

University Mechanical Engineering

Name: _____ Score: _____

1. Atomic packing factor of BCC (four decimals)?

2. A 10.0 mm rod at 15.0 kN: engineering stress in MPa (one decimal)?
_____ MPa
3. Eutectoid composition of the iron-carbon system in wt% C (two decimals)?
_____ wt%
4. Rule of mixtures along fibres: E1 with $V_f = 0.60$, $E_f = 230$ GPa, $E_m = 3.0$ GPa (one decimal)?
_____ GPa
5. Quenched and tempered at 600 C: yield strength in MPa (nearest integer)?
_____ MPa
6. Service amplitude 160 MPa against a Goodman budget of 175: the verdict is:
 - ☐ survives with 8.6% margin
 - ☐ fails by 15 MPa
 - ☐ cannot be judged without the yield
 - ☐ exactly at the limit
7. The atomic packing factor measures:
 - ☐ the density of the metal
 - ☐ the binding energy per atom
 - ☐ the number of slip planes
 - ☐ the geometric fraction of the cell filled by atoms as hard spheres
8. Yield strength by the certificate convention is read at:
 - ☐ the ultimate point
 - ☐ fracture
 - ☐ the 0.2% strain offset line's crossing of the curve
 - ☐ 50% of ultimate
9. Martensite is best described as:
 - ☐ a type of grain boundary

- ☐ a soft equilibrium mixture
- ☐ a hard supersaturated phase that must be tempered before service
- ☐ a fine precipitate in aluminium

10. A laminate datasheet should quote modulus as:

- ☐ only E1, the fibre direction
- ☐ a single average of E1 and E2
- ☐ one value per direction, because E1 and E2 differ 19-fold
- ☐ only E2, the safe choice

University Mechanical Engineering

1. **0.6802**

$\pi \sqrt{3}/8$.

2. **191.0 MPa**

$F \text{ over } \pi d^2/4$.

3. **0.76 wt%**

The classic constant.

4. **139.2 GPa**

$V_f E_f + V_m E_m$.

5. **620 MPa**

The menu line.

6. **survives with 8.6% margin**

$(175-160)/175$.

7. **the geometric fraction of the cell filled by atoms as hard spheres**

Geometry only - mass still decides density.

8. **the 0.2% strain offset line's crossing of the curve**

The offset construction, always stated.

9. **a hard supersaturated phase that must be tempered before service**

Hard and brittle as quenched.

10. **one value per direction, because E1 and E2 differ 19-fold**

Anisotropy is the material.