Question 1- 12: Translate English into Chinese, 0.5pt/question

1. Covalent 共价的
2. modulus 模量
3. allotropy 同素异形体
4. creep 蠕变
5. lattice parameter 晶格参数
6. fatigue strength 疲劳强度
7. dislocation 位错
8. life cycle analysis 生命周期分析
9. amorphous 无定型
10. yield strength 屈服强度
11. specific heat 比热
12. Mohs Hardness 莫氏硬度

13. The family of materials is composed of (A)____Metallics____, (B)___Ceramics_____ (C)________Polymerics_____(D)___Composites_____ and other materials. (4 pt)

14. _______**B**_______describes the term that places recycling at the beginning of design stage of the materials cycle in order to facilitate recycling. (1pt)

    A) Design for Assembly, B) Design for Disassembly,

    C) Design for Service, D) Design for Safety

15. Life cycle analysis aids in ensuring (1pt) **B**

    A) High profits, B) Sustainable environment, C) Minimal materials, D) Improved cycles

16. The key word to describe the nature of covalent bond is (A) __sharing__________of electrons, for metallic bond (B)___swarming_______of electrons, and for ionic bond (C)_____transfer of electrons. (3pt)

17. Which of the following crystal system has lattice parameters of $a=b\neq c$; $\alpha=\beta=90^{o}C$, $\gamma=120^{o}C$? (1pt) **B**

    A) Monoclinic crystal B) Hexagonal crystal C) Tetragonal crystal D) Cubic Crystal

18. Crystal defects can be classified into___point___ defects, _line_____defects, and _______area defects. (3pt)

19. (T or **F**) Coarse-grained material will, at normal temperatures, be stronger than fine-grained material. (1pt)

20. Specify the bonding type in the following materials: (3pt)

(1) NaCl ionic bonding (2) Al metallic bonding

(3) Polyethylene covalent bonding

21. The forming conditions for a substitutional solid solution are ___**D**___ . (1pt)

    A) Similar atomic sizes B) Similar Electron configurations

    C) Similar crystal lattice structure D) All of the above

22. ____**D**_____ is a measure of the energy per unit volume of a material required to produce fracture under static conditions. (1pt)

    A) Modulus of elasticity B) Modulus of resilience

C) Modulus of rigidity D) Modulus of toughness

23. Which of the following diagram can be obtained by a Fatigue test. (1pt)

A) $\sigma \sim \varepsilon$, B) S~N, C) T- θ , D) $\tau \sim \delta$

24. Which property is vital important in selecting a material for steam turbine blades? (1pt)

A) Creep resistance B) Thermal insulation C) Hardness D) Strength

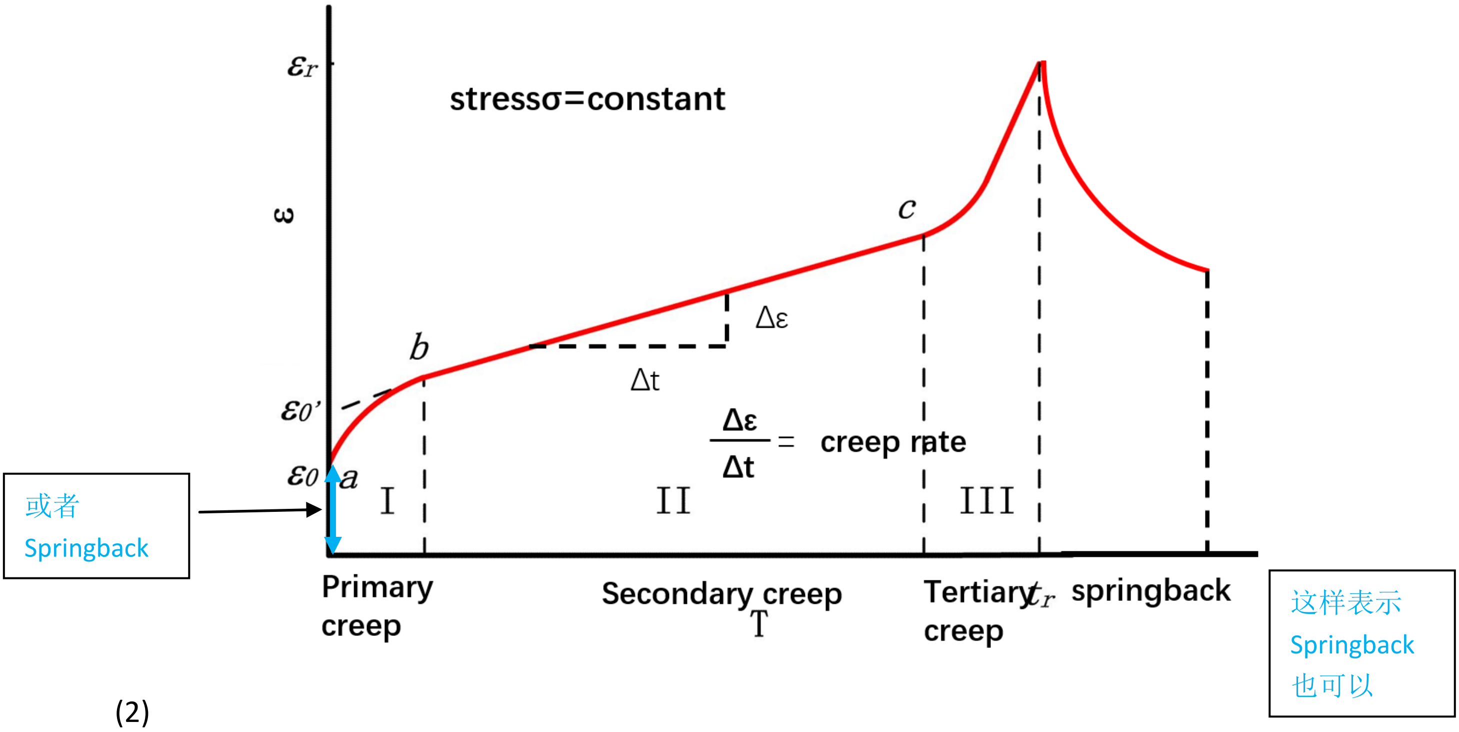
25. Which statement concerning elastic modulus is NOT correct? (1pt)
    A) Elastic modulus is also known as Young's modulus.
    B) Elastic modulus is the constant of proportionality in Hooke's Law.
    C) Elastic modulus can be measured graphically in the plastic region of the stress-strain diagram.
    D) The higher the magnitude of elastic modulus, the higher the resistance of the materials to be deformed.
26. Under similar conditions, the temperature of a material with a higher heat capacity increases faster than the material with a low heat capacity. (T or F) (1pt)
27. The lower the coefficient of thermal expansion of a material, the higher its melting temperature. (T or F) (1pt)
28. Thermal expansion is important when dissimilar materials will be fastened and heated. (T or F) (1pt)
29. Thermal energy can be conducted through a material by two mechanisms: the movement of B____, and the movement of___C___. (2pt)

A) Neutrons, B) Electrons, C) Phonons D) Protons

30. Which of the following statement about the thermal conductivity is NOT correct? (1pt)
    A) Thermal conductivity of materials has a varied relationship to temperature.
    B) Oriented polymers have much higher conductivities than unoriented polymers.
    C) Thermal conductivities are lower for crystalline than for noncrystalline ceramics.
    D) Metals have comparatively high thermal conductivities while polymers have rather low values.
31. The two methods to measure ductility are _Percent elongation___and___Percent reduction of area_____. (4pt)
32. （1）Draw a typical creep curve (4pt), and label the three stages, springback, and creep rate on the curve. (10pt)

（2）Explain how a stress change and a temperature change affect the creep rate of a material. (6pt)

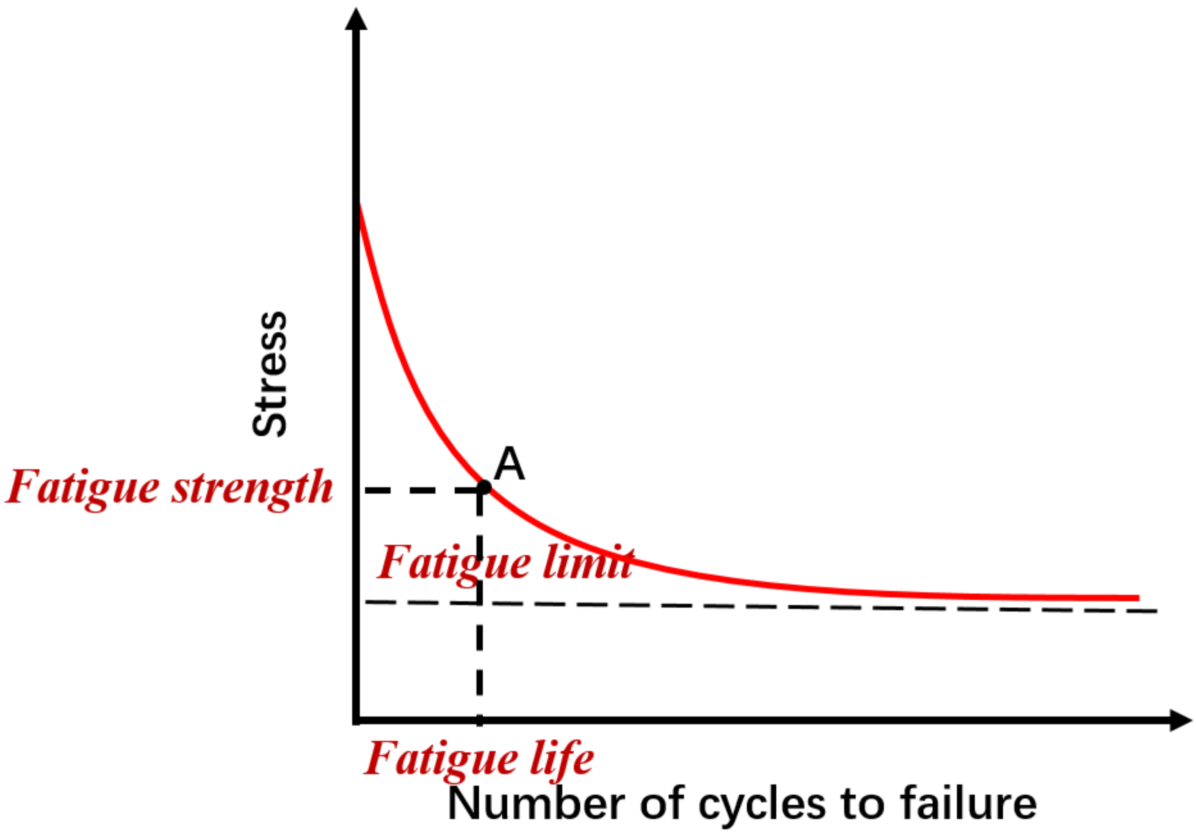
(1)



(2)

As the temperature and stress increase, the creep rate increases.

33. Draw Stress~ Number of cycles to failure curve for ferrous alloys (4pt), and label Fatigue limit, Fatigue strength, and Fatigue life (6pt).



34. Compare the thermal expansion of Silica (ceramics), Aluminum (metal), PE 聚乙烯 **(thermoplastics), and Epoxy** 环氧树脂 **(thermosets)** using the symbol “>”. And explain the reasons. For example: The hardness of Silica is greater than PE. Thus, the comparison is expressed as Silica > PE.

Thermal expansion: ①__________ > ② __________ > ③ __________ > ④__________

(6pt)

And explain the reasons. (10pt)

PE (thermoplastics)>Epoxy (thermosets)>Aluminum (metal)>Silica (ceramics)

补充：Thermal expansion of a material is related to the strength of its bonding forces. Smaller bonding forces lead to large thermal expansion.

PE (thermoplastics): van der Waals bonds between chains

Epoxy (thermosets) : crosslinking (或答 covalent bonding) and van der Waals bonds between chains

Aluminum (metal): metallic bonds

Silica (ceramics): Covalent and ionic bonds

35. Figure 1 is a stress-strain diagram of Metals versus Ceramics. (20pt)

(A) Point out which curve (a or b) is the stress-strain curve of metals, which one is that of ceramics. Explain why. (4)

b is the stress-strain curve of metals (ductile); a is the stress-strain curve of ceramics (brittle).

(B) Name c, d, e, f; (4)

C: Elastic region D: Plastic region E: Yield point F: Tensile Strength

(C) Compare the modulus of elasticity (E) of the Curve a and b. Explain how E is related to the structure (e.g. inter-atomic bonding forces) and stiffness of a material. (6)

Ea > Eb. E is a measure of interatomic bonding forces and the stiffness of materials.

Interatomic bonding forces ↑ E ↑ Stiffness↑

Covalent and ionic bonds of ceramics > **metallic bonds** of metals

(D) Is curve b for a ductile or brittle material? Give two reasons to support your answer. (6)

Ductile material.

1. wide difference between tensile strength and yield strength;
2. Extensive plastic deformation ahead of crack;
3. Large strains before rupture.

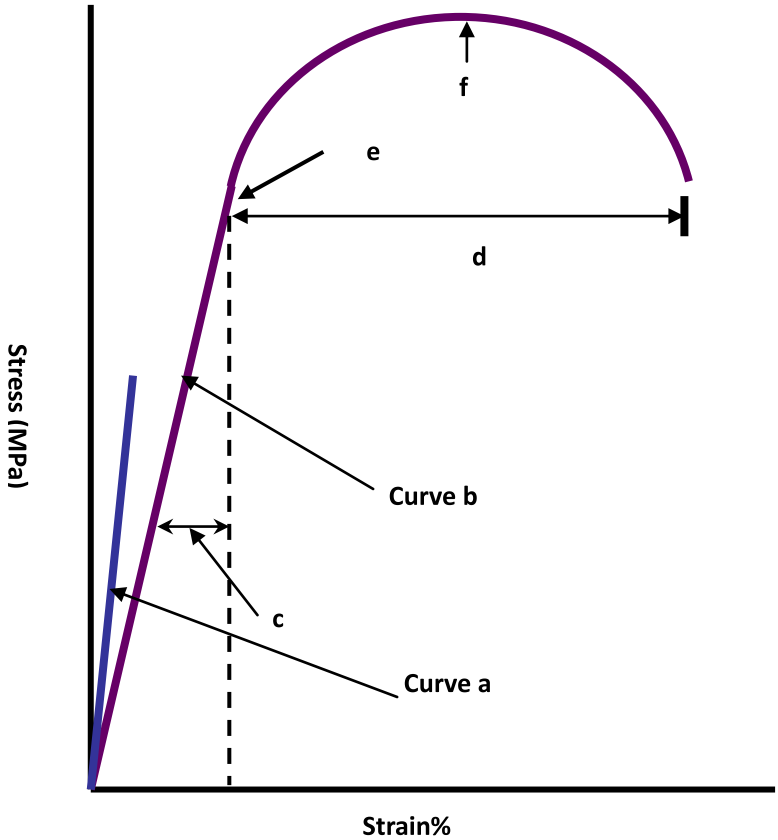


Fig.1 A stress-strain diagram