the reciprocal of focal length in meters. The prism diopter is a separate unit measuring prismatic deviation.

2. B — Spherical. A spherical lens has the same power in every meridian, focusing light to a single point. A cylindrical or toric lens, by contrast, has differing power across meridians.

3. C — The left eye. "OS" (oculus sinister) denotes the left eye; OD is the right and OU is both. Correct eye identification prevents transposing a patient's two corrections.

4. A — Prism equals decentration in centimeters times power. Prentice's rule is $\Delta = c \times F$, with decentration in centimeters and power in diopters. The centimeter requirement makes mm-to-cm conversion essential.

5. A — Abbe value. The Abbe value quantifies a material's dispersion and therefore its chromatic aberration; a lower Abbe value means more color fringing. Index of refraction governs bending and thickness, not dispersion directly.

6. C — The point delivering prescribed power and prism to the eye. The major reference point is where the full prescribed power and prism reach the eye, coinciding with the optical center only when no prism is prescribed. Correct MRP placement delivers the intended correction.

7. C — Half the cylinder power. Spherical equivalent equals sphere plus half the cylinder (respecting signs). It represents the single sphere power whose focus lies midway between the two focal lines.

8. D — 1 inch equals 25.4 mm. The standard inch-to-millimeter conversion is 25.4 mm, the value opticians use to convert imperial measurements to the metric dispensary units. From it any inch-based value can be derived.

9. C — Converges it to a focal point. A plus (convex) lens converges parallel light to a focal point, which is what corrects hyperopia. This convergence is the defining behavior of a plus lens.

10. A — Eye size plus DBL. Frame PD equals the eye size (A) plus the DBL (bridge). This value is compared to the patient's PD to determine decentration.

11. C — The orientation of the cylinder in degrees. The axis is a direction from 1 to 180 degrees describing the cylinder's orientation, not a power. Confusing axis with power leads to predictable errors.

12. C — +2.00 D. Power is the reciprocal of focal length in meters: 1 ÷ 0.50 = 2.00 D. Longer focal lengths give weaker powers.

13. A — It has two principal powers in two principal meridians. A spherocylindrical lens combines a sphere and a cylinder, producing two distinct powers in its two principal meridians. This two-meridian behavior underlies transposition.

14. A — 90 degrees. Transposition rotates the cylinder axis exactly 90°, adding 90 if the axis is 90 or below and subtracting 90 if above. This keeps the new axis within the 1–180 range.

15. D — The edges. A minus lens is thin at the center and thickest at the edges, with edge thickness growing as minus power increases. This is why strong myopes benefit from smaller frames and higher index.

16. A — A higher index yields a thinner lens for the same power. A higher index bends light more strongly, so less thickness is needed for the same power. This is the cosmetic advantage of high-index materials.

17. A — Apex. A prism bends light toward its base but displaces the perceived image toward its apex (thin edge). This image-toward-apex behavior is how prism repositions images.

18. D — The point where no prismatic effect occurs. The optical center is the point on a lens where light passes without prismatic deviation. This is why centration aims to place it before the pupil.

19. C — Falls. Abbe value runs inversely to index of refraction, so as index rises the Abbe value generally falls and chromatic aberration increases. This inverse relationship is the key material trade-off.

20. A — The axis meridian. A cylinder has zero power at its axis meridian, with full power 90° away. This is why "effect at the axis" is always 0%.

21. B — The splitting of white light into colors. Dispersion is the splitting of white light into its component wavelengths, producing chromatic aberration. Reflection and refraction are separate light behaviors.

22. B — More than a lower-index lens. Higher-index materials reflect more light at their surfaces, which is why anti-reflective coatings benefit them most. The increased reflection slightly reduces transmission.

23. D — Combine sphere with cylinder, reverse cylinder sign, rotate axis 90°. Transposition follows these three steps in order. Performing them in sequence yields the equivalent cylinder form.

24. A — Sine squared of the angle from the axis. Power in an oblique meridian is $F \times \sin^2\theta$, with θ measured from the cylinder axis. This gives 0% at the axis, 50% at 45°, and 100% at 90°.

25. D — Meters. The diopter is the reciprocal of focal length in meters, so focal lengths must be converted to meters before computing power. This is the basis of the power definition.

26. D — Toward the normal. Light entering a denser medium slows and bends toward the normal (the perpendicular to the surface). This bending is the basis of refraction and focusing.

27. A — 50%. At 45° from the axis, $\sin^2 45° = 0.5$, so half the cylinder power is effective. Cylinder effect runs from 0% at the axis to 100% at 90°.

28. B — A minus lens. A minus lens minifies, making the wearer's eyes appear smaller. A plus lens, by contrast, magnifies.

29. A — Frame PD minus patient PD. Total decentration equals the difference between frame PD and patient PD, then split between the two lenses. This determines how far each optical center moves.

30. A — 2.0 prism diopters. Convert 5 mm to 0.5 cm and apply Prentice's rule: $\Delta = 0.5 \times 4.00 = 2.0\Delta$. The millimeter-to-centimeter conversion prevents a tenfold error.

31. B — Anisometropia. Anisometropia is a difference in refractive error between the two eyes. It can cause vertical imbalance in down-gaze and aniseikonia.

32. C — Aniseikonia. Aniseikonia is a difference in the size of the two eyes' retinal images, which interferes with fusion. It can result from significant anisometropia but is a distinct concept.

33. A — A minus (concave) lens. Myopia is corrected with a minus lens, which diverges light to move the focus back onto the retina. This is the defining correction for nearsightedness.

34. C — The cornea. The cornea provides the greatest share of the eye's refracting power (about two-thirds), more than the crystalline lens. Its clarity and curvature are critical to vision.

35. B — The age-related loss of accommodation. Presbyopia is the progressive stiffening of the crystalline lens that impairs near focus with age, corrected with a plus add. It differs from a clouded lens (cataract) or elevated pressure (glaucoma).

36. C — Cones. Cones, concentrated at the macula, provide color and fine detail in bright light. Rods, by contrast, handle dim-light and peripheral vision without color.

37. D — A latent tendency controlled by fusion. A phoria is a latent misalignment held in check by the brain's fusion, revealed only when fusion is interrupted. A tropia, by contrast, is a constant, manifest misalignment.

38. C — Behind the retina. In hyperopia the eye is too weak or short, so relaxed-eye light focuses behind the retina. A plus lens converges the light forward onto the retina.

39. A — Aphakia. Aphakia is the absence of the crystalline lens with no implant. Pseudophakia, by contrast, is having an artificial intraocular lens implant.

40. A — Sharp, detailed central vision. The macula, with the fovea at its center, is responsible for sharp, detailed central and color vision. Damage here degrades central vision specifically.

41. B — Eso-. The prefix "eso-" indicates an inward (toward the nose) eye deviation; "exo-" is outward. These prefixes name the direction of phorias and tropias.

42. D — The peripheral field. Glaucoma characteristically erodes peripheral vision first while central vision is preserved until late. This is the mirror image of macular degeneration.

43. D — The ciliary muscle. The ciliary muscle changes the crystalline lens's shape to focus on near objects, the process of accommodation. Its age-related decline produces presbyopia.

44. C — Double vision from misaligned eyes. Diplopia is double vision occurring when misaligned eyes cannot fuse their two images. It is a key symptom of muscle imbalance.

45. B — Pseudophakic. An eye with an artificial intraocular lens implant is pseudophakic, typically after cataract surgery. Aphakia, by contrast, is the absence of the lens with no implant.

46. C — 180 degrees. In minus-cylinder notation, with-the-rule astigmatism has its cylinder axis near 180° (steeper vertical meridian). This is opposite to against-the-rule.

47. D — 0.5 meters in front of the eye. The far point of an uncorrected myope is the reciprocal of the power: $1 \div 2.00 = 0.5$ m. This is why a myope sees clearly only at near without correction.

48. C — Rods. Rods are highly light-sensitive and responsible for dim-light and peripheral vision without color. Cones, by contrast, handle color and detail in bright light.

49. C — A near object. Convergence is the inward rotation of the eyes to maintain single vision on a near target. Divergence is the opposite movement toward distance.

50. B — Polycarbonate. Polycarbonate is the standard impact-resistant material for children's eyewear, also being lightweight and UV-blocking. Its impact resistance, not thinness, drives the choice.

51. D — Grooved to seat the cord. A semi-rimless nylon-cord mounting requires a groove cut in the lens edge to seat the cord. Each mounting type dictates its own edge treatment.

52. D — A flat horizontal surface like water. Polarized lenses block horizontally oriented reflected glare, such as that off water, snow, and roads. This makes them ideal for outdoor and driving glare.

53. A — Darker at the top and lighter at the bottom. A gradient tint transitions from darker at the top to lighter at the bottom, unlike a uniform solid tint. This distinguishes it from a solid tint.

54. A — Titanium. Titanium is lightweight, strong, corrosion resistant, and hypoallergenic, suiting patients with sensitivities. These properties make it a premium frame material.

55. C — Intermediate, such as a monitor. The trifocal's middle zone serves arm's-length intermediate distances between distance and near. This is the gap a standard bifocal does not address.

56. D — Ultraviolet radiation. Most photochromic lenses darken in response to UV exposure and lighten when UV is removed. This is why many darken less behind a windshield.

57. B — Titanium or a hypoallergenic material. A metal-allergic patient should be fitted with a hypoallergenic material such as titanium. Nickel-containing alloys risk provoking the reaction.

58. A — Anti-reflective coating. An anti-reflective coating reduces surface reflections and increases light transmission to the eye. Its benefit is greatest on high-index lenses.

59. A — Polycarbonate or Trivex. Rimless drill-mount lenses are stressed at the holes, so impact-resistant polycarbonate or Trivex prevents cracking. Glass and brittle materials are inappropriate.

60. D — Uniform density across the lens. A solid tint has the same density across the entire lens, unlike a gradient tint that varies top to bottom. Solid tints serve general sun and cosmetic use.

61. B — The same power and a fixed OC spacing. OTC readers carry identical power in both lenses and a fixed optical-center spacing, limiting them to simple presbyopic near use. They cannot address astigmatism or unequal eyes.

62. A — Spans the full width of the lens. The executive bifocal's near segment extends across the entire lens width, giving the widest near field. Its size also makes it heavier.

63. B — A handheld magnifier. A handheld magnifier is a classic low vision aid that enlarges reading material. Routine coatings and standard lenses are not low vision aids.

64. C — Dilates the pupil while admitting UV. A dark non-UV lens dilates the pupil due to reduced brightness while letting UV reach the eye, which can be worse than no sunglasses. This is why UV protection must be confirmed separately.

65. D — Magnification and contrast enhancement. Low vision aids work primarily through magnification and contrast/glare control to maximize remaining vision. They do not restore acuity or reverse disease.

66. B — Semi-rimless frame requires a groove. A semi-rimless nylon-cord mounting requires a groove; full-rim uses a bevel and rimless uses drilled holes. Matching mounting to edge treatment is essential.

67. D — A metal frame with adjustable nose pads. Metal frames with adjustable nose pads allow the bridge fit to be fine-tuned after dispensing. Plastic frames have a largely fixed bridge.

68. A — The highest Abbe value of common materials. Polycarbonate has a relatively low Abbe value (~30), so this is NOT one of its properties; it is impact resistant, UV-blocking, and lightweight. The low Abbe value is the trade-off for its safety advantages.

69. D — An executive-style bifocal. The executive bifocal's full-width near segment gives the widest near field for drafting work. Round segments and shallow progressives offer narrower zones.

70. B — An anti-reflective coating. Because high-index lenses reflect more light, an anti-reflective coating best offsets that increased reflection. It recovers transmission and reduces glare.

71. A — Driving behind a windshield. Most photochromics activate via UV, which a windshield largely blocks, so they darken less while driving. This is a key limitation to disclose.

72. D — A child who plays contact sports. A child in contact sports most needs impact-resistant polycarbonate for safety. Thinness, economy, and Abbe value are secondary to impact protection.

73. C — Cosmetic and sun applications. A gradient tint is most often chosen for cosmetic and sun applications, with its darker-top design. It does not correct astigmatism or eliminate reflections.

74. D — They have a fixed optical-center spacing. OTC readers have a fixed optical-center spacing, unlike a custom prescription pair, which can induce prism if it does not match the PD. They cannot correct astigmatism or provide different powers per eye.

75. B — A higher Abbe value. A patient sensitive to peripheral color fringing is better served by a higher-Abbe material, which produces less chromatic aberration. The trade-off is a thicker lens for the same power.

76. A — The back vertex power of a lens. The lensmeter measures back vertex power — sphere, cylinder, axis, add, and prism — and locates the optical center. It is the central instrument for verifying finished lenses.

77. C — Surface curvature in diopters. A lens clock measures the curvature of a lens surface in diopters and is the primary tool for checking base curve. It reads one surface at a time, not total power.

78. D — Vertex distance to the cornea. The distometer measures the vertex distance — the gap from the back of the lens to the cornea. This is used for vertex compensation in higher-powered prescriptions.

79. B — Pupillary distance. A corneal reflex pupillometer measures the patient's PD using the corneal light reflex. PD determines optical-center placement.

80. D — Back vertex power. Spectacle power is specified as back vertex power, so the lens is placed back-surface against the lensmeter stop. Reversing it introduces error in higher powers.

81. B — Displacement of the target from the reticle center. Prism is indicated when the lensmeter target is displaced from the reticle center, with the amount and direction giving its magnitude and base. A centered target indicates the optical center.

82. B — Power reading is not perfectly accurate. A lens clock is calibrated to one assumed index, so on a different-index lens it measures curvature faithfully but the power reading is not exact. The curvature itself is read accurately.

83. C — Subtracting the distance reading from the near reading. The add power equals the near zone reading minus the distance zone reading, since the add is the additional near plus power. It is obtained by difference, not read directly.

84. D — The material's Abbe value. A digital measurement system captures position-of-wear data — PD, pantoscopic tilt, vertex distance, seg height — but not the material's Abbe value, which is a material property. This makes Abbe value the exception.

85. A — The optical center. A centered, undisplaced lensmeter target indicates the instrument is reading through the optical center, where no prism is present. Displacement would indicate prism.

86. B — Size or perimeter. A circumference (lens) gauge measures a lens's size or perimeter, used in edging and sizing. It does not measure power, curvature, or thickness.

87. D — Lens thickness and small linear dimensions. Calipers measure lens thickness and small linear dimensions in millimeters. They do not measure power, PD, or UV transmission.

88. B — Displays the readings electronically. An automatic lensmeter displays its readings electronically once the lens is positioned, reducing operator variability. It measures the same back vertex parameters as a manual instrument.

89. A — Angle and position the nose pads. Pad-adjusting pliers grip and angle the nose-pad arms to position the pads. Matching the plier to its task protects both the frame and the fit.

90. C — Warming with a frame heater. Plastic (zyl) frames must be warmed before bending because cold plastic is brittle and can crack. The warmth lets the frame reshape and hold its new form.

91. A — Cold at room temperature. Metal frames are generally adjusted cold, unlike plastic frames which must be warmed first. Knowing which to heat is a practical distinction.

92. D — Protect the frame finish from marring. Padded nylon-jaw pliers grip frame parts without scratching the finish. Metal jaws on cosmetic surfaces would mar the frame.

93. B — Facial asymmetry. Monocular PDs measure each eye separately from the bridge center, improving accuracy when the face is asymmetric. This ensures each optical center aligns with its own pupil.

94. B — Pupillary distance. A millimeter ruler measures linear distances such as PD and seg height. It cannot measure power, curvature, or dispersion.

95. C — Form curves in metal components. Round-nose pliers are used to form curves and bends in metal frame parts. Each plier shape serves a specific adjustment task.

96. B — The lens clock. A lens clock measures a lens's surface curvature in diopters and is the primary tool for checking base curve. The other instruments measure vertex distance, PD, or lens size.

97. C — Lensmeter measures back vertex power. The lensmeter measures back vertex power; the other pairings are incorrect. Matching each tool to its true function is the testable skill.

98. C — Prescribed prism. A persistently displaced lensmeter target, even at the thickest point, indicates the lens contains prism. Coatings and treatments do not displace the target.

99. A — A purely spherical lens. A lens reading sphere power with no cylinder is purely spherical, having one power in all meridians. A spherocylindrical lens would show a second power and an axis.

100. D — Distometer. The distometer measures vertex distance, the gap from the back of the lens to the cornea, used for compensating high-powered prescriptions. The other instruments measure curvature, PD, or lens size.

101. D — The nose and the two ears. The fitting triangle's three points of support are the nose (bridge or pads) and the two ears (temples). Even weight distribution across these produces a comfortable, stable fit.

102. B — The bridge or nose-pad fit and temples. A frame that slides down points to the fitting triangle's support points — the bridge/nose pads and temples. Restoring even three-point support resolves the slipping.

103. C — The lower edge of the lens sits closer to the face. Pantoscopic tilt is the vertical tilt in which the lens's lower edge sits closer to the face than the top. A modest tilt aligns the lens with the downward line of sight.

104. C — Lowered relative to the pupil. As pantoscopic tilt increases, the optical center is lowered (roughly 1 mm per 2° of tilt) to keep the line of sight near the OC. Tilt and OC height are linked.

105. A — Lower eyelid margin. For most flat-top bifocal fits, the segment top is set at the lower eyelid margin so the patient sees over it for distance and into it for near. Setting it too high or low compromises vision.

106. A — Center of the pupil in primary gaze. A progressive lens's fitting cross is aligned with the pupil center in primary gaze so the power zones sit correctly. Fitting it too low places the reading area too far down.

107. B — Pupillary distance. PD determines where each lens's optical center must be placed to align with the pupil. Accurate PD prevents unwanted induced prism.

108. D — PD and optical-center placement. Headaches with correctly verified power suggest a centration error, so the optician checks PD and OC placement, which can induce prism. Centration is verified before blaming the prescription.

109. D — Base curve from the previous pair. A "swim" sensation with correctly verified power often signals a base-curve change from the patient's prior lenses. Matching the previous base curve helps a remake feel familiar.

110. B — Expected adaptation. Mild initial peripheral blur in a first-time progressive wearer is normal adaptation to the design, not a power error. Recognizing adaptation prevents an unnecessary remake.

111. C — Horizontal curvature around the face. Face-form (wrap) angle is the horizontal curvature of the frame front following the contour of the face. Significant wrap requires lens compensation to avoid distortion.

112. B — Too high relative to the lower lid. A bifocal segment that intrudes on distance vision was set too high relative to the lower-lid reference. Correct seg height places the top near the lower lid.

113. B — High (around 4.00 D or more). Vertex distance meaningfully affects effective power only in higher prescriptions, around 4.00 D and above. Low powers are not meaningfully affected.

114. D — Working distances and tasks drive selection. A lifestyle assessment matters because the patient's daily working distances and tasks, more than the prescription alone, determine the right lens design. The same Rx can call for different products.

115. C — A smaller, well-centered frame. Beyond high-index material, a smaller, well-centered frame most effectively reduces edge thickness for a strong minus prescription. A large frame or wide bridge keeps edges thick.

116. C — A centration error inducing prism. Double vision in correctly powered glasses most likely reflects a centration error inducing unwanted prism. Coatings, tints, and warranties do not cause diplopia.

117. A — An intermediate zone (trifocal or progressive). Good distance and near but blurry arm's-length vision indicates a missing intermediate zone, supplied by a trifocal or progressive. A tint or stronger distance does not address it.

118. D — Place the OC before the pupil and avoid induced prism. Correct centration places the optical center in front of the pupil so no unwanted prism is induced in primary gaze. This is the core purpose of accurate centration.

119. B — Optically compensated for the wrap. Moving to a high-wrap frame with a strong prescription requires lenses optically compensated for the wrap to avoid peripheral distortion. Thickness changes and blank size do not address the wrap optics.

120. C — Vertical (B) measurement depth. A progressive needs adequate vertical (B) depth to fit its distance, intermediate, and near zones. A too-shallow frame cuts off the near area.

121. B — Back vertex power. Spectacle prescriptions and lensmeter verification use back vertex power, referenced to the surface nearest the eye. This is why the lens is read back-surface against the stop.

122. D — Within the allowed tolerance for that value. A finished lens is acceptable under ANSI Z80 when each parameter falls within its allowed tolerance, not when it matches every number exactly. "Within tolerance" is the practical standard.

123. D — FDA. The FDA requires that dress eyeglass lenses be impact resistant, regulating eyewear as a medical device. This is distinct from the ANSI Z87 occupational standard.

124. C — Occupational safety eyewear. ANSI Z87 governs occupational and educational safety eyewear, distinct from ANSI Z80 for dress lenses. It imposes stricter impact and protection requirements.

125. A — The privacy of patient health information. HIPAA protects the privacy and security of a patient's health information, including prescriptions and personal data. It governs how records are stored, accessed, and disclosed.