Aerospace Materials I **2020/21**

Assessment Test III **B** **Grade:** [ ] **Points/10**

Surname and Name

Date:December 16th 2020

Important: Please write your last and first name before you start. Neither books nor any other extra material is allowed in the exam but the calculator. You may use the back of this sheet if needed. **Mark the right answer with a X in the table below. The correct answers will mark + 0.5 points while the incorrect answers will mark as -0.15 points**. Non answered questions will not mark nor positively nor negatively. The resulting mark will not be smaller than 0 in any case. **There is only one correct answer per question**. Good luck!

Part I (5 points)

	Answer					Answer			
Question	a	b	c	d	Question	a	b	c	d
1					6				
2					7				
3					8				
4					9				
5					10				

1. Which ionic structure has cubic packing of the negative ions and positive ions filling half of the tetrahedra interstitials	
a	Zn-blende structure
b	Fluorite structure
c	NaCl structure
d	CsCl structure

2. Which of the following factors are important in determine the packing of ions and cations (only one correct answer)	
a	Lattice energy
b	Valance and bond length
c	Relative size of anions and cations and electroneutrality
d	All of the above

3	Which of the following statements about ceramics is TRUE:
a	Slip casting can be used to form components with a high dimensional accuracy
b	Ceramic injection molding involves mixing a ceramic powder with a binder or wax
c	Sintering involves heating the ceramic compact above the melting point
d	The ceramic component after sintering is called a "green compact"

4. Which of the following statements is TRUE:	
a	Glasses are inorganic ionic solids the structure of a liquid
b	SiO_2 and Al_2O_3 are the main components of glasses and they are both glass formers
c	Glasses, like ceramics, have a distinct melting point
d	Mechanical properties of glasses, like those of ceramics, are influenced strongly by imperceptions and defects

5. Which of the following polymers is more likely to be crystalline?	
a	Polyethylene
b	Atactic Polypropylene
c	Epoxy resin
d	Styrene-butadiene (SB) copolymer

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6. Which of the following statements is TRUE:	
a	Thermosetting polymers are usually crystalline
b	Thermoplastic polymers cannot be reheated
c	Deforming a polymer can increase their strength
d	Homopolymers contain more than one type of monomer

7	Which of the following processing method is more appropriate for thermosetting polymers
a	Thermoforming
b	Transfer molding
c	Extrusion
d	Blow molding

8	Indicate which of the following is NOT the function of the matrix in a fiber reinforced composite:
a	Transfer external load among fibers
b	Prevents chemical and abrasive degradation of the fibers
c	Keeps fiber orientation
d	Support the major part of the applied load

9	Which of the following statement is FALSE:
a	Prepegs cannot be assembled into laminated structures
b	Prepegs are resin-impregnated fiber forms (tape or fabric) which are manufactured by impregnating fibers with a controlled amount of resin
c	Laminar composites are prepared by piling of layers of oriented composite material
d	Prepregs with thermosetting resins have limited shelve life

10	Typical applications for composites in civil aircrafts are:
a	Turbine blades
b	Bulkheads and stringers
c	Engine cowlings, elevators and spoilers
d	Landing gear

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Part II (5 points)

A composite material has a 55 % in volume of unidirectional graphite-HM fibers in an epoxy matrix.

a) (1.5 points) Estimate the density and elastic modulus of the composite considering stresses parallel to the fibers.
b) (1.5 point) Estimate the % in weight of the fiber.
c) (1 point) If 50% of the graphite fibers are replaced with Kevlar fibers, estimate the specific elastic modulus and the specific tensile strength in the longitudinal direction in this new hybrid composite.
d) (1 point) Calculate the elastic modulus under stresses perpendicular to the fibers for the composite a).

Material	Density g/cm^3	Elastic modulus GPa	Tensile strength, MPa
Epoxy resin	1.23	3.5	70
Graphite-HM fiber	1.86	390	2400
Kevlar-49 fiber	1.44	131	3700

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