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DENT 5351
Spring Semester 2007
INTRODUCTION TO BIOMATERIALS
FINAL EXAMINATION (40 questions)
February 16, 2007
8:00 a.m. – 9:00 a.m.

- This final examination consists of 7 pages and 40 questions.
- Mark all of your answers clearly on these examination pages, as instructed.
- Please read each question carefully. You have one hour to complete the examination, which will end at 9:00 a.m.
- Please turn in these question sheets at the end of the examination period.
- Please make sure that your name is clearly given above.
- Page 8 is an extra page, for optional use. If any question appears to be ambiguous, you may comment on it, and your comments will be taken into consideration in grading the question. Or you can detach the page and submit it anonymously with comments on the questions. Or you can ignore it completely! Your choice.
- This examination comprises 50% of the overall grade for the semester.
- Final grades will be available after you have completed the course evaluation.

Questions 1-4
Lists (NOTE: Question 1 is worth 4 points; questions 2-4 score 2 points each)

1. List the available types of dental cement. (4 points) (I will accept 8; try for 9!)
   - calcium hydroxide
   - zinc oxide-non eugenol
   - zinc oxide-eugenol
   - zinc polycarboxylate
   - zinc phosphate
   - glass-ionomer
   - resin-modified glass-ionomer
   - resin cement
   - adhesive resin

2. List the three major mechanisms of adhesion. (2 points)
   - micromechanical adhesion
   - chemical adhesion
   - hybridization (diffusion) bonding

3. List three general methods for the reinforcement of ceramics (2 points)
   - inclusions to hinder crack propagation
   - transformation toughening
   - bonding to stronger material
4. List four dental applications for dental veneers (2 points).
   - closing spaces between teeth
   - restoring chipped teeth
   - whitening permanently stained or discolored teeth
   - correcting uneven or crooked teeth

Questions 5-8
Definitions (2 points per question)

5. Define biocompatibility.

   Biocompatibility is...
   “the ability of a material to elicit an appropriate biological response in a given application.”

6. Define adhesion.

   Adhesion - when two unlike substances join together on being brought into contact, because of forces of attraction between them.

7. Define the term cement as it is used dentally.

   A cement is a non-metallic material that is mixed to a plastic consistency, followed by setting.
8. Define ceramic materials.

Broad definition - a compound of metallic and non-metallic elements (e.g. oxides, nitrides, silicates).

Questions 9-12
True/false (1 point per question)
Circle ‘T’ or ‘F’ as appropriate

9. To get polymer reinforcement by a filler, the filler should have a higher modulus of elasticity than the polymer  
   \[ \boxed{T} \quad \boxed{F} \]

10. 0.6% of the population may shows signs of allergy to mercury.  
   \[ \boxed{T} \quad \boxed{F} \]

11. Feldspar-based materials are strong ceramics.  
   \[ \boxed{T} \quad \boxed{F} \]

12. The loss of fluoride ions from a glass-ionomer cement results in a reduction in strength.  
   \[ \boxed{T} \quad \boxed{F} \]

Questions 13-19
Fill in the most appropriate word or words (1 point per question)

13. In dental resin composites, the name of one of the dimethacrylates that can be used is Bowen’s resin, or Bis-GMA, or urethane dimethacrylate.

14. The amount of energy to fracture a material is called the fracture toughness.

15. Cements containing the compound eugenol should never be used in conjunction with composite resins.

16. Methyl mercury (CH₃Hg) is an example of a very toxic material containing mercury.
17. Fissure sealants bond to enamel by the mechanism of **micromechanical bonding**

18. The compound phenyl-P is an example of a **self-etching primer**.

19. The bonding mechanism to dentin is **hybridization (diffusion bonding)**

Questions 20-42
Multiple choice questions (1 point per question)
For each question select the one best answer, and circle the appropriate letter.

20. In *general terms*, in contrasting metallic and ceramic materials:
   (a) ceramics are less durable chemically than metals
   (b) most metals are more brittle than most ceramics
   **(c) most ceramics are more brittle than most metals**
   (d) none of the above

21. A common mechanism of failure of ceramics is:
   (a) movement of dislocations
   (b) **propagation of cracks**
   (c) ductile failure
   (d) creep
   (e) none of the above

22. Feldspars are:
   **(a) naturally occurring anhydrous aluminosilicates**
   (b) synthetic anhydrous aluminosilicates
   (c) naturally occurring hydrous aluminosilicates
   (d) synthetic hydrous aluminosilicates
   (e) none of the above

23. The typical volumetric firing shrinkage of a conventional powder-slurry ceramic is:
   (a) 1%
   (b) 5%
   (c) 10%
   (d) 20%
   **(e) 30-40%**

24. In terms of flexural strength, the strongest ceramic is:
   (a) glass-infiltrated alumina
   **(b) zirconia**
   (c) castable ceramics
   (d) feldspathic porcelain
   (e) aluminous porcelain
25. In the metal-ceramic restoration (Figure 1), the veneered metal is:
   (a) A  
   (b) B  
   (c) C  
   (d) D  
   (e) E

26. Esthetic veneers:
   (a) are made of very strong materials
   (b) are usually made of polymers
   (c) give strong structures if bonded to enamel
   (d) involve the removal of much tooth substance
   (e) none of the above

27. The effects of particulate fillers in a dental resin composite include:
   (a) increased compressive strength and hardness
   (b) increase in thermal expansion and compressive strength
   (c) increase in tensile strength, radiopacity, improved esthetics
   (d) more setting shrinkage and a contribution to esthetics
   (e) radiopacity and decreased tensile strength

28. In Figure 2, the cement marked ‘X’ is:
   (a) zinc phosphate cement
   (b) glass-ionomer cement
   (c) silicate cement
   (d) zinc polycarboxylate cement
   (e) none of the above

29. In Figure 2, the cement marked ‘Y’ is:
   (a) zinc phosphate cement
   (b) glass-ionomer cement
   (c) silicate cement
   (d) zinc polycarboxylate cement
   (e) resin-modified glass-ionomer

30. In a glass-ionomer cement, the ions that cause the material to set are:
   (a) zinc and calcium
   (b) aluminum and calcium
   (c) aluminum and zinc
   (d) calcium and fluoride
   (e) aluminum and fluoride
31. The type of structure represented in Figure 3 is:
   (a) a cored structure
   (b) homogeneous
   (c) anisotropic
   (d) amorphous
   (e) none of the above

32. The type of compound represented in Figure 4 is a:
   (a) silicon
   (b) siloxane
   (c) silicate
   (d) silicone
   (e) silane

33. Figure 5 represents:
   (a) a hybrid layer
   (b) etched enamel
   (c) smear layer
   (d) conditioned dentin
   (e) unetched enamel

34. In Figure 6 the area marked X is:
   (a) etched material
   (b) conditioned dentin
   (c) resin composite
   (d) hybrid layer
   (e) primer

35. Figure 7 is the formula of a primer used in a dentin bonding system. Which part of the molecule is hydrophilic?
   (a) A
   (b) B
   (c) C
   (d) D
   (e) E

36. Which of the following combinations of cements sets by an acid-base reaction only?
   (a) adhesive resin cement and zinc polycarboxylate cement
   (b) calcium hydroxide and glass-ionomer
   (c) resin-modified glass-ionomer and zinc phosphate
   (d) glass-ionomer and resin-modified glass-ionomer
   (e) resin cement and zinc oxide eugenol
37. The following is true about HEMA (2-HEMA, or 2-hydroxyethylmethacrylate):
   (a) it is hydrophilic and capable of being polymerized
   (b) it is hydrophobic and capable of being polymerized
   (c) it is a dentin conditioner
   (d) it is cytotoxic
   (e) none of the above

38. In the usage of acrylic resins for denture construction, biocompatibility is improved by minimizing the quantity of which constituent?
   (a) benzoyl peroxide
   (b) tertiary amine
   (c) methyl methacrylate
   (d) PMMA
   (e) camphor quinone

39. In the diagram in Figure 8, the missing factor is:
   (a) temperature
   (b) material function
   (c) environment
   (d) surface morphology
   (e) none of the above

40. The mercury in set amalgam is mainly in the form of:
   (a) mercury salts
   (b) methyl mercury
   (c) intermetallic compounds
   (d) elemental mercury
   (e) none of the above

END OF EXAMINATION