

Name \_\_\_\_\_

*Vision Science IV - Binocular Aspects of Vision*

**Examination 2**

(3/24/2000)

This exam has 30 questions for a total of 50 points. **READ CAREFULLY** and chose the best answer in the four alternative forced choice (4AFC) questions. Other answers should be brief and to the point.

1.	When correcting refractive errors with spectacles or contact lenses, optometrists and ophthalmologists generally ignore the influence of pupil size on vision. Which of the following is true? (1)
A.	Pupil size is also not a significant clinical consideration in refractive surgery.
B.	Pupil size should be considered since diffraction increases with pupil size, and it may degrade vision.
C.	<b>Pupil size should be considered since aberrations increase with larger pupils, and they may degrade vision.</b>
D.	In the CustomCornea procedure, the surgeon should center the ablation on the pupil after full dilation.

2.	The key to ablating aberration-free contours in refractive surgery is ... (1)
A.	knowledge of the spherocylindrical refractive error for both large and small pupils
B.	real time corneal topography guided lasers
C.	contrast sensitivity test rather than standard Snellen visual acuity data
D.	<b>wavefront sensor guided lasers</b>

3.	The Shack-Hartmann sensor is a ophthalmic instrument that is designed to measure ... (1)
A.	microsaccadic eye movements during refractive surgery.
B.	<b>optical quality of the human eye.</b>
C.	low contrast letter acuity of postoperative LASIK and PRK patients.
D.	the corneal wavefront aberration function.

4.	According to Landy (1995), how does the visual system process depth cues, when it has access to a large amount of monocular and binocular depth data, some of which may conflict? (1)
A.	It averages distance estimates from all of the cues for the final distance estimate.
B.	In the case of a conflict, it ignores monocular cues and gives preference to stereopsis.
C.	Significant conflict between depth cues leads to a system break-down and loss of depth perception.
D.	<b>Different cues are weighed differently, and some are even ignored when calculating the final distance estimate.</b>

5. Write the formula to compute the angle of disparity ( $\eta$ ) based on the minimum distance that an object must be moved nearer or farther than a fixation point, in order to be seen in stereopsis. (1)

$$\eta = \frac{PD(\Delta D)}{D^2}$$

6.	Under ideal test conditions, what is the stereoscopic threshold? (1)
A.	<b>2-10 arc seconds</b>
B.	2-10 arc minutes
C.	20-40 arc seconds
D.	20-40 arc minutes

7.	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)? (1)
A.	~ 0.04 mm
B.	~ 2.1 mm
C.	<b>~ 3.6 mm</b>
D.	~ 208 mm

8.	If a person has their right eye only dilated, and they carefully observe an object travel in the fronto-parallel plane from left to right, the object should appear to ... (1)
A.	remain in the fronto-parallel plane.
B.	<b>move away from the person as it approaches the midline.</b>
C.	move toward the person as it approaches the midline.
D.	oscillate in and out as it approaches the midline.

9.	Sometimes, when viewing a color slide with red and blue letters against a black background, the red and blue letters appear to be at different distances in space. What basic principle explains this phenomenon? (1)
A.	Neurons from the retina conduct data at a slightly slower rate for dim than for bright images.
B.	Binocular sensory integration is based on brightness averaging.
C.	probability summation
D.	<b>Different wavelengths are refracted differently for light entering the eye off the optic axis.</b>

10. What is Fechner's paradox and what does it show about binocular interactions? (2)

**While viewing an object binocularly, if you put a ND filter in front of one eye, it may appear to become slightly darker. This suggests that the visual system averages the monocular brightnesses when it computes the binocularly perceived brightness.**

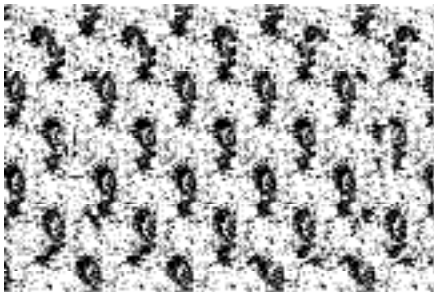
11.	If a military pilot has a PD of 68 and a stereoacuity threshold of 20 arc seconds, what is the maximum distance that they can use stereopsis to judge relative distances? (1)
A.	~ 10,000 meters
B.	~ 1200 meters
C.	<b>~ 700 meters</b>
D.	~ 330 meters

12.	What is hyperstereopsis? (1)
A.	<b>enhanced stereopsis from an optically enlarged PD</b>
B.	point by point matching of features to compute local stereoscopic disparity
C.	stereopsis associated with vertical phorias
D.	stereoacuity thresholds better than 10 arc minutes

13. Complete the following table, which summarizes certain characteristics of fine and coarse stereopsis. (4)

Stereopsis subtype	Spatial freq specialty	Disparity range	Temporal specialty	Neural pathway
Fine stereopsis	<b>high</b>	< 30 arc minutes	<b>stationary, slow</b>	<b>parvo</b>
Coarse stereopsis	<b>low</b>	<b>&gt; 30 arc min</b>	<b>moving targets</b>	<b>magno</b>

14.	What important principle was demonstrated by the random dot stereograms of Julesz? (1)
A.	<b>Monocular form perception and stereopsis are processed by different centers in the brain.</b>
B.	Monocular form perception must precede stereopsis in visual processing.
C.	Two identical random dot patterns can stimulate stereopsis.
D.	Objects located on the horopter stimulate disparate retinal points.

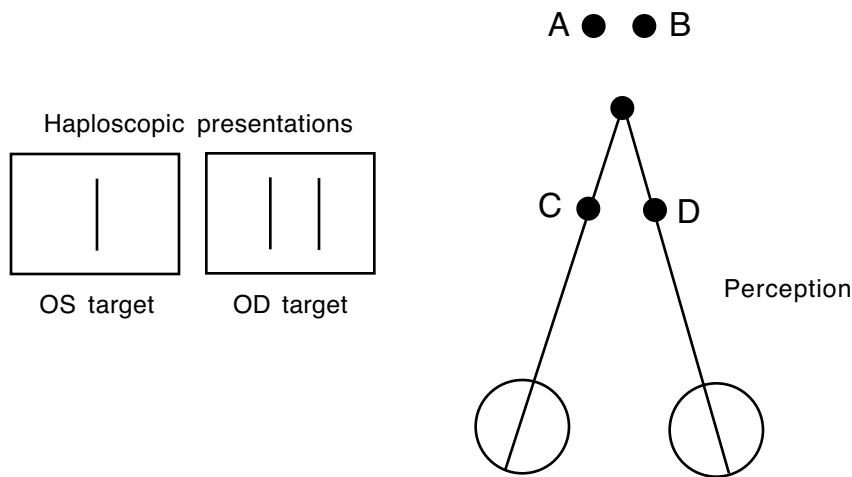


15. Above is an example of a famous autostereogram created by Dr. Christopher Tyler (1979). Outline the basic principles of how an autostereogram works. (3)

**repetitive pattern, eyes converge/diverge one repetitive width, disparity on the retina stimulates stereopsis**

16. Why are stereoacuity threshold tests so useful in pediatric eye examinations? (2)

**These tests are easy to perform, and if the child can successfully identify the object stereoscopically, you know that they have achieved all the lower levels of fusion.**



17.	The figure above shows an example of the minimum stimulus needed to create a sense of stereopsis in a haploscope. Referring to the right figure, where in space would the non-fixated object appear to be? (1)
A.	Position B only.
B.	Position C only.
C.	<b>Either position B or C depending on fixation.</b>
D.	Either position A or D depending on fixation.

18. Describe how you would use Bagolini lenses and ND filters to grade the relative suppression proneness in the two eyes. (3)

**When a patient wears the Bagolini lenses and views a point of light, they see a cross pattern. Add ND filters of increasing optical density before one eye and record the value of the minimum optical density, which causes one branch of the cross to disappear. Repeat the procedure with the other eye. The eye which took the lower optical density is the one that is more easily suppressed.**

19. For each of the following pairs of words, circle the retinal image characteristics that would dominate, or tend to suppress the other in a case of binocularly rivalry. (5)

dark	bright
low contrast	high contrast
blurred image	clear image
foveal image	peripheral image
pattern	homogeneous field

20. When viewing red-green random dot stereograms with anaglyph glasses, the depth contours seem to reverse when the glasses are flipped, but this generally does not occur when viewing stereograms of natural scenes. Why? (2)

**Natural scenes contain abundant monocular depth cues, which conflict with the stereoscopic depth contour if the glasses are worn incorrectly. The brain must reconcile the conflicting cues; it usually favors the monocular cues and ignores the erroneous stereoscopic interpretation of depth, which may be absurd.**

21. If binocular summation is strictly due to the increased probability of detection because two rather than one eye is used (probability summation), how much would you expect binocular sensitivity to improve over monocular sensitivity? (1)

**It should be about 1.5 times greater.**

22.	Probability summation is evident when comparing binocular to monocular contrast sensitivity, when both eyes are well corrected. When one eye is gradually blurred, binocular contrast sensitivity ... (1)
A.	remains unchanged.
B.	gradually decreases but never falls below the monocular level.
<b>C.</b>	<b>gradually decreases and may fall below the monocular level.</b>
D.	Paradoxically, improves slightly until about 1.50 diopters of blur, then drops to the monocular level.

23.	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? (1)
A.	With the distance Rx in place, the distance binocular visual acuity is better when a +1.50 lens is placed over the left eye.
<b>B.</b>	<b>With the distance Rx in place, the distance binocular visual acuity is better when a +1.50 lens is placed over the right eye.</b>
C.	With the near Rx in place, the near binocular visual acuity is better when a -1.50 lens is placed over the right eye.
D.	With the distance Rx in place, a directional dominance indicates that the right eye is dominant at far.

24.	While maintaining binocular fusion, as base out prism is added before both eyes, the object will appear to ... (1)
<b>A</b>	<b>move closer and become smaller.</b>
B	move closer and become larger.
C	move farther and become smaller.
D	move farther and become larger.

25. Sometimes an overall magnification before one eye causes less aniseikonia than a horizontal only magnification before the same eye. Why? (2)

**An overall magnification would cause both an induced and geometric effect, which cancel each other out.**

26. Describe what features must be included in a pair of Synoptophore slides designed to stimulate only Worth Grade 1 fusion (Maples Grade 1 and 2). (2)

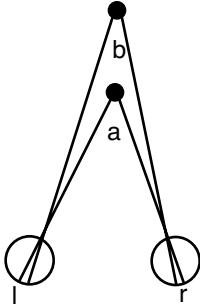
**The right and left slide must have different images, with no overlap and no common features.**

27. Describe what features must be included in a pair of Synoptophore slides designed to stimulate only Worth Grade 2 fusion (Maples Grade 3). (2)

**Some common fusible features but no disparity.**

28. Describe what features must be included in a pair of Synoptophore slides designed to stimulate only Worth Grade 3 fusion (Maples Grade 3). (2)

**Common fusible features with some disparities that can stimulate stereopsis.**



29.	Referring to the absolute value of the angles indicated on the figure above, the stereoscopic disparity may be computed as ... (1)
A	the difference between angles a and b only.
B	the sum of angles a and b only.
C	<b>the sum of angles r and l or the difference between angles a and b.</b>
D	the sum of angles r and l only.

30. When binocularly increasing BI or BO prism before the eyes in a clinical test of a person fusional vergence ability (BI or BO to blur/break/recover), a person who starts to suppress will notice that the target begins to move to the side. Why? (4)

**As long as the person is fusing, BI and BO prism stimulate vergence movements of both eyes which are equal in magnitude, but opposite in direction. Since both eyes keep bifoveal fixation, the local sign information from both eyes indicates a visual direction of straight ahead, and the proprioceptive data from the two eyes cancel each other out. The net result is that, during fusion the object still appears straight ahead. When one eye suppresses, that eye swings to its phoria position, and as prism is increased before the fixating eye, both it and the suppressed eye will move in the direction of the prism. Local sign data from the fixating eye still indicate a direction of straight ahead, but the proprioceptive data from both eyes now signals that the eyes are moving in the direction of the prism.**