單一選擇題共四十題：答對每題各得 2.5 分，答錯每題各倒扣 0.7 分。
未答部分不得分數，也不倒扣分數。

(1) The stacking sequence of zinc blende crystal structure is (a) Simple Cube (b) BCC (c) FCC (d) HCP (e) none of the above

(2) The crystal structure of MgO is (a) Hexagonal Close-Packed (b) Wurtzite (c) Rock Salt (d) Zinc Blende (e) Diamond crystal structure

(3) The density of MgO is 3.58 g/cm^3. How long is the unit cell edge length? (a) 0.015 (b) 0.127 (c) 0.225 (d) 0.319 (e) 0.421 nm

(4) What material's resistivity rises with increasing temperature? (a) silver (b) wood (c) gallium nitride (d) aluminum oxide (e) silicon

(5) What materials can be utilized in transducers to convert electrical energy into mechanical strains, or vice versa? (a) TiO_2 (b) Al_2O_3 (c) $BaTiO_3$ (d) AlGaInP (e) GaN

(6) The distinct difference in material characteristics between metal, semi-conductor, and insulator is the location and magnitude of (a) empty band (b) conduction band (c) filled valence band (d) valence band (e) band gap

(7) What is the effect on the shape of the free-energy curve for a solution if its interaction parameter is positive? (a) produces a curve which has one minimum (b) produces a curve with no minimum and one maximum (c) produces a curve which contains a maximum at low temperature (d) produces a curve which contains a maximum at high temperature (e) none of the above

(8) Below what point corresponds to that temperature fracture will occur before the onset of plastic deformation in the processing of glasses? (a) strain point (b) working point (c) softening point (d) annealing point, (e) melting point?

(9) If a p-type silicon exists in three structures: single crystalline, polycrystalline, and amorphous structures, what kind of crystalline structure will have the longest life-time of carriers? (a) single crystal (b) poly-crystal (c) amorphous (d) all are the same (e) can not judge

(10) When a high purity, crystalline materials with the band gap of 2 eV is irradiated by visible light, its color will appear (a) red (b) yellow (c) green (d) blue (e) colorless

(11) Pure iron up to 912 °C has a bcc structure and is known as (a) delta ferrite (b) alpha ferrite (c) gamma ferrite (d) delta ferrite (e) gamma ferrite

(12) Between 1394 °C and the melting point of iron the bcc structure is known as (a) alpha ferrite (b) delta ferrite (c) alpha ferrite (d) gamma ferrite (e) delta ferrite

(13) A piece of copper has modulus of elasticity of 110 GPa and its original length is 305 mm. Now it is pulled in tension with a stress of 276 MPa. If the deformation is entirely elastic, the elongation will be (a) 0.26 (b) 0.54 (c) 0.77 (d) 0.85 (e) 1.12 mm

(14) The minimum wavelength for visible light is about 0.4 μm and the maximum band gap energy Eg of a crystal materials for which absorption of visible light is (a) 1.5 (b) 1.9 (c) 2.7 (d) 3.1 (e) 4.3 eV

(15) The most salient property of refractories: (a) acid (b) high melting point (c) low density (d) inflammable (e) single crystal structure

(16~18) A continuous and aligned glass fiber-reinforced composite consists of 40 vol% of glass fibers having a modulus of elasticity of 80 GPa and 60 vol% of a polyester resin that, when hardened, display a modulus of 5 GPa

(16) The modulus of elasticity of this composite in the longitudinal direction is (a) 15 (b) 20 (c) 25 (d) 35 (e) 45 GPa

(17) The ratio of fiber load to matrix load is (a) 10.7 (b) 12.6 (c) 13.3 (d) 15.2 (e) 17.1

(18) If the cross-sectional area is 250 mm^2 and a stress of 50 MPa is applied in this longitudinal direction, load carried by the fiber phase is (a) 860 (b) 3040 (c) 7030(d) 9730 (e) 11430 N

(19) If the cross-sectional area is 250 mm^2 and a stress of 50 MPa is applied in this longitudinal direction, strain is sustained by the fiber phase is (a) $2.87 * 10^{-4}$ (b) $6.75 * 10^{-4}$ (c) $1.27 * 10^{-3}$ (d) $1.65 * 10^{-3}$ (e) $1.84 * 10^{-3}$ mm

(20~21) The following electric characteristics have been determined for both intrinsic and P-type extrinsic indium phosphide (InP) at room temperature:

	σ $(\Omega\text{-m})^{-1}$	n (m^{-3})	p (m^{-3})
Intrinsic	$2.5*10^{-6}$	$3.0*10^{13}$	$3.0*10^{13}$
Extrinsic	$3.6*10^{-5}$	$4.5*10^{14}$	$2.0*10^{12}$

(20) The electron mobility of InP is (a) 0.27 (b) 0.50 (c) (d) 0.75 (e) 1.20 m^2/V-s

(21) The hole mobility InP is (a) 0.011 (b) 0.017 (c) 0.021 (d) 0.034 (e) 0.075 m^2/V-s

(22) Annealing process in recrystallization step can eliminate ________ from a previously cold-worked material. The underlined is (a) aging hardening (b) strain hardening (c) precipitate hardening (d) fine-grain hardening (e) strain hardening,

(23) Annealing process in recrystallization step can increase ________ from a previously cold-worked material. The underlined is: (a) ductility (b) strength (c) brittleness (d) resistivity (e) conductivity

(24) The crystal structure of copper is face-centered cubic. What is the slip plane of copper crystal? (a) {111} (b) {110} (c) {211} (d) {0001} (e) {321}

(25) How many possible slip systems are in copper crystal? (a) 12 slip systems (b) 16 slip systems (c) 24 slip systems (d) 32 slip systems (e) 64 slip systems

(26~28) For a 99.65 wt% Fe-0.35 wt% C alloy at a temperature just below the eutectoid:

(26) The fraction of total ferrite phase (W_a) and cementite phase (W_b) is (a) $W_a = 0.75$, $W_b = 0.12$ (b) $W_a = 0.82$, $W_b = 0.07$ (c) $W_a = 0.95$, $W_b = 0.05$ (d) $W_a = 1.02$, $W_b = 0.27$ (e) $W_a = 1.37$, $W_b = 0.15$

(27) The fraction of the proeutectoid ferrite (W_c) and pearlite (W_d) is (a) $W_c = 0.47$, $W_d = 0.53$ (b) $W_c = 0.56$, $W_d = 0.44$ (c) $W_c = 0.64$, $W_d = 0.36$ (d) $W_c = 0.71$, $W_d = 0.29$ (e) $W_c = 0.83$, $W_d = 0.17$

(28) The fraction of eutectoid ferrite is (a) 0.15 (b) 0.27 (c) 0.39 (d) 0.47 (e) 0.62

(29~31) The density and associated percent crystallinity for two polyethylene materials are as follows:

ρ (g/cm^3)	Crystallinity (%)
0.965	76.8
0.925	46.4

(29) The density of totally crystalline polyethylene is (a) 0.453 (b) 0.870 (c) 0.972 (d) 1.241 (e) 1.568 (g/cm^3)

(30) The density of totally amorphous polyethylene is (a) 0.347 (b) 0.571 (c) 0.723 (d) 0.998 (e) 1.205 (g/cm^3)

(31) The percent crystallinity of a specimen having a density of 0.950 is (a) 25.2 (b) 37.9 (c) 44.3 (d) 48.7 (e) 67.7 %

(32~35) A cooper wire (electrical conductivity = $6.0*10^7$ 1/Ω-m) is 3 millimeter in diameter and 2 meter long.

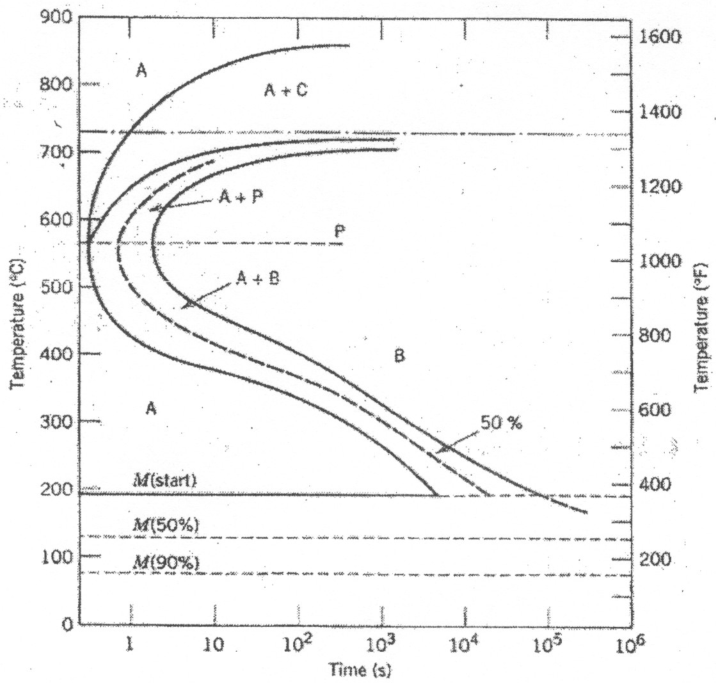
(32) The resistance of this cooper wire is (a) $7.5*10^{-1}$ (b) $3.2*10^{-1}$ (c) $4.7*10^{-3}$ (d) $6.3*10^{-5}$ (e) $1.4*10^{-7}$ Ω

(33) If the potential drop across the ends of the cooper wire is 0.05V, the current flow in the cooper wire is (a) 1.4 (b) 3.4 (c) 7.5 (d) 10.6 (e) 12.7 A

(34) If the potential drop across the ends of the cooper wire is 0.05V, the current density in the wire is (a) $1.5*10^6$ (b) $3.2*10^7$ (c) $6.5*10^7$ (d) $4.7*10^9$ (e) $2.4*10^{10}$ A/m^2

(35) If the potential drop across the ends of the cooper wire is 0.05V, the magnitude of the electric field across the ends of the wire is (a) $2.7*10^{-1}$ (b) $5.8*10^{-1}$ (c) $7.5*10^{-1}$ (d) $1.7*10^{-2}$ (e) $2.5*10^{-2}$ V/m

(36~40) Using the isothermal transformation diagram for 1.13 wt% C steel alloy as shown in below figure.



In the following case assume that the specimen begins at 1690˚F and that is has been held at this temperature long enough to have achieved a complete and homogeneous austenitic structure.

(36) Determine the final microstructure of a small specimen that has been subjected to the following time-temperature treatments: rapidly cool to 480˚F, hold for 10^3 seconds, then quench to room temperature. (a) martensite (b) bainite (c) pearlite (d) spheroidite (e) proeutectoid cementite

(37) Determine the final microstructure of a small specimen that has been subjected to the following time-temperature treatments: rapidly cool to 750˚F, hold for 500 seconds, then quench to room temperature. (a) martensite (b) bainite (c) pearlite (d) spheroidite (e) proeutectoid cementite

(38) Determine the final microstructure of a small specimen that has been subjected to the following time-temperature treatments: rapidly cool to 1290˚F, hold for 10^5 seconds, then quench to room temperature. (a) martensite (b) bainite (c) pearlite (d) spheroidite (e) proeutectoid cementite

(39) Determine the final microstructure of a small specimen that has been subjected to the following time-temperature treatments: rapidly cool to 660°F, hold for 300 seconds, then quench to room temperature. (a) martensite and bainite (b) martensite, bainite, and spheroidite (c) martensite, bainite, and pearlite (d) bainite, spheroidite, and proeutectoid cementite (e) martensite, pearlite, and proeutectoid cementite.

(40) Determine the final microstructure of a small specimen that has been subjected to the following time-temperature treatments: rapidly cool to 1250°F, hold for 7 seconds, then quench to room temperature. (a) martensite and bainite (b) martensite, bainite, and spheroidite (c) martensite, bainite, and pearlite (d) bainite, spheroidite, and proeutectoid cementite (e) martensite, pearlite, and proeutectoid cementite.