

Viva in Dental Materials



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Contents

Part I: General Survey

1. Human Tooth	1
2. Dentist and his Work	6
3. History of Dental Materials	8

Part II: Foundation

4. Matter	12
5. Physical Properties	16
6. Mechanical Properties	21
7. Biocompatibility of Dental Materials	27
8. Metals	29
9. Tarnish and Corrosion	36

Part III: Super Structure

SECTION A: MATERIALS INVOLVED IN MAKING DENTAL AND ALLIED APPLIANCES—PROSTHODONTIC MATERIALS

10. Impression Materials	41
11. Gypsum Products	57
12. Synthetic Resins	66
13. Dental Implants	77

SECTION B: MATERIALS INVOLVED IN RECONSTRUCTION OF DAMAGED TOOTH—CONSERVATION MATERIALS (DIRECT RESTORATIONS)

14. Restorative Resins	81
15. Dental Amalgam	91
16. Direct Filling Gold—Cohesive Gold	97
17. Dental Cements	98

X Viva in Dental Materials

SECTION C: MATERIALS FOR INLAYS, CROWNS AND BRIDGES (INDIRECT RESTORATIONS)

18. Dental Casting Alloys	110
19. Dental Waxes	114
20. Dental Investment Materials for Metal Casting	117
21. Casting Procedure	120
22. Ceramics	126

SECTION D: MATERIALS FOR ORTHODONTICS AND OTHERS

23. Wrought Base Metal Alloys—Stainless Steel	137
24. Soldering and Welding	141
25. Finishing and Polishing Materials: Abrasives and Polishers	144
26. Tooth Cutting Materials	150

SECTION E: MISCELLANEOUS

27. Miscellaneous Materials	154
28. Materials for Spotters	159
29. Manipulation of Materials	165
30. University Question Papers	172
<i>Index</i>	183

CHAPTER 6

MECHANICAL PROPERTIES

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| 65 What is force? | Force changes an object's motion, making it move more or less quickly and or making it change direction. |
| 66 What is Newton? | It is a unit of force.
One Newton is the force, which will accelerate one kg by one metre per second. |
| 67 What is pressure? | It is the force on a unit area of a surface from the substance in contact with it. |
| 68 What is Pascal (Pa)? | It is the unit of pressure used for calculation.
$1\text{ Pa} = 1\text{ N/m}^2$ |
| 69 What is stress? | It is the internal resistance or force to an applied external load, and it is equal and opposite to the load. |
| 70 What is strain? | Strain is deformation due to stress, e.g. change in length divided by the original length. |
| 71 What is elastic strain? | If the deformation disappears after the stress is removed. |
| 72 What is plastic strain? | If the deformation remains permanent even after removal of stress. |
| 73 What are the types of stress and strain? | Compressive stress and strain
Tensile stress and strain
Shear stress and strain
Complex stress and strain |
| 74 What is modulus of elasticity? | It is a ratio of stress to strain.
Stress/strain
It is a measure of stiffness of a material. |

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22 Viva in Dental Materials

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| 75 | What is torsion? | It is a twisting force. |
| 76 | What is bending? | It is a combination of several types of stresses. |
| 77 | What is elastic limit? | It is the greatest force, which makes a thing go out of shape, yet shape is regained when force is removed. |
| 78 | What is Hooks law? | It states that: "Direct proportionality between two quantities is always a straight line on the graph." |
| 79 | What is proportional limit? | It is the limit of stress above, which stresses no longer proportional to strain. It is same as elastic limit. |
| 80 | What is yield point or yield strength also called proof stress? | It is the point at which the material begins to yield (give-up) and change occurs. This point is slightly higher than proportional limit. |
| 81 | What is ultimate strength? | It is the point at which the material breaks. |
| 82 | What is strength? | It is the ability of the material to resist breaking up. |
| 83 | What is tensile strength? | It is the strength, which resists fracture when the material is stretched or pulled apart. |
| 84 | What is compressive strength? | It is the strength which resists fracture under pressing or load from above. |
| 85 | What is flexure or transverse strength? | It is the strength, which resists bending, which involves complex stresses and strains as seen in objects supported only at the ends, e.g. Beam supported by pillars. |
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| 86 | What is fatigue strength and give example? | It is the strength which resists repeated stresses falling on it over and over again,
e.g. RPDS |
| 87 | What is impact strength and give an example? | It is the strength which resists fracture under impact or motion. Dentures break if dropped |
| 88 | What are the compressive strength of some of the dental structures and materials? | Natural tooth enamel—400 MPA
Natural tooth dentin—296 MPA
Dental amalgam—310 MPA
Dental porcelain—172 MPA
Silicate cement—158 MPA
Zinc phosphate cement—103 MPA
Acrylic resin—96 MPA |
| 89 | What is Poisson's ratio and Explain? | The ratio of strain in the direction of the stress to the strain in the direction perpendicular to the stress. All materials change shape in three dimensions even if the stress is only in one direction, e.g. object under tensile force becomes longer but thinner.
Biting on a filling is compressive stress. The filling becomes wider mesiodistally, buccolingually, but thinner occluso-apically. That means if the filling is distorted in one direction, it is likely distorted in other two directions too. |

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24 Viva in Dental Materials

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| 90 | What is flexibility? | It is the ability to bend within its elastic limit. |
| 91 | What is resilience and its significance? | It is the ability to absorb energy and yet not deformed. Orthodontic wires store energy and deliver to the tooth. Denture soft liner prevents ulcer. |
| 92 | What is toughness? | It is difficult to break. |
| 93 | What is brittleness? | It is easy to break. |
| 94 | What is fracture toughness? | Presence of cracks and defect in a material makes it fracture easily than otherwise. |
| 95 | What is transformation toughening? | It is a method of adding Zirconium oxide to dental ceramic material, which changes shape to bulkier form under stress and thus blocks the path of crack and prevents fracture. |
| 96 | Give the examples of high and low fracture toughness value? | Metals—high
Glass—low |
| 97 | What is stress concentration? | When a stress is focussed around a crack or defect in a material, it breaks easily. |
| 98 | What is stress relaxation and its significance? | It is slow reduction in force over a period of time. Orthodontic elastic bands need to be changed every now and then. |
| 99 | What is ductility and give an example? | It is a property of metal, which allows it, to be drawn into wire under tensile stress. Gold is highly ductile. |

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| 100 What is malleability and give an example? | It is a property of metal to be hammered or rolled without breaking it under compressive load. Gold is highly malleable |
| 101 What is hardness? | It is the resistance of the material to scratching, cutting, wearing or indentation. |
| 102 What makes one material hard, another soft? | It is the way in which atoms are arranged, e.g. Diamond—hard, Graphite—soft |
| 103 What are the standard hardness tests? | Both are carbon though
Indentation tests are; Brinell, Rockwell, Vickers and Knoop
Scratch tests are; Moh's scale; Micro-character |
| 104 What is Moh's scale? | It is the scale to determine hardness of minerals developed by Fredreich Moh in 1822. In the scale there are ten minerals arranged in the order of increasing hardness—talc as 1 and softest. Diamond as 10 and hardest. |
| 105 What is the basis of indentation tests for calculation? | Area of indentation } Gives the Number divided by Load |
| 106 Mention the tools used in indentation tests. | <ul style="list-style-type: none"> • Brinell test—Steel Ball • Rockwell test—Steel ball or cone-shaped diamond. • Vickers—Pyramid shaped diamond • Knoop—Rhombic-shaped diamond |

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26 Viva in Dental Materials

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| 107 | What are the Knoop hardness of some of the dental structure and materials? | Enamel—300 KHN
Dentin—65 KHN
Amalgam—90 KHN
Composite—Resin
—55 KHN
Pure gold—32 KHN
Acrylic—Resin
—16 KHN |
| 108 | What is rheology? | It is a science that deals with flow of materials. |
| 109 | What is fluidity? | Tendency of liquid to flow. |
| 110 | What is viscosity? | It is the resistance of liquid to flow. |
| 111 | What is thixotropism? | If the viscosity of liquid decreases and becomes more fluidly due to stirring or shaking. |
| 112 | How do you classify the liquids based on viscosity? | 1. Newtonian liquid—where viscosity doesn't change
2. Pseudoplastic—Viscosity decreases
3. Dilatent—Viscosity increases |
| 113 | What is flow? | It is deformation under static load before the material has completely hardened |
| 114 | What are the applications of flow in dentistry? | With impression materials, casting metal, inlay wax, polishing pastes, adhesive materials. |
| 115 | What is creep? | It is a time-dependent slow deformation in a completely set material like solid metal due to stress. It is a kind of slow flow. |
| 116 | What is static creep? | It takes place under constant load. |
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| 117 What is dynamic creep? | It takes place under fluctuating load as in the case of masticatory load. |
| 118 What is the significance of creep? | It is related to marginal integrity of a restoration and marginal leakage leading to failure of restoration. |
| 119 Give the examples of high and low creep value. | High copper amalgams — low
Low copper amalgams — high |
| 120 What is sag? | It is a form of creep occurring in a metal at high temperatures under its own weight. |

CHAPTER 7

BIOCOMPATIBILITY OF DENTAL MATERIALS

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| 121 What is biocompatibility and what should be the nature of biocompatible material? | All materials that are used on human beings must be accepted by the body without causing any ill effects. This is biocompatibility.
Non-toxic, non-irritant, non-allergic, non-carcinogenic, etc. |
| 122 What is iatrogenesis? | Doctor (Dentist) while treating a patient by various procedures and materials must not do more harm than good by his actions. |
| 123 What is biological evaluation of dental materials? | All dental materials must undergo certain tests by competitive authorities for biocompatibility. This is biological evaluation. |

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Viva in Dental Materials

Viva in Dental Materials is a companion to another book by the same author *Essentials of Dental Materials*. Both these together will take care of Theory and Practical aspects of the University examinations. It is hoped that these twin books by the same author will benefit the students immensely.

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Graduated from the University of Bombay in the year 1959, underwent an intensive postgraduate training at the Royal College of Surgeons of England and Eastman Institute of Dental Surgery, London during the early years of 1960s. He worked as a House Surgeon at the prestigious University College Hospital, London and at the Plastic and Maxillofacial Unit of Glasgow Royal Infirmary, Scotland. He was a dental practitioner in London under National Health Service of United Kingdom for more than a decade. After returning to India, he taught Dental Materials in Bapuji Dental College, Davangere, SJM Dental College, Chitradurga and Rajiv Gandhi College of Dental Science, Bangalore for 22 years and maintained a private dental clinic at Davangere, Karnataka. He has travelled widely in India and abroad, besides being a voracious reader.



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