NAME:..... POINTS: GRADE:

1. DEFINITIONS Write down the definition of the following concepts:
*In your definitions (use **f**ormulae or **g**raphs or **d**rawings!)* (4x10=40p)

a) Elastic strain recovery ***(g)***

b) Polydispersity index

c) Substitutional impurity ***(d)***

d) Hardness

e) Fatigue fracture

f) Dilatant fluid ***(g)***

g) Heat expansion ***(f)***

h) Spectral reflectance

i) Young's modulus ***(f)***

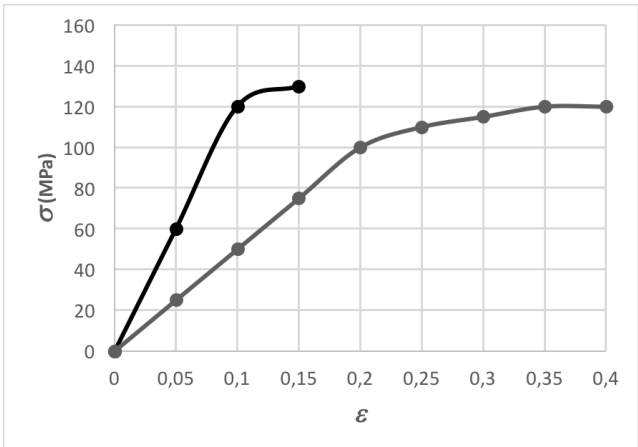
j) Ionic bond

CALCULATIONS

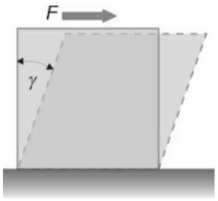
2. How much is the contact angle of a saliva drop on enamel? Surface tension values: saliva–air 41 mJ/m^2, enamel–saliva 38 mJ/m^2, enamel–air 70 mJ/m^2. (10p)

3. The attenuation coefficient of a healthy enamel is 2.9 cm^{-1} for 1310 nm wavelength light. The 2 mm thick enamel is illuminated by 500 W/m^2 intensity of this light. How much is the transient light's intensity? (10 p)

4. The graph shows the stretch diagram of two different metal threads until fracture. Calculate the resilience of the tougher metal! (10p)



5. A cube made of rubber (edge = 5 cm) is sheared as the picture shows. Calculate the force required to reach a shear angle of $\gamma = 5^o$! (Young's modulus is 2.8 MPa and the Poisson's ratio is 0.4. (10 p)



6. COMPOSITES. In your answers use figures!(24 p total)

a) Structure of composites (8p)

b) Types of composites (8p)

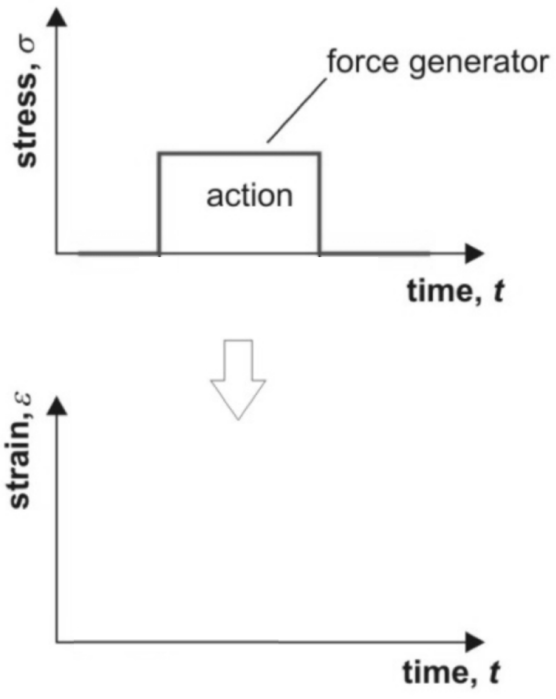
c) Give examples for the dental application of composites (8p)

7. VISCOELASTICITY. In your answers use equations, graphs, figures! (40p total)

a) Give a short definition for viscoelasticity: (4p)

b) What is the Kelvin-Voight model? (Make a drawing of the model too) (4p)

c) Draw the strain-time diagram of the Kelvin-Voight model according to the stress time diagram! (8p)



d) Describe the three main viscoelastic phenomena. **Use graphs** in your description in each case! (8p each)!

1. Creep:

2. Stress relaxation:

3. Hysteresis:

8. **Comparison of materials and material families.** Compare the material families according to the listed properties. Put relation signs between the materials according to each of the properties. Use signs greater/less (<, >) or about equal (≈). (8x2p)

Plasticity	*Metals*	*Ceramics*
Toughness	*Ceramics*	*Polymers*
Tensile strength	*Polymers*	*Metals*
Stiffness	*Ceramics*	*Metals*
Hardness	*Composites*	*Polymers*
Young's modulus	*Enamel*	*Collagen*
Hardness	*Pure Au*	*Au-Cu alloy*
Density	*Composites*	*Metals*