本試題是否可以使用計算機：☑可使用 ，☐不可使用 （請命題老師勾選）

A 卷：普通物理、物理冶金、量子物理導論。共 90 題，滿分 90 分。倒扣至零分為止。
科目名稱：　普通物理
每題為 4 選 1，每一題答對得 1 分，答錯倒扣 0.25 分。

1. The largest diamond ever found had a size of 3106 carats. One carat is equivalent to a mass of 0.2 g. Use the fact that 1 kg has a weight of 2.205 lb under certain conditions, and determine the weight of this diamond in pounds.

   Ⓐ 1.37 lb　Ⓑ 1370 lb　Ⓒ 2.74 lb　Ⓓ 2740 lb

2. Vector A has a magnitude of 6 units and points due east. Vector B points due north. What is the magnitude of B, if the vector A+B points 60° north of east?

   Ⓐ 5.2 units　Ⓑ 6 units　Ⓒ 10.4 units　Ⓓ 12 units

3. A jet is taking off from the deck of an aircraft carrier. Starting from rest, the jet is catapulted with a constant acceleration of 31 m/s^2 along a straight line and reaches a velocity of 62 m/s. Find the displacement of the jet.

   Ⓐ 31 m　Ⓑ 62 m　Ⓒ 93 m　Ⓓ 124 m

4. A penny is dropped from rest from the top of the tower. Considering that the height of the tower is 78.4 m and ignoring air resistance, find the speed with which the penny strikes the ground.

   Ⓐ 7.9 m/s　Ⓑ 15.8 m/s　Ⓒ 39.2 m/s　Ⓓ 62.4 m/s

5. A locomotive is accelerating at 1.6 m/s^2. It passes through a 20-m-wide crossing in a time 2.4 s. After the locomotive leaves the crossing, how much time is required until its speed reaches 32 m/s?

   Ⓐ 14 s　Ⓑ 28 s　Ⓒ 16 s　Ⓓ 32 s

6. In 2 minutes, a ski lift raises four skiers at constant speed to a height of 120 m. The average mass of each skier is 50 kg. What is the average power provided by the tension in the cable pulling the lift?

   Ⓐ 500 W　Ⓑ 1500 W　Ⓒ 1000 W　Ⓓ 2000 W

7. Batman (mass = 100 kg) jumps straight down from a bridge into a boat (mass = 500 kg) in which a criminal is fleeing. The velocity of the boat is initially 12 m/s. What is the velocity of the boat after Batman lands in it?

   Ⓐ 8 m/s　Ⓑ 10 m/s　Ⓒ 12 m/s　Ⓓ 15 m/s

（背面仍有題目，請繼續作答）

8. A car is hauling a 50-kg trailer, to which it is connected by a spring. The spring constant is 1500 N/m. The car accelerates with an acceleration of 0.3 m/s^2. By how much does the spring stretch?

Ⓐ 0.01 m　Ⓑ 0.03 m　Ⓒ 0.05 m　Ⓓ 0.09 m

9. An object is placed 4 cm in front of a concave mirror that has a 12-cm focal length. The object is 4 cm high. Find the image height.

Ⓐ 3 cm　Ⓑ 6 cm　Ⓒ 8 cm　Ⓓ12 cm

10. A small postage stamp is placed in front of a concave mirror (radius = R), such that the image distance equals the object distance. In terms of R, what is the object distance?

Ⓐ $-R$　Ⓑ $+R$　Ⓒ $-2R$　Ⓓ $+2R$

11. A series RCL circuit has a capacitance of 1.2 mF and an inductance of 2.0 mH. What is the resonance frequency of the circuit?

Ⓐ 325 Hz　Ⓑ 1250 Hz　Ⓒ 2580 Hz　Ⓓ 3250 Hz

12. A laser emits a narrow beam of light. The radius of the beam is 1.0×10^{-3} m, and the power is 1.2×10^{-3} W. What is the intensity of the laser beam?

Ⓐ 1.0×10^2 W/m^2　Ⓑ 2.2×10^2 W/m^2　Ⓒ 2.8×10^2 W/m^2　Ⓓ 3.8×10^2 W/m^2

13. Two plane mirrors are separated by 120°. If a ray strikes mirror M_1 at a 65° angle of incidence, at what angle does it leave mirror M_2?

Ⓐ 65°　Ⓑ 55°　Ⓒ 25°　Ⓓ 35°

14. A glass window (n=1.5) has a thickness of 4.0×10^{-3} m. How long does it take light to pass perpendicularly through the plate?

Ⓐ 6.0×10^{-11} sec　Ⓑ 3.0×10^{-11} sec　Ⓒ 2.0×10^{-11} sec　Ⓓ 1.3×10^{-11} sec

15. A beam of sunlight encounters a plate of crown glass at a 45° angle of incidence. Please find the angle between the violet ray (410 nm, n=1.538) and the red ray (660 nm, n=1.520) in the glass　Ⓐ 0.15°　Ⓑ 0.25°　Ⓒ 0.35°　Ⓓ 0.45°

16. An object is located 9.0 cm in front of a converging lens (f =6.0 cm). Please determine where the image is located?　Ⓐ 3cm　Ⓑ 6cm　Ⓒ 9cm　Ⓓ 18cm

17. An object is 20.0 cm from a converging lens, and the image falls on a screen. When the object is moved 4.0 cm closer to the lens, the screen must be moved 2.7 cm farther away from the lens to register a sharp image. Determine the focal length of the lens.

Ⓐ 4.0 cm　Ⓑ 5.0 cm　Ⓒ 6.0 cm　Ⓓ 8.0 cm

18. A transparent film (n=1.43) is deposited on a glass plate (n=1.52) to form a nonreflective coating. The film has a thickness of 1.07×10^{-7} m. What is the longest possible wavelength of light (in vacuum) for which thin film has been designed?

Ⓐ 612 nm　Ⓑ 562 nm　Ⓒ 512 nm　Ⓓ 462 nm

19. Light shines through a single slit whose width is 5.6×10^{-4} m. A diffraction pattern is formed on a flat screen located 4.0 m away. The distance between the middle of the central bright fringe and the first dark fringe is 3.5 mm. What is the wavelength of the light?

Ⓐ 460nm　Ⓑ 470nm　Ⓒ 480nm　Ⓓ 490nm

20. The potential at location A is 452 V. A positively charged particle is released there from rest and arrives at location B with a speed v. The potential at location C is 791 V, and when released from this spot, the particle arrives at B with a speed of 2v. Find the potential at B.

Ⓐ 339 V　Ⓑ 452 V　Ⓒ 791 V　Ⓓ 0 V

21. A 270kg rocket accelerates straight upward from Earth at 5.1 m/sec^2. What is the thrust (force) provided by the rocket's engine?

Ⓐ 1.6×10^1N　Ⓑ 1.6×10^2N　Ⓒ 1.6×10^3N　Ⓓ 1.6×10^4N

22. A 50-kg skater can exert a horizontal force of 940 N against the ice. If she's gliding toward a wall of the rink at 6.7 m/s, how close can she get before attempting to stop and still avoid colliding with the wall?

Ⓐ 0.08m　Ⓑ 0.6cm　Ⓒ 1.2m　Ⓓ 12m

23. Two skiers start down a 28°slope. Skier 1 accelerates at 2.7 m/s^2, skier 2 at half this rate. How do their coefficients of friction between skis and ground compare ?

Ⓐ $\frac{\mu k_1}{\mu k_2} = 0.59$　Ⓑ $\frac{\mu k_1}{\mu k_2} = 1$　Ⓒ $\frac{\mu k_1}{\mu k_2} = 1.7$　Ⓓ $\frac{\mu k_1}{\mu k_2} = \infty$

（背面仍有題目，請繼續作答）

24. The temporal and spatial variation of the waves in a microwave oven are described by $\cos(50.3x-15.1t)$, with t in nanoseconds and x in meters. Find the wave speed.

Ⓐ 9.00×10^{1} m/s　Ⓑ 4.600×10^{3} m/s　Ⓒ 6.00×10^{6} m/s　Ⓓ 3.00×10^{8} m/s

25. A 4.5-g piano wire is under 680 N tensions. If it supports waves propagating at 320 m/s, what is its length ?

Ⓐ 3.14 cm　Ⓑ 32 cm　Ⓒ 68 cm　Ⓓ 1600 cm

26. A suspension bridge cable has 3800 kg/m and is under 230 MN tension. What power is required to send a 15-Hz wave with amplitude 5.0 mm along this cable ?

Ⓐ 100×10^{1}W　Ⓑ 100×10^{2}W　Ⓒ 100×10^{3}W　Ⓓ 100×10^{4}W

27. In air at 20℃ and 30% humidity, the speed of sound is 343.8 m/s. Under these conditions the fundamental resonant frequency in a hollow pipe is 1148 Hz. When the humidity increases to 80%, the resonant frequency rises to 1150 Hz. What is the sound speed at 80% humidity ?

Ⓐ344.4 m/s　Ⓑ 343.9m/s　Ⓒ 340.5m/s　Ⓓ 331.7m/s

28. An electric field $E=-450\hat{i}$ kN/C is used to accelerate electrons in a portion of a TV picture tube, where the x axis points from the back to the front of the tube. Which particle will be accelerated toward the front of the tube ?

Ⓐ neutron　Ⓑ electron　Ⓒ proton　Ⓓ α particle

29. At time t = 0 you slam on your car's brakes. From then until the car stops, your position is given by $x = ct - bt^2$, where c = 20 m/s, b = 1.2 m/s^2, and x is the displacement in meters from the point where you applied the brakes. What is the average velocity during the first 5.0 s of braking?

Ⓐ 7m/sec　Ⓑ 14m/sec　Ⓒ 21m/sec　Ⓓ 28m/sec

30. Electrons in a particle accelerator are moving at 9.0×10^{5} m/s when they enter a tube where they are accelerated to 6.5×10^{6} m/s. If they spend 0.61 μs in the tube, what is the tube's length?

Ⓐ 2.26m　Ⓑ 4.52m　Ⓒ 6.78m　Ⓓ 9.04m

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科目名稱：　物理冶金

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31. What is the critical radius ratio for the tetrahedral arrangement?

Ⓐ 0.414　Ⓑ 0.731　Ⓒ 0.556　Ⓓ 0.225

32. For substitutional diffusion in a body-centered cubic lattice, what is α in the diffusion equation $D = \alpha a^2/\tau$?

Ⓐ 1/12　Ⓑ 1/24　Ⓒ 1/6　Ⓓ 1/8.

33. Estimate the ionic conductivity of MgO with an aluminum content of 400 mole ppm.

Ⓐ 8×10^{-5}　Ⓑ 9×10^{-5}　Ⓒ 2.4×10^{-5}　Ⓓ $5 \times 10^{-5}\ \Omega^{-1}cm^{-1}$.

34. When Al^{3+} ions substitute the Mg sites in MgO, what is the charge-compensated defect?

Ⓐ Mg vacancy　Ⓑ Electron　Ⓒ Hole　Ⓓ Oxygen ion.

35. When Mg^{2+} ions substitute the Al sites in Al_2O_3, what is the effective charge of Mg defects?

Ⓐ +1　Ⓑ -1　Ⓒ +3　Ⓓ -3.

36. What is the relation between vacancy diffusivity, D_v and atomic self-diffusivity, D_a?

Ⓐ $D_a=[V_a]^2D_v$　Ⓑ $D_a=[V_a]D_v$　Ⓒ $D_a=[V_a]^3D_v$　Ⓓ $D_a=[V_a]^4D_v$,

where $[V_a]$ is the vacancy concentration of atoms.

37. The ambipolar diffusion coefficient of the reduced TiO single crystal is $3D_eD_{V_O..}/(D_e+2D_{V_O..})$. In a purely electronic conductor, the ambipolar diffusion coefficient is equal to

Ⓐ $3D_{V_O..}$　Ⓑ $4D_{V_O..}$　Ⓒ $5D_{V_O..}$　Ⓓ $6D_{V_O...}$

38. For the sintering process, what is the reason for the increase of the densification rate by reducing the grain size?

Ⓐ Increase the volume diffusion　Ⓑ Increase the pipe diffusion

Ⓒ Increase the surface diffusion　Ⓓ Increase the grain-boundary diffusion.

(背面仍有題目,請繼續作答)

39. Which of the following is more effective to stop dislocation motion?

Ⓐ High-angle boundaries Ⓑ Coherent boundaries

Ⓒ Low-angle boundaries Ⓓ Twin boundaries.

40. What is the electrostatic bond strength of Al^{3+} in $MgAl_2O_4$?

Ⓐ 1/5 Ⓑ 1/2 Ⓒ 1/3 Ⓓ 1/4

41. For Au/p-GaN subjected to annealing the diffusion of Ga into Au can

Ⓐ decrease the hole concentration Ⓑ decrease the electron concentration

Ⓒ increase the electron concentration Ⓓ increase the hole concentration in p-GaN.

42. ZnO has a wide band gap, therefore, introduction of oxygen vacancies into ZnO would enhance

Ⓐ ultraviolet emission Ⓑ green emission Ⓒ x-ray emission Ⓓ none.

43. As compared with static recovery, dynamic recovery may be observed at a

Ⓐ lower rate of work hardening Ⓑ higher rate of work hardening

Ⓒ lower temperature Ⓓ higher temperature.

44. For a tetragonal crystal with three lattice constants, a = 1i, b = 1j, c = 2k, the reciprocal lattice vector, G_{112}, is

Ⓐ [1,1,2] Ⓑ [2,1,1] Ⓒ [1,2,1] Ⓓ [1,1,1]. d

45. For applications of nanomaterials in field emission devices the

Ⓐ 1D Ⓑ 2D Ⓒ3D Ⓓ 4D structure is most available.

46. For FCC the primary slip system of a screw dislocation is (-1,1,1)[1,0,1], then its cross-slip system could be

Ⓐ (1,1,1)[-1,0,1] Ⓑ (1,-1,1)[1,0,-1] Ⓒ (1,1,-1)[1,0,1] Ⓓ none.

47. A partial dislocation with b=1/6[-2,1,1] tries to move from the (1,1,1) plane to the (1,1,-1) plane, its Burgers vector should dissociate to 1/6[-1,2,1] and 1/6[-1,-1,0]. The trailing partial dislocation

Ⓐ 1/6[-2,1,1]　Ⓑ 1/6[-1,2,-1]　Ⓒ 1/6[-1,-1,2]　Ⓓ 1/6[-1,2,1]

can react with the dislocation of 1/6[-1,-1,0] and then moves off on the cross-slip plane.

48. For a FCC crystal the stacking faults associated with the partials can be formed by inserting impurity atoms in the (1,1,1) plane, thus the displacement vector of the stacking faults could be

Ⓐ 1/6[1,-2,1]　Ⓑ 1/3[1,1,1]　Ⓒ 1/6[-1,-1,2]　Ⓓ 1/6[2,-1,-1].

49. The interfacial energy decreases in the sequence of (001), (011), and (111). At a very high supercooling,

Ⓐ (001)　Ⓑ (011)　Ⓒ (111)　Ⓓ no,

preferred orientation would be formed.

50. For an order-disorder transformation there is no sudden change in order at T_c, therefore, this transformation is

Ⓐ zero order　Ⓑ first order　Ⓒ second order　Ⓓ third order.

51. The relationships between engineering strain (Ee) and true strain (Et) is

Ⓐ Et=ln(1+Ee)　Ⓑ Et=ln(1-Ee)　Ⓒ Ee=ln(1+Et)　Ⓓ Ee=ln(1-Ee)

52. The poison ratio of a typical metal is

Ⓐ 1/2　Ⓑ 1/3　Ⓒ 1/4　Ⓓ 1/5

53. The relationships between engineering stress (Se), true stress (St), true strain (Et) and engineering strain (Ee) is

Ⓐ St=Se(1+Ee)　Ⓑ Se=St(1+Ee)　Ⓒ St=Se(1+Et)　Ⓓ Se=St(1+Et)

54. The Resilience in elastic deformation is

Ⓐ σ_{max}/E^2　Ⓑ $\sigma_{max}^2/2E$　Ⓒ σ_{max}/E　Ⓓ σ_{max}^2/E

（背面仍有題目，請繼續作答）

55. Which of the following materials has the widest dislocation width

Ⓐ Ionic Solids　Ⓑ Covalent Solids　Ⓒ FCC metals　Ⓓ BCC metals

56. Which of the following is the Tresca's Yield Criterion

Ⓐ $\sigma_{max}-\sigma_{min}=\sigma_y^2$　Ⓑ $\sigma_{max}-\sigma_{min}=\sigma_y$　Ⓒ $(\sigma_{max}-\sigma_{min})/2=\sigma_y$　Ⓓ $\sigma_{max}-\sigma_{min}=\sigma_y^2$

57. Which of the following materials has the smallest yield strength sensitivity

Ⓐ Ionic Solids　Ⓑ Covalent Solids　Ⓒ FCC metals　Ⓓ BCC metals

58. Appreciable quantities of a solute may be accommodated in the substitutional type of solid solution only when the difference in atomic radii between the two atom types is less than about:

Ⓐ $\pm$5 %　Ⓑ $\pm$10 %　Ⓒ $\pm$15 %　Ⓓ $\pm$20 %

59. Which of the following materials has the highest frictional stress for dislocation

Ⓐ Ionic Solids　Ⓑ Covalent Solids　Ⓒ FCC metals　Ⓓ BCC metals

60. The yield strength increment due to the "conventional "substitutional solid-solution strengthening is proportional to

Ⓐ $c^{1/2}$　Ⓑ $c^{1/3}$　Ⓒ c^2　Ⓓ $\ln c^{1/2}$.

where c is the solute concentration

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科目名稱：　量子物理導論

每題為 4 選 1，每一題答對得 1 分，答錯倒扣 0.25 分。

$h = 6.63 \times 10^{-34}$ J.s,　　mass of an electron = 9.1×10^{-31} kg,

speed of light = 3×10^{8} m/sec,　　charge of an electron = 1.6×10^{-19} C,

Boltzmann constant = 1.381×10^{-23} J/K

61. If Bob travels at a speed of 0.8c, then when your heart beats 5 times, how many times does Bob's heart beat? (c is the speed of light.)

Ⓐ 5.　Ⓑ 4.　Ⓒ 2.　Ⓓ 3.

62. The Hubble's law

Ⓐ describes the relationship between the recession speed of a remote star and the distance between the star and the earth.

Ⓑ suggests that the universe is shrinking.

Ⓒ indicates the recession speed of a remote star may be an exponential function of the distance between the earth and the star.

Ⓓ does not support the big bang theory.

63. If you travel at a speed of 2×10^{8} m/s in the +x direction, then you will find the speed of light, in the –x direction, to be

Ⓐ unknown.　Ⓑ 1×10^{8} m/s　Ⓒ 3×10^{8} m/s.　Ⓓ 5×10^{8} m/s.

64. Spacecraft A is moving at 0.9c with respect to the earth. If Spacecraft B is to pass A at a relative speed of 0.5c in the same direction, what speed must B have with respect to the earth?

Ⓐ Impossible.　Ⓑ 0.4c

Ⓒ 0.97c.　Ⓓ c. (c is the speed of light.)

65. For electromagnetic waves A of wavelength 10 pm and electromagnetic waves B of wavelength 20 pm, which produces more pronounced Compton effect?

Ⓐ A.　Ⓑ Both are the same.

Ⓒ B.　Ⓓ Both cannot produce Compton effect.

66. Considering photoelectric effect, Compton effect, and pair production,

Ⓐ Pair production always happens.

Ⓑ Only one of the above three phenomena can happen during a photon absorption.

Ⓒ All the above three phenomena could possibly happen at the same time..

Ⓓ Photoelectric effect always happens.

（背面仍有題目，請繼續作答）

67. A gravitational force,
Ⓐ can change the energy of a photon if the force is in the same direction of the photon's movement.
Ⓑ cannot change the energy of a photon if the force is parallel to the direction of the photon's movement.
Ⓒ cannot change the energy of a photon.
Ⓓ can change the energy of a photon.

68. A material whose work function is 1.9 eV is exposed to a light having a wavelength of 198 nm. What is the maximum kinetic energy of the photoelectrons?
Ⓐ 3.6 eV.　Ⓑ 3.9 eV.　Ⓒ 4.3 eV.　Ⓓ 4.7 eV.

69. The de Broglie wavelength =
Ⓐ $\frac{\hbar}{\gamma m V}$ ．Ⓑ $\frac{h}{\gamma m V}$ ．Ⓒ $\frac{\hbar}{2\pi\gamma m V}$ ．Ⓓ $\frac{h}{4\pi\gamma m V}$ ．

70. What is the de Broglie wavelength of a 60-g ball with a velocity of 30 m/s?
Ⓐ 3.68×10^{-34} m.　Ⓑ 5.15×10^{-34} m.　Ⓒ 3.68×10^{-33} m.　Ⓓ 5.15×10^{-33} m.

71. The de Broglie wavelength is
Ⓐ inversely proportional to v.
Ⓑ inversely proportional to m.
Ⓒ inversely proportional to the plank constant, h.
Ⓓ Classical physics explains both blackbody radiation and the internal energy's variation with T.

72. If we want to observe a particle having a diameter of 0.20 nm, then what is the minimum-energy photon that can be used?
Ⓐ 6200 eV.　Ⓑ 368 eV.　Ⓒ 736 eV.　Ⓓ 295 eV.

73. The uncertainty principle can be expressed as

Ⓐ $\Delta x \Delta p \geq \frac{\hbar}{2}$　Ⓑ $\Delta E \Delta t \geq \frac{\hbar}{2}$　Ⓒ all of the above.　Ⓓ none of the above.

74. The amplitude of a wave function of a moving particle
Ⓐ is the probability of finding the particle at a particular place and all the time.
Ⓑ is the probability of finding the particle at a particular time and all the places.
Ⓒ is the probability of finding the particle at a particular place and a particular time.
Ⓓ means nothing as it is not measurable.

75. Based on Rutherford's atomic model,
Ⓐ an atom has a tiny nucleus where all its positive charge and all its mass are concentrated.
Ⓑ an atom has a tiny nucleus where nearly all its positive charge and nearly all its mass are concentrated.
Ⓒ an atom has a tiny nucleus where nearly all its positive charge and all its mass are concentrated.
Ⓓ an atom has a tiny nucleus where all its positive charge and nearly all its mass are concentrated.

76. The eigenvalue of the radial part of hydrogen wave function
Ⓐ is proportion to n^2（n is principal quantum number）
Ⓑ is precisely the same formula for the energy levels of the hydrogen atom that Bohr obtained.
Ⓒ involves three quantum numbers.
Ⓓ all of above are correct.

77. Total angular momentum is
Ⓐ the summation of orbital、magnetic、spin magnetic quantum numbers.
Ⓑ the summation of orbital and spin magnetic quantum numbers
Ⓒ the vector summation of orbital、magnetic、spin angular momentum
Ⓓ the vector summation of orbital and spin angular momentum.

78. Which following description of the comparison between fluorescence and phosphorescence is wrong ?
Ⓐ The life time 女>ㄅ
Ⓑ Both of their wavelength are in the UV and visible light range.
Ⓒ There are energy transitions involve vibrational transitions and electronic configuration transitions.
Ⓓ All of the description is correct.

（背面仍有題目，請繼續作答）

79. The average energy of electrons in a metal is approximately equal to（ε_F：Fermi energy level）

Ⓐ $\frac{3}{8}\varepsilon_F$　Ⓑ $\frac{3}{7}\varepsilon_F$　Ⓒ $\frac{1}{2}\varepsilon_F$　Ⓓ $\frac{3}{5}\varepsilon_F$

80. When the peak frequency from an blackbody is doubled，what happens to the power output（assuming constant area）？

Ⓐ 4 times greater　Ⓑ 8 times greater

Ⓒ 16 times greater　Ⓓ $\frac{1}{4}$ times smaller

81. According to the three distribution functions，if the energy of the particles $\varepsilon >> kT$，the probability n（ε）is

Ⓐ $n_{FD}(\varepsilon) > n_{BE}(\varepsilon) > n_{MB}(\varepsilon)$

Ⓑ $n_{FD}(\varepsilon) = n_{BE}(\varepsilon) = n_{MB}(\varepsilon)$

Ⓒ $n_{FD}(\varepsilon) < n_{BE}(\varepsilon) < n_{MB}(\varepsilon)$

Ⓓ Cannot be determined.

82. According to question 81，if the energy of the particles $\varepsilon << kT$，the probability n（ε）is

Ⓐ $n_{FD}(\varepsilon) > n_{MB}(\varepsilon) > n_{BE}(\varepsilon)$

Ⓑ $n_{FD}(\varepsilon) = n_{MB}(\varepsilon) = n_{BE}(\varepsilon)$

Ⓒ $n_{FD}(\varepsilon) < n_{MB}(\varepsilon) < n_{BE}(\varepsilon)$

Ⓓ Cannot be determined.

83. If $T \neq 0k$，the probability of electron at it's Fermi energy level is

Ⓐ $\frac{1}{2}$　Ⓑ $\frac{1}{4}$　Ⓒ $\frac{1}{6}$　Ⓓ 0

84. Which following theoretic calculation is precisely correct？

Ⓐ Rayleigh-Jeans formula for blackbody radiation

Ⓑ Planck formula for blackbody radiation

Ⓒ Dulong-Petit law for specific heat of solid

Ⓓ Einstein's approach for specific heat of solid

85. Which following potential energy of mechanic system can be approximately viewed as the potential function of simple harmonic oscillator ?

Ⓐ A particle in a one dimension box.

Ⓑ Tunnel effect：A particle without the energy to pass over a potential barrier may still tunnel through it.

Ⓒ The electric potential of the hydrogen atom.

Ⓓ Diatomic molecule varies with the internuclear distance.

86. In quantum mechanics，which of the following expressions concerns the energy conservation of a particle ?

Ⓐ $\int_{-\infty}^{\infty}|\psi|^2 dV = 1$　　Ⓑ $\lambda = \frac{h}{p}$

Ⓒ $i\hbar\frac{\partial\psi}{\partial t} = -\frac{\hbar^2}{2m}\frac{\partial^2\psi}{\partial x^2} + U\psi$　　Ⓓ $\langle x\rangle = \int_{-\infty}^{\infty} x|\psi|^2 dx$

87. Which metal has the highest Fermi energy level ?

Ⓐ Li　　Ⓑ B　　Ⓒ C　　Ⓓ Ne

88. The wavelength of the laser beam used in a compact disc player is 790 nm. Suppose that a diffraction grating produces first order tracking beams that are 1.2 mm apart at a distance of 3.0 mm from the grating. Estimate the spacing between the slits of the grating.

Ⓐ 1.0×10^{-6} m　Ⓑ 2.0×10^{-6} m　Ⓒ 4.0×10^{-6} m　Ⓓ 5.0×10^{-6} m

89. In a molecular，the energy level is

Ⓐ $E_e > E_v > E_r$　　Ⓑ $E_r > E_v > E_e$

Ⓒ $E_e = E_v = E_r$　　Ⓓ $E_e > E_r > E_v$

E_e：electronic spectra of molecules，E_v：vibration spectra，E_r：Rotational spectra

90. Of the following quantities，which decreases in the Bohr atomic model as the quantum number n increase ?

Ⓐ The orbital radius of electron.

Ⓑ The velocity of electron.

Ⓒ The energy level of electron.

Ⓓ All of above.