

84

14 JUN 2023

**BINDURA UNIVERSITY OF SCIENCE EDUCATION**

**FACULTY OF SCIENCE AND ENGINEERING**

**DEPARTMENT OF OPTOMETRY**

**BACHELOR OF SCIENCE HONOURS DEGREE IN OPTOMETRY**

**CANDIDATE NUMBER:**

--	--	--	--	--	--	--	--	--	--

**OPT/207. CONTACT LENS 1**

**TIME 3 HOURS.**

**(100 Marks)**

**INSTRUCTIONS:**

- This paper contains 2 (two) sections.
- Answer all 40 questions in section (1) on this paper and any 3 questions in Section two (2) in the Examination Booklet. Set your answers on separate sheets.

**SECTION (1) ANSWER ALL QUESTIONS (1 MARK)**

1. Which statement best describes a contact lens?
  - (a) It is an optical appliance that is used together with spectacles to correct vision.
  - (b) It is an optical device that corrects myopia only.
  - (c) It's an optical device used for either therapeutic, cosmetic or vision correction.
  - (d) It is an optical device that can only be made of glass for vision correction.
2. Which statement is true of contact lens materials?
  - (a) Rigid gas permeable lenses are heavier than PMMA lenses.
  - (b) Polymethylmethacrylate was the first material to be used for corneal lenses.
  - (c) Hydroxyethyl methacrylate has a lower water content than PMMA.
  - (d) Hydroxyethyl methacrylate is not a typical hydrogel lens material.
3. Which statement is true of the history of contact lenses (CL)?
  - (a) The first contact lens was a scleral made of glass in 1887.
  - (b) Leonardo da Vinci was the first to use the CLs for vision correction in 1508.
  - (c) The first practical contact lens design concept was by an astronomer in 1823.
  - (d) All of the above.
4. In optics which is true of scleral contact lenses?
  - (a) They are extended wear contact lenses that rest on the cornea.
  - (b) They have a scleral portion and an optic central part that covers the tear film.
  - (c) The scleral portion allows for sufficient gaseous exchange.
  - (d) The scleral lenses are no longer being used because of their design.

5. Which statement is true of the optics of contact lenses?
- (a) They are actually regarded as thick lenses.
  - (b) The power of the contact lens is found using the formula:  $F = F_1 + F_2$ .
  - (c) There is only one principal plane where all the refraction takes place.
  - (d) The hypothetical principal planes depend on the object position.
6. Which is not true of the power of contact lenses?
- (a) It is practical to measure the first principal focus of the contact lens.
  - (b) The second principal focus is easily accessible when measuring the contact lens power.
  - (c) The back vertex of the contact lens gives the back-vertex power.
  - (d) The center thickness is significant when calculating the power of a contact lens.
7. Which statement is true of the front vertex power in contact lenses?
- (a) It is used to specify the power of the haptic of scleral lenses.
  - (b) It is not related in any way to the neutralizing power of the lens.
  - (c) The formula for front vertex power is different from that of the back-vertex power.
  - (d) The center thickness and the refractive index are irrelevant when calculating the power.
8. Which statement is true of scleral lenses?
- (a) They can be pre-formed, lathe cut or they can be spin cast.
  - (b) The spin cast lenses have a plastic memory whilst the lathe made are not.
  - (c) Scleral lenses offer more stable vision than corneal lenses.
  - (d) All of the above.
9. Which statement best describes advantages of scleral lenses?
- (a) They can have multiple curves to suit the scleral and corneal profiles.
  - (b) Best for refractive error, cosmesis, anisometropia, astigmatism and corneal abnormalities.
  - (c) They offer a wider field of view, stable vision but poor tear circulation.
  - (d) All of the above.
10. Which statement is true of the cornea?
- (a) There principally 6 different cellular layers.
  - (b) The thickest layer is the stroma which is composed of collagen fibers.
  - (c) The endothelium is the innermost layer facing the aqueous humor.
  - (d) All of the above.
11. Which statement best describes corneal function?
- (a) Due to its clarity it offers the bulk part of refractive power of the eye.
  - (b) It provides 18 diopters of the total eye refraction.
  - (c) It does not play any significant role in refractive ametropia.
  - (d) There are blood vessels as well as nerves within the different layers.



12. Which statement best describes the corneal epithelium?
- (a) It is significant in maintaining water and solute balance of the cornea.
  - (b) It consists of 6 cell layers, starts from the conjunctiva and continually regenerates.
  - (c) It is not a derivative of the ocular surface ectodermal cells.
  - (d) all of the above.
13. Which statement is true of scleral contact lenses?
- (a) It is possible to have multiple curves which provide comfortable blending zones.
  - (b) A lens order should include the optic radius and the back-optic diameter.
  - (c) It is not practical to specify the cone angle and haptic chords.
  - (d) It is not possible to make an off-set lens when designing scleral lenses.
14. Which statement is true of corneal epithelium in contact lens wear?
- (a) Fluorescein stain is only possible when there wearing of the superficial cells.
  - (b) Damage to 3 or 4 layers is very rare when there is epithelial damage.
  - (c) The cell turn-over time is the period of cell regeneration of the superficial cells.
  - (d) All of the above.
15. Which statement is true of the human cornea?
- (a) The stroma is transparent due to the specific arrangement of the collagen fibers.
  - (b) The neural crest cells form the endothelium and stromal keratocytes.
  - (c) The endothelial cell count reduces with age and increases in sizes on cell loss.
  - (d) All of the above.
16. Which statement best defines the word deturgescence when referring to the cornea?
- (a) State of relative dehydration in a normal cornea to ensure state of transparency.
  - (b) A corneal state maintained by the epithelium due to its impermeability to water.
  - (c) It is a state maintained by a metabolic transport system in the endothelium.
  - (d) All of the above.
17. Which statement is not true of the human cornea?
- (a) Central and the peripheral corneal thicknesses are 0.52mm and 0.67mm respectively.
  - (b) The epithelium has a normal thickness of about 50-90  $\mu\text{m}$ .
  - (c) The endothelium has about 2400-3000 cells/ $\text{mm}^2$  and approximately 18-20  $\mu\text{m}$  thick.
  - (d) None of the above.
18. Which properties are key to the cornea's primary function?
- (a) It must be thin, dehydrated and have a smooth anterior surface.
  - (b) The optical transparency has no direct relationship with the state of hydration.
  - (c) Corneal swelling causes an increase in thickness with no effect on optical properties.
  - (d) At 80% water content the cornea does not match any body connective tissue.

19. Which statement is true of cornea's state of hydration?
- (a) Corneal water content of levels above 80% causes increased thickness and less transparency.
  - (b) There is a direct relationship between corneal thickness and its state of hydration.
  - (c) Corneal hydration is only maintained by the Na<sup>+</sup> and K<sup>+</sup> active pump.
  - (d) Mechanical barriers like contact lenses and intraocular pressure do not affect corneal hydration.
20. Which signs and symptoms are not typical of contact lens induced epithelial oedema?
- (a) Detachment of the epithelium from the basement membrane forming a bullae.
  - (b) Rapture of the bullae, severe pain, photophobia and epiphora.
  - (c) Narrowing of the palpebral fissure as well as experience of coloured haloes.
  - (d) None of the above.
21. Which characteristics best describes Essential Iris Atrophy?
- (a) Distortion of the pupil, anterior synechiae, glaucoma and iris atrophy.
  - (b) Unilateral glaucoma and iris atrophy only.
  - (c) Peripheral anterior synechiae, corectopia and optic atrophy.
  - (d) Corectopia, peripheral anterior synechiae and glaucoma.
22. Which are the classical signs and symptoms of Essential Corneal oedema?
- (a) Corneal oedema, foreign body sensation and diminished vision coupled with haloes.
  - (b) Recurrent corneal erosions with pain.
  - (c) Bullae, ciliary injection, pain and photophobia.
  - (d) All of the above.
23. Which statement is true of corneal oedema due to contact lens wear?
- (a) Settler's veil which can be viewed by way of sclerotic scatter on the slit lamp.
  - (b) The microcystic epithelial oedema found within the central cornea where the lens rests.
  - (c) Prolonged contact lens use results in insufficient oxygen to the corneal epithelium.
  - (d) All of the above.
24. Which statement is not true of continued contact lens use?
- (a) Continued use causes stromal oedema and Descemet's membrane folds.
  - (b) Alteration of contact lens fitting can successfully reduce corneal oedema.
  - (c) Corneal oedema affects contact lens wearers of all age groups.
  - (d) None of the above.
25. Which group of disorders best represents irido-corneal endothelial syndrome?
- (a) Progressive iris atrophy, Chandler's syndrome and Cogan Reese syndrome.
  - (b) Corneal endothelial abnormalities and corectopia only.
  - (c) Glaucoma, blurred vision and haloes.
  - (d) Iris nevus syndrome and iris atrophy.



26. Which statement is not true of the human cornea?
- (a) The centre and periphery are about 0.52mm and 0.67 mm thick respectively.
  - (b) The corneal epithelium is approximately 50-90  $\mu\text{m}$  thick.
  - (c) The endothelium is approximately 18-20  $\mu\text{m}$  thick with about 2400-3000 cells/ $\text{mm}^2$ .
  - (d) The stroma is roughly 0.5  $\mu\text{m}$  thick, contributes most of the corneal thickness.
27. Which properties are key to the primary function of the cornea?
- (a) It must be thin, dehydrated and have a smooth surface.
  - (b) Its transparency should not be directly related to its state of hydration.
  - (c) Any increase in thickness due corneal swelling does not affect its optical properties.
  - (d) With its water content at 80% the cornea has the least of all connective tissues in the body.
28. Which statement is true of corneal hydration?
- (a) Hydration Levels above 80% increase its thickness but reduces its transparency.
  - (b) There is a direct relationship between corneal thickness and its state of hydration.
  - (c) Corneal hydration is only maintained by the endothelial  $\text{Na}^+$  and  $\text{K}^+$  active pump.
  - (d) Mechanical barriers such as contact lenses and intra ocular pressure do not affect hydration.
29. Which statement does not represent signs and symptoms of epithelia oedema alone?
- (a) Its detachment from the basement membrane, formation of a bullae due to contact lens wear.
  - (b) Rapture of a bullae, severe pain, photophobia and epiphora.
  - (c) Narrowing of the palpebral fissure and experience of coloured haloes.
  - (d) None of the above.
30. Which statement is true of characteristics of 'rigid' contact lenses?
- (a) Consists of polymethylmethacrylate which ensures stable vision and resists warpage.
  - (b) They 'wet', clean well, and allow sufficient oxygen permeability and tear exchange.
  - (c) They are difficult to maintain and do not have any hydration capability.
  - (d) They are not bio-compatible and easily accumulate protein debris.
31. Which statement is not true of 'soft' contact lenses?
- (a) A combination of hydroxyl groups to polymethylmethacrylate makes them hydrophilic.
  - (b) They can have a water content of as much as 38% which allows oxygen permeability.
  - (c) Tetrafilcon and polymacon materials both have water content of above 50%.
  - (d) It is known that the higher the water content the lower the modulus.
32. Which statement is not true of continued contact lens use?
- (a) Continued use can cause stromal oedema and Descemet membrane folds.
  - (b) Altering the fit of a contact lens can significantly reduce corneal oedema.
  - (c) Corneal oedema due contact lens wear is not related to age.
  - (d) None of the above.
33. Which statement best describes Fick's Law on contact lenses?
- (a) It is the principle of diffusion of oxygen from the air to the cornea.
  - (b) It is the diffusion of solutes from the tear film to the cornea.
  - (c) It is the diffusion of water from the cornea into the tear film
  - (d) It is the principle of movement of gases in all lens materials.

34. Which statement is true of oxygen supply to the cornea?
- (a) The Equivalent Oxygen % is the best estimate of oxygen found underneath a lens.
  - (b) Fick's Law relates to the difference of oxygen on either side of a contact lens.
  - (c) The greater the transmissibility the greater the oxygen flow (flux).
  - (d) All of the above.
35. Which statement is true of water content and lens thickness?
- (a) Maximum oxygen is best achieved with a thin lens of high-water content.
  - (b) Thick lenses of high-water content allow for high oxygen transmission.
  - (c) Thin lenses of low water content allow for significant oxygen transmission.
  - (d) Thick lenses of high water-content respond the same as thin lenses of low-water content.
36. Which statement best describes composition of rigid gas permeable contact lenses?
- (a) It consists of Cellulose acetate butyrate, Silicone acrylate, Teflon and Styrene.
  - (b) The Cellulose acetate is composed of 13% acetyl, 37% butyryl and 2% hydroxy groups.
  - (c) The Silicone acrylate is combined with polymethylmethacrylate.
  - (d) All of the above.
37. Which statement is true of oxygen in relation to contact lenses?
- (a) A better performance contact lens is one where there is less oxygen debt.
  - (b) The lens thickness and its mobility on the cornea determines transmissibility.
  - (c) Oxygen characteristics of similar contact lenses behave differently on both eyes.
  - (d) All of the above.
38. Which statement is true of the cornea and oxygen levels?
- (a) The basal level of oxygen required by the cornea is 15 mm Hg.
  - (b) Oxygen levels that fall below the critical level lead to a malfunctioning cornea.
  - (c) Good contact lenses should always have their critical levels above 15 mmHg.
  - (d) All of the above.
39. Which statement is true of the status of the tear film and contact lens wear?
- (a) The fractional tear volume replacement is usually 10% of the tear volume per blink.
  - (b) The corneal oxygen consumption is normally 6 ul per sq cm per hour.
  - (c) A normal oxygen debt should be 16 ul per sq cm/hour on contact lens removal.
  - (d) All of the above.
40. Which characteristics are true of soft contact lenses?
- (a) They are usually made of hydroxymethyl methacrylate material.
  - (b) They are mostly comfortable and well tolerated.
  - (c) Show poor optical quality, limited life and not possible for astigmatism > 2 diopters.
  - (d) All of the above.



**SECTION (2): ANSWER ANY 3 QUESTIONS**

1. (a) Draw the cross section of the cornea using a reasonable scale and (b) briefly describe the function of each layer. **[20 MARKS]**
2. A slit lamp is a very valuable instrument in contact lens practice. Detail clinical the applications within a contact lens routine and general management of contact lens patients. **[20 MARKS]**
3. A gentleman visits your practice for a routine check-up and possibly get a new set of spectacles. The patient is keen on getting contact lenses. (a) Explain the different reasons for contact lens wear and (b) Detail your routine and management to address his wish. **[20 MARKS]**
4. A patient with high myopia of the following spectacle prescription:  
R -4.00/-1.00 X 180 and L -5.00/-1.00 X 180 and he plays squash as a hobby(a) with the use of diagrams show the lens effectivity to give you contact lens prescription (assume vertex distance of 15 mm and (b) Discuss the lens material and functional prescription you would order. **[20 MARKS]**
5. A patient with suspected keratoconus has come in for management. Discuss your routine and management plan. (explain your choice of lenses). **[20 MARKS]**

**END OF PAPER**