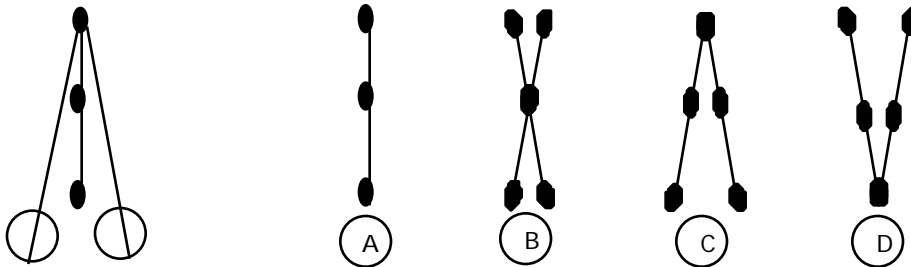


**Final Examination**

April 28, 2000

1. Which of the following statements about binocular vision are correct?
  - A. Binocular vision is important because without it a person will have no depth perception.
  - B. If a person loses one eye, their visual field (binocular) will be reduced to one half (monocular).
  - C. Stereopsis is the only advantage of binocular over monocular vision.
  - D.** Stereopsis makes the greatest contribution to depth perception at near rather than far distances.
  
2. An understanding of the parvo and magno cellular pathways is relevant to all of the following topics in clinical optometry EXCEPT,
  - A. early diagnosis of primary open angle glaucoma.
  - B. vision therapy for dyslexic patient.
  - C. age related cataract.
  - D. degenerative diseases of the peripheral retina.
  
3. Which of the following correctly lists the location of important synapses the human magnocellular pathway?
  - A. LGN dorsal (#3,4,5,6) layers; V1 layer IVC-beta; V1 layers II and II; V2; V4 (color area); IT (form)
  - B.** LGN ventral (#1,2) layers; V1 layer IVC-alpha; V1 layer IVB; V2; V5 (MT)
  - C. LGN dorsal (#3,4,5,6) layers; V1 layer IVC-alpha; V1 layers II and II; V2; V4 (color area); IT (form)
  - D. LGN ventral (#1,2) layers; V1 layer IVA; V1 layer IVB; V1 layer IVC; V1 layer IVD.
  
4. Which of the following is most closely associated with oculocentric localization?
  - A. the ultimate sense of binocular visual direction.
  - B.** local sign
  - C. direction relative to a point midway between the eyes.
  - D. proprioceptive input from the extraocular muscles
  
5. When binocularly increasing BI or BO prism in a clinical test of a fusional vergence, a person who starts to suppress will notice that the target begins to move to the side. Why?
  - A. Prism moves the image off the fovea of the fixating eye, so it appears to move to the side.
  - B. The suppressed eye moves to its phoria position and sends local sign information, which combines with local sign information from the fixating eye to give the perception of movement.
  - C. When fusion is lost, a version movement begins as the fixating eye follows the target. Proprioceptive data combines with local sign data from the fixating eye to give the perception of movement.
  - D. After suppression, the magnocellular tract becomes more dominant, and since it specializes in motion perception, the person begins to observe apparent movement of the object.

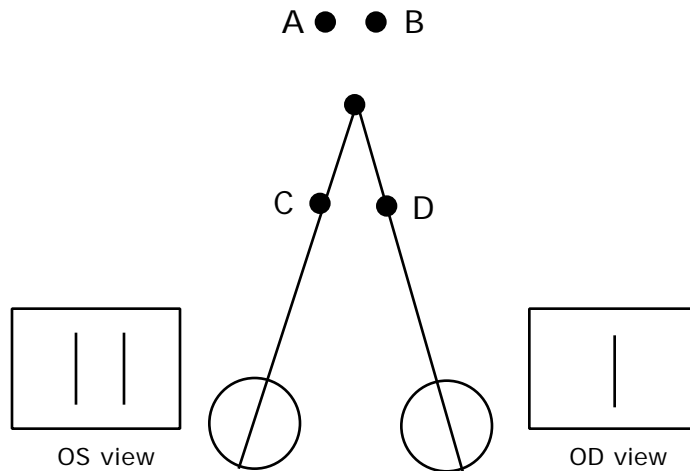
6. Which of the following correctly describes crossed disparity?
- A. The kind of retinal disparity associated with an object which is located closer than the fixation point.
  - B. The object seen by the right eye appears to the right and the one seen by the left eye appears to the left.
  - C. The kind of retinal disparity associated with an object that is located beyond than the fixation point.
  - D. The kind of disparity that is associated with uncrossed diplopia.



7. When a person binocularly fixates the far bead of a Brock string (left figure, above), based on the laws of visual direction, which of the four figures to the right best illustrates what they should perceive? Single circles represent cyclopean eyes.

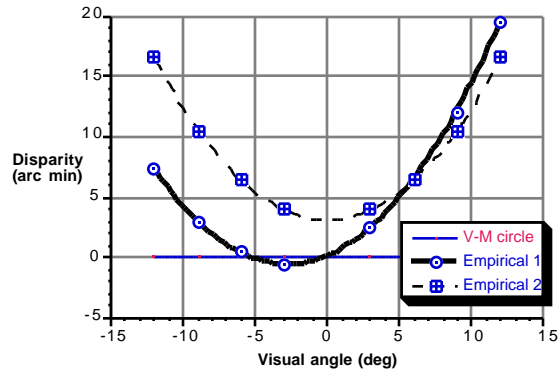
**Your answer:**

**B**

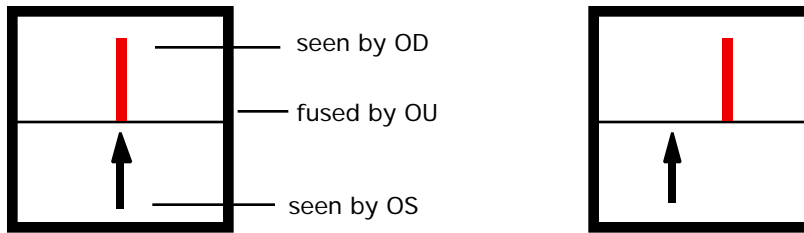


8. The figure above shows an example of the minimum stimulus needed to create a sense of stereopsis in a haploscope (Panum's limiting case). Referring to the dots, where in space would the non-fixated object appear to be?
- A. Either position A or B.
  - B. Either position C or D.
  - C. Either position A or D.
  - D. Either position B or C.

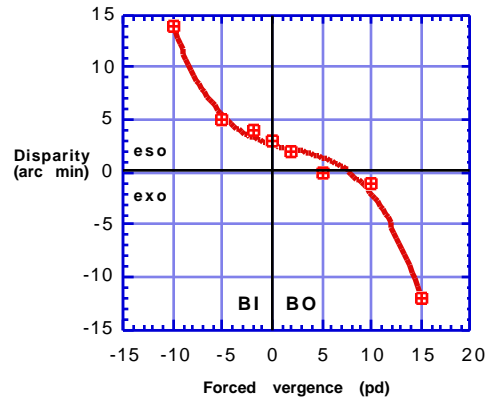
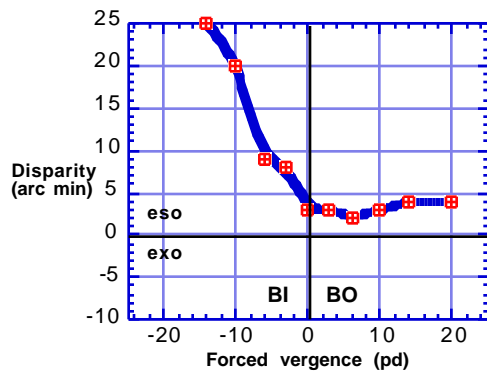
9. Which of the following is NOT a correct description of disparity vergence?
- A. It makes the largest contribution to angular convergence when the eyes shift fixation from far (6 meters) to near (40 cm).
  - B. It is the only form of vergence that is stimulated by retinal disparity.
  - C. It is supported by separate fine and coarse disparity vergence control centers in the brain.
  - D. When it falls short of perfect fixation, it the person will have a fixation disparity.
10. A microbiologist complains that whenever he spends long hours using a binocular microscope he has headaches and eye strain, but he has no problems with normal reading. This might be due to ...
- A. overconvergence caused by proximal convergence.
  - B. a conflict between oculocentric and egocentric visual directions
  - C. an uncorrected refractive error
  - D. suppression in one eye secondary to strabismus.
11. Which of the following DO NOT describe the Veith-Müller circle?
- A. It is a theoretical horopter.
  - B. It includes the fixation point and two nodal points of the eyes.
  - C. Objects located on the circle should always stimulate corresponding points.
  - D. It becomes flat (fronto-parallel) at the abathic distance.
12. Which of the following may account for the Hering-Hillebrand deviation?
- A. The spherical shape of the two retinas.
  - B. Corresponding points in the two retinas are probably not symmetrically distributed.
  - C. The nodal points and centers of rotation do not coincide in each eye.
  - D. There is a disagreement between directional and sensory dominance tests.
13. Why is the Nonius horopter considered a more true measure of the empirical horopter than the AFPP method?
- A. It gives results that are closer to the Veith-Müller circle.
  - B. It locates the points in space that have identical visual directions in the two eyes.
  - C. It uses a separate rod for each eye.
  - D. It assumes nasal-temporal and right-left symmetry of local signs between in two eyes.



14. The longitudinal horopter for two subjects was measured, and disparity relative to the Veith-Müller circle was plotted as a function of eccentricity (or visual angle), as shown in the figure above (a Shipley-Rawling plot). The dashed curve (Empirical 2) shows that the subject has ...
- an enlarged retinal image in the left eye.
  - B.** an exo fixation disparity.
  - a small associated phoria.
  - a Type I fixation disparity.
15. Referring to the same figure, the dark curve (Empirical 1) shows that the subject has ...
- an enlarged retinal image in the left eye.
  - B. an exo fixation disparity.
  - C. An enlarged retinal image in the right eye
  - D. a type I fixation disparity.
16. Referring to the Empirical 2 curve in the same figure, compute the point in space where the visual axes cross relative to the fixation point. Assume that the PD is 64 mm, and the fixation point was located at 40 cm.
- A. At the fixation point.
  - B. Approximately 0.5 mm beyond the fixation point.
  - C. Approximately 3.2 mm nearer than the fixation point.
  - D.** Approximately 3.2 mm beyond the fixation point.
17. What is the approximate width of Panum's area in terms of retinal disparity in front of or behind the fixation point, assuming no fixation disparity and a static target?
- A.  $\pm 10$  arc seconds
  - B.**  $\pm 10$  arc minutes
  - C.  $\pm 100$  arc minutes
  - D.  $\pm 1000$  arc minutes

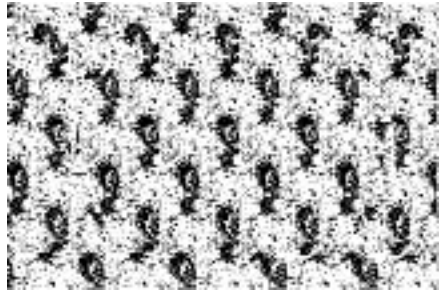


18. A polarized target is designed with fixed (non-moveable) lines as shown by the left figure above; the right eye sees the upper line, the left eye sees the lower arrow and both eyes see and fuse the square frame. Which of the following corresponds with the right figure?
- eso fixation disparity based on the Wesson card strategy
  - exo fixation disparity based on the Wesson card strategy
  - eso fixation disparity based on the Sheedy Disparometer strategy
  - exo fixation disparity based on the Sheedy Disparometer strategy
19. A device is designed with moveable lines, so that with no fixation disparity the target looks like the left figure shown above Question 18. When person with a certain fixation disparity shifts the lines to the positions shown in the right figure, they appear aligned to the patient. Which of the following corresponds with this condition?
- eso fixation disparity based on the Wesson card strategy
  - exo fixation disparity based on the Wesson card strategy
  - eso fixation disparity based on the Sheedy Disparometer strategy
  - exo fixation disparity based on the Sheedy Disparometer strategy
20. Under ideal conditions, what is the stereoscopic threshold?
- 2-10 arc seconds
  - 2-10 arc minutes
  - 20-40 arc seconds
  - 20-40 arc minutes
21. In a 5-year-old patient who is difficult to examine, you are able to measure a stereo acuity of 40 arc seconds using random dot stereograms. What does this tell you about the patient?
- Only that they are not suppressing.
  - Only that they probably do not have amblyopia.
  - Only that they are capable of normal motor fusion (no strabismus).
  - All of the above, plus they are capable of Worth grade three fusion.



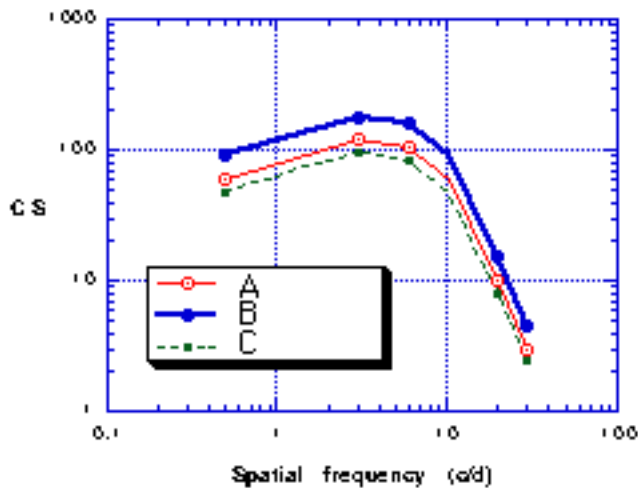
22. On a plot of fixation disparity as a function of the power of base-in (left side of graph) or base-out (right side of graph) prisms, most subjects exhibit ...
- an “L”-shaped curve with increasing eso fixation disparity with BI prism but a nearly constant level of fixation disparity with BO prism. (left figure, above)
  - B.** a sigmoid function with increasing eso fixation disparity with BI prisms but increasing exo fixation disparity with BO prisms. (right figure, above)
  - an “L”-shaped curve with increasing exo fixation disparity with BO prism but a nearly constant level of fixation disparity with BI prism. (mirror image of left figure, above)
  - a sigmoid function with increasing eso fixation disparity with BO prisms and exo fixation disparity with BI prisms. (mirror image of right figure, above)
23. Refer to the right figure above Question 22. Which of the following correspond with that plot?
- Type II response, associated phoria = ~7 prism diopters, fixation disparity = ~3' eso
  - Type I response, associated phoria = ~3 prism diopters BO, fixation disparity = ~7' eso
  - C.** Type I response, associated phoria = ~7 prism diopters BO, fixation disparity = ~3' eso
  - Type I response, associated phoria = ~7 prism diopters BI, fixation disparity = ~3' exo
24. The stereoscopic disparity specified for the fly in the Titmus stereo test is 300 arc seconds. If the test is designed to be used at 40 cm, for a person with a PD of 64, how high should the wings appear to be off the page (assuming that the 300 arc seconds applies to the wings)?
- ~218 mm
  - B.** ~3.6 mm
  - ~2.1 mm
  - ~0.36 mm
25. For a person with a PD of 60 and a stereoacuity of 40 arc seconds, what is the maximum distance at which they can judge depth using stereopsis?
- ~5 meters
  - ~30 meters
  - C.** ~300 meters
  - ~500 meters

26. What important principle was demonstrated by the random dot stereograms of Julesz?
- A. Form perception and stereopsis are probably processed by the same center in the brain.
  - B. Two identical random dot patterns can stimulate stereopsis.
  - C. Vertical disparity contributes to stereopsis.
  - D. Monocular form perception is not required for a person to perceive stereopsis.



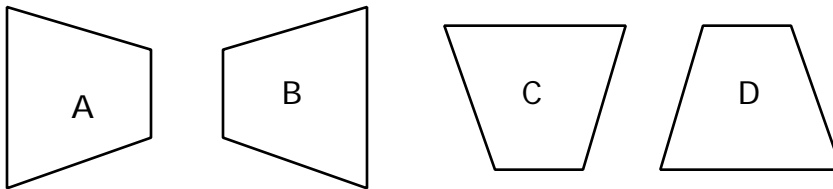
27. The figure above is a famous autostereogram designed by Dr. Christopher Tyler (1979). Of the following principles, which one is NOT important for making an autostereogram such as this?
- A. The image should contain a regular repeating pattern.
  - B. The pattern should be polarized so one eye sees one part and the other eye sees the rest.
  - C. The eyes should over or underconverge one pattern width.
  - D. When viewed correctly the retinal images should contain disparities which stimulate stereopsis.
28. When a neutral density filter is placed over the right eye, while a subject views a pendulum swinging from left to right, it should appear to
- A. curve inward, toward the person.
  - B. curve outward, away from the person.
  - C. slow down slightly, while remaining in the fronto-parallel plane.
  - D. become slightly brighter than the monocular view seen by either eye.
29. When looking at red/green stereoscope images of natural scenes, reversing the anaglyph glasses does not cause a noticeable depth reversal, as is seen with simple line figures. Why?
- A. The stereoscopic disparities in natural scenes are so large that reversing the glasses does not change the actual disparity in the retinal images.
  - B. Red/green figures are ineffective for creating binocular disparity. Reversal would be noticed if polarized targets were used.
  - C. Monocular depth cues are so strong that when contradicted by stereoscopic disparity, the brain favors the monocular cues.
  - D. The reasons for this is unknown and is referred to as Fechner's paradox.

30. Which of the following statements about suppression is NOT correct?
- Foveal suppression eliminates confusion, while peripheral suppression eliminates diplopia.
  - High contrast features tend to suppress low contrast features.
  - Peripheral images tend to suppress foveal images.
  - Clear images tend to suppress blurred images.
31. Using Bagolini lenses to test the relative depth of suppression, you find that OS is suppressed using a 1.0 ND filter, but OD is suppressed using a 2.0 ND filter. Based on this, which eye is probably the sensory dominant eye?
- OD
  - OS
  - Either eye is equally likely to be the dominant eye.
  - Not enough information. It will depend the results of a directional dominance test.



32. The contrast sensitivity of a normal, healthy emmetrope was tested under the following conditions: 1) binocular best corrected; 2) OD monocular best corrected; 3) binocular OD best corrected, OS blurred by + 2.50 diopters. According to what you would normally expect, which of the curves is most likely the binocular best corrected contrast sensitivity function?
- Curve A.
  - Curve B.
  - Curve C.
  - Any of the curves
33. With respect to apparent brightness, Fechner's paradox suggests that binocular sensory integration is based upon
- right-eye, left-eye sensory independence
  - linear summation
  - facilitation
  - averaging

34. After testing a monovision patient's sensory dominance at far and near, you decide to put the near correction on the right eye. Which of the following results is consistent with this plan?
- With the distance Rx in place, a directional dominance indicates that the right eye is dominant at far.
  - With the distance Rx in place, the distance binocular visual acuity is better when a +1.50 lens is placed over the left eye.
  - With the distance Rx in place, the distance binocular visual acuity is better when a +1.50 lens is placed over the right eye.
  - With the near Rx in place, the near binocular visual acuity is better when a -1.50 lens is placed over the right eye.
35. In vision therapy clinic you are working with a patient who can achieve Worth grade 1 fusion, but you want to train the patient at the level of Worth grade 2 fusion. Among the following synoptophore slides, which is most appropriate?
- A dog and a house.
  - A clown with a hat and the same clown with a bow tie.
  - A pair of slides with matching concentric rings, except some inner rings are slightly displaced in one.
  - A pair of stereoscopic photographs of a real clown holding some balloons.



36. Based on what we learned about the expected space distortion caused by anisometric spectacle prescriptions, what type of distortion should a person experience with the following Rx: OD - 1.00 -2.00 x 180, OS -3.00 sphere. Refer to the figures above.
37. Similarly, what type of distortion should a person experience with the following Rx: OD - 2.00 -3.00 x 045, OS -2.00 -3.00 x 135. Refer to the figures above Question 36.

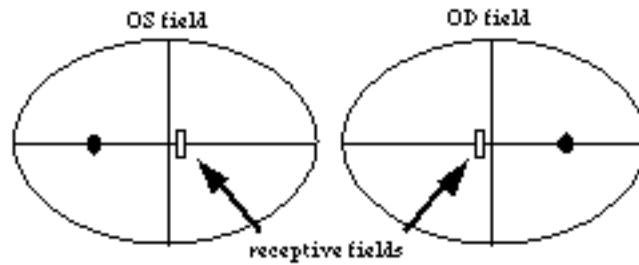
**Your answer:**

**B**

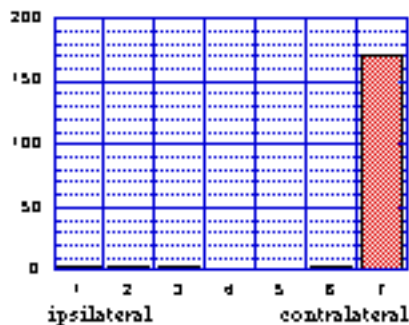
**Your answer:**

**D**

38. According to Knapp's law, aniseikonia should be less if
- an axial anisometropia is corrected with contact lenses rather than spectacles.
  - both axial and refractive anisometropia are corrected with contact lenses rather than spectacles.
  - a refractive anisometropia is corrected with contact lenses rather than spectacles.
  - a refractive anisometropia is corrected with spectacles rather than contact lenses.

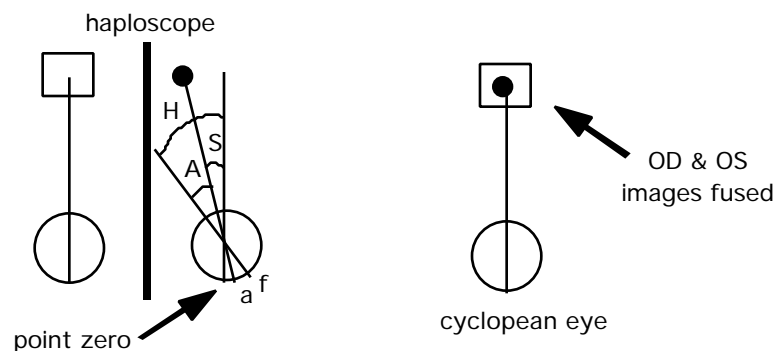


39. A trained monkey maintains straight ahead fixation on a point 60 cm away, while you record from a neuron in the visual cortex. The location of the receptive fields for the right and left eye are shown above (both tested at 60 cm). Which answer best describes the neuron?
- The neuron is a monocular neuron since it is sensitive to a stimulus in either the right or left eye, but they are in non-corresponding locations.
  - The response shown in the figure cannot be correct since it is impossible for a single neuron to have receptive fields in non-corresponding locations.
  - The neuron is binocular and specifically tuned to detect an object in space with a certain amount of uncrossed disparity (located beyond the fixation point).
  - The neuron is binocular and specifically tuned to detect an object in space with a certain amount of crossed disparity (located nearer than the fixation point).

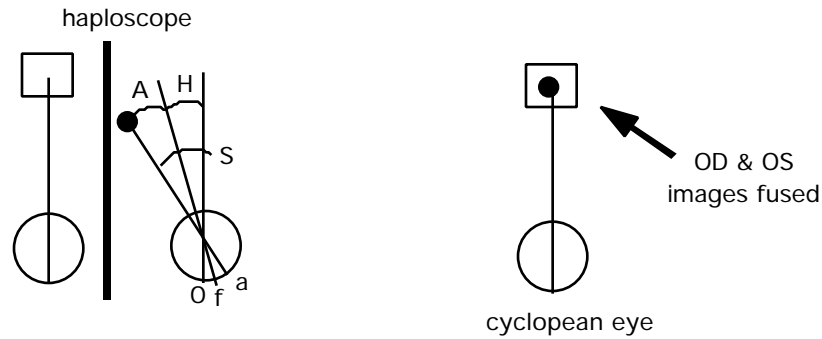


40. Which of the following conditions, if present during much of the critical period, would most likely result in an ocular dominance histogram like the one shown above?
- Alternating esotropia
  - Complete monocular deprivation of the contralateral eye.
  - Complete monocular deprivation of the ipsilateral eye.
  - Normal binocular development.
41. A relatively normal level of stereoacuity of about 60 arc seconds indicates that the patient is also capable of normal motor fusion and all levels of sensory fusion below stereopsis. What is the youngest age at which a child would normally be capable of these binocular functions?
- By about 6 months of age.
  - By about 1 year of age.
  - By about 3 years of age.
  - By about 6 years of age.

42. Which of the following is NOT characteristic of infantile esotropia?
- A face turn away from the strabismic eye.
  - A preference for following objects moving nasally.
  - Nystagmus when fixating stationary objects.
  - Onset at 1-2 years of age accompanied by a large hyperopia.
43. Which of the following is characteristic of microstrabismus, also known as monofixation syndrome?
- These patients are incapable of binocular fusion.
  - These patients frequently complain of difficulty reading.
  - Surgery is usually required if this condition is present.
  - It is a small residual deviation following strabismus surgery.
44. Which of the following would cause you the greatest concern if noticed in a 3 month older infant?
- unstable ocular alignment with an intermittent exotropia
  - equal preference for a random dot stereogram with 300 arc seconds of disparity and a flat pattern of random dots
  - constant unilateral esotropia
  - preference for smooth pursuits in the nasal direction
45. Which of the following is true about amblyopia in humans?
- The magnocellular system is more severely affected by optical defocus than the parvo system.
  - Any strabismus must be surgically corrected before prescribing a correction for any refractive error.
  - A congenital cataract will cause pattern deprivation and severe irreversible amblyopia if not surgically removed by about 3 months of age.
  - Treatment should include direct occlusion of the amblyopic eye to preserve superior vision in the dominant eye.
46. Eccentric fixation ...
- occurs only under monocular conditions.
  - is a condition in which the subjective and objective angles of strabismus are not equal.
  - is a condition in which the fovea in one eye corresponds with a non-foveal point in the other eye.
  - is present when one eye fixates with a non foveal point during either monocular or binocular viewing.

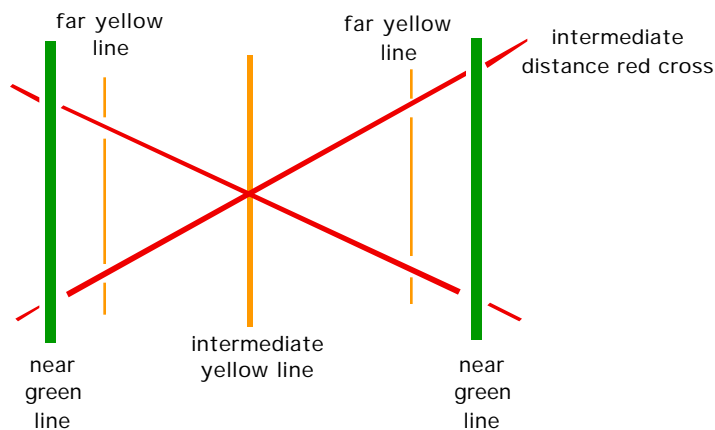


47. What kind of anomalous correspondence is illustrated by the figure above?
- A. harmonious
  - B. typical unharmonious**
  - C. paradoxical type I
  - D. paradoxical type II



48. What kind of anomalous correspondence is illustrated by the figure above?
- A. Harmonious
  - B. Typical unharmonious**
  - C. Paradoxical type I
  - D. Paradoxical type II**

49. Which of the following test would be most useful in designing the proper LASIK ablation contour to correct the higher order aberrations of the eye?
- A. wavefront analysis of corneal topography
  - B. Shack-Hartmann wavefront sensor measurements of the eye's optics**
  - C. a very accurate spherocylindrical refraction
  - D. the best corrected contrast sensitivity function



50. When testing aniseikonia using an Eikonometer, what should the patient observe if he has an overall magnification in the right eye?
- A. Vertical lines appear further away on the right side, but the cross will be normal.
  - B. Vertical lines and the cross appear further away on the right side.
  - C. Vertical lines appear normal but the cross is tilted away from the right side.
  - D. Vertical lines appear normal but the cross is tilted away at the top.
51. When observing a small stationary light in a dark room, it may appear to move about. This is a demonstration of ...
- A. biological motion
  - B. self-motion
  - C. autokinesis
  - D. Induced motion

Record answers here. You may tear this page off and keep it when you are done.

Q.	A.	Q.	A.
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