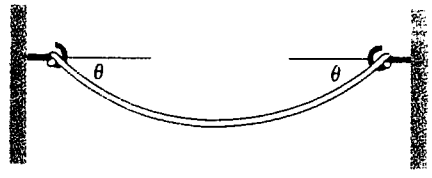
成功大學材料系 94 學年度碩士班入學考試試題

A 卷：普通物理、物理冶金、近代物理。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. It is desired to launch a satellite in a circular orbit 1000 m above the earth. What orbital speed must be imparted to the satellite?
Ⓐ 3780 m/s　Ⓑ 7560m/s　Ⓒ 11340 m/s　Ⓓ 15120 m/s

2. A flexible rope of weight W hangs between two hooks at the same height, as the accompanying figure. At each end the rope makes an angle θ with the horizontal. What is the magnitude and direction of the force F exerted by the rope on the hook at the left?
Ⓐ $w/2\sin\theta$　Ⓑ $w/2\sin 2\theta$　Ⓒ $w/2\sin^2\theta$　Ⓓ $w/2\cos\theta$



3. The mass of the moon is about one eighty-first, and its radius one-fourth, that of the earth. What is the acceleration due to gravity on the surface of the moon?
Ⓐ $1.94 m/s^2$　Ⓑ $19.4 m/s^2$　Ⓒ $3.6 m/s^2$　Ⓓ $36 m/s^2$

4. An elevator with mass 2000 kg rises with an acceleration of $1 m * s^{-2}$. What is the tension in the supporting cable?　Ⓐ 1,860 N　Ⓑ 18,600 N　Ⓒ 2,160 N　Ⓓ 21,600 N

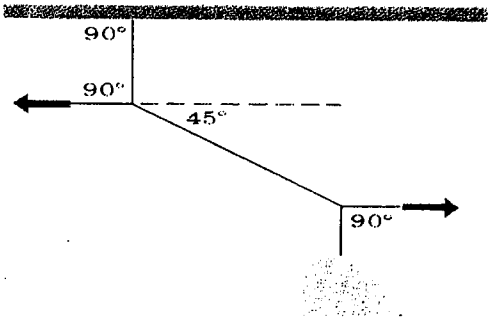
5. The asteroid Toro, discovered in 1964, has a radius of about 5 km and a mass of about 2×10^{15} kg. Calculate the escape velocity for a body at the surface of Tore?
Ⓐ 5.34m/s　Ⓑ 53.4 m/s　Ⓒ 10.68 m/s　Ⓓ 106.8 m/s

6. A ski tow is to be operated on a 37° slope 300 m long. The rope is to move at 12 km / hr and power must be provided for 80 riders at one time, with average mass per rider of 70 kg. Estimate the horsepower required to operate the tow.
Ⓐ 36 hp　Ⓑ 72 hp　Ⓒ 108 hp　Ⓓ 148 hp

7. A 5-g bullet is fired horizontally into a 3-kg wooden block resting on a horizontal surface. The coefficient of sliding friction between block and surface is 0.20. The bullet remains embedded in the block, which is observed to slide 25 cm along the surface before stopping. What was the velocity of the bullet?
Ⓐ 225 m/s　(b) 325 m/s　(c) 595 m/s　Ⓓ 625 m/s

8. See the accompanying figure, find the weight of the suspended body if the tension in the diagonal string is 20 N.

Ⓐ 2.82 N　Ⓑ 28.2 N　Ⓒ 1.41 N　Ⓓ 14.1 N



9. An open-topped freight car of mass 10,000 kg is coasting without friction along a level track. It is raining very hard, with the rain falling vertically downward. The car is originally empty and moving with a velocity of 1 m/ s. What is the velocity of the car after it has traveled long enough to collect 1000 kg of rain water?

Ⓐ 0.91 m/s　Ⓑ 1.21 m/s　Ⓒ 1.51 m/s　Ⓓ 1.81 m/s

10. A child weighing 400 N sits on one end of a seesaw that is 3.0 m long and is pivoted 1.4 m from the child. If another child sitting at the opposite end just balances, what is his weight?

Ⓐ 35 N　Ⓑ 350 N　Ⓒ 70 N　Ⓓ 700 N

11. The magnitude of mass (kg) for Uranium atom is in the order of

Ⓐ 10^{-10}, Ⓑ 10^{-30}, Ⓒ 10^{-24}, Ⓓ 10^{-8}

12. The inch, pound and second system is used mostly in

Ⓐ the United States, Ⓑ Germany, Ⓒ Italy, Ⓓ France

13. When vectors are multiplied by scalars

Ⓐ the result is a scalar

Ⓑ the result is a vector with same magnitude point to the same direction

Ⓒ the result is a vector with different magnitude point to the same direction

Ⓓ the result is a vector with different magnitude point to the opposite direction

14. The edge of a regular tetrahedron has a length of L and height of H. The ratio between H/L is

Ⓐ $\sqrt{1/2}$, Ⓑ $\sqrt{2/3}$, Ⓒ 1, Ⓓ depends on the shape

15. Both 100 yd and 100 m are used as measures of distance for track meets.
Ⓐ 100 yd. is equal to 100m.
Ⓑ 100 yd is longer than 100 yd by 8.56 m.
Ⓒ 100 yd is longer than 100 m by 28.1 ft.
Ⓓ 100 yd is shorter than 100 m by 8.56 m

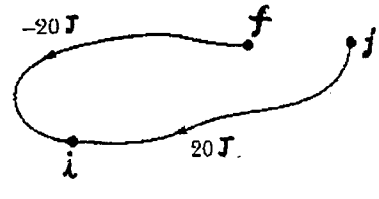
16. In 1977, Kitty O'Neil set a dragster record by reaching 392.54 mi/h in a sizzling time of 3.72s. In 1958, Eli Beeding Jr. rode a rocket sled from a standstill to a speed of 72.5 mi/h in an elapsed time of 0.04s. How you compare which athletic was more exciting ?
Ⓐ by acceleration speed , Ⓑ by final speed,
Ⓒ by elapsed time, Ⓓ not enough information to compare

17. Which of the following atom is usually used for measuring the atomic mass?
Ⓐ C12 , Ⓑ O16 ,
Ⓒ C60 , Ⓓ H1

18. Two stones each travels in circle over a frictionless surface. Each stone is tied to a cord whose opposite end is anchored at the center of the circle. If the stones travel (1) at the same speed and (2) with the same period of motion, the tension in the longer cord is _____ than that in the shorter cord.
Ⓐ always larger , Ⓑ (1) less, (2) larger ,
Ⓒ (1) larger (2) less Ⓓ always less

19. If you tossed an object either up or down and could somehow eliminate the effect of air, the object acceleration of the object depends mostly on
Ⓐ its mass , Ⓑ its density ,
Ⓒ its shape , Ⓓ non of the above

20. When a particle moves from *f* to *i* and from *j* to *i* along the paths shown in the figure, and in the indicated directions, a conservative force **F** does the indicated amounts of work on it. How much work does **F** do when the particle moves from J *j* to *f* ?
Ⓐ 0 , Ⓑ 40J , Ⓒ -40J , Ⓓ -20J



(背面仍有題目,請繼續作答)

21. The resistance of resistor 1 is twice the resistance of resistor 2. The two are connected in parallel and a potential difference is maintained across the combination. Then
Ⓐ the current through resistor 1 is twice that through resistor 2,
Ⓑ the current through resistor 1 is half that through resistor 2.,
Ⓒ the potential difference across resistor 1 is twice that across resistor 2.
Ⓓ the potential difference across resistor 1 is half that across resistor 2.

22. Two 110 V light bulbs, one "25 W" and the other "100 W", are connected in series to a 110 V source. Then
Ⓐ the current in the 100 W bulb is greater than that in the 25 W bulb.
Ⓑ the current in the 100 W bulb is less than that in the 25 W bulb.
Ⓒ. both bulbs will light with equal brightness.
Ⓓ none of the above.

23. A series circuit with an inductance of 15 mH, a capacitance of 35 μF and a resistance of 5Ω contain a sinusoidal source of emf with a frequency of 500 Hz. The frequency with which the charge on the capacitor oscillates is
Ⓐ less than 500 Hz.　　Ⓑ 500 Hz.
Ⓒ between 500 Hz and 1.4 kHz.　　Ⓓ greater than 1.4 kHz.

24. In a purely capacitive AC circuit, the current
Ⓐ leads the voltage by one-fourth of a cycle.
Ⓑ leads the voltage by one-half of a cycle.
Ⓒ lags the voltage by one-fourth of a cycle.
Ⓓ lags the voltage by one-half of a cycle.

25. In a purely inductive circuit, the current
Ⓐ lags the voltage by one-fourth of a cycle.
Ⓑ lags the voltage by one-half of a cycle.
Ⓒ lags the voltage by three-fourths of a cycle.
Ⓓ lags the voltage by one cycle.

26. A nichrome wire is 1 m long and has a 1 mm2 cross-sectional area. When connected to a potential difference of 2 V, a current of 4A exists in the wire. The resistivity of the nichrome is
Ⓐ 10^{-7} Ω.m　Ⓑ 2×10^{-7} Ω.m　Ⓒ 4×10^{-7} Ω.m　Ⓓ 5×10^{-7} Ω.m.

27. For an ohmic resistor, resistance is the proportionality constant for
Ⓐ potential difference and electric field.　　Ⓑ current and electric field.
Ⓒ potential difference and current.　　Ⓓ current and cross-sectional area.

28. You wish to double the rate of energy dissipation (or power dissipated) in a heating device. You could
   Ⓐ double the potential difference keeping the resistance the same
   Ⓑ double the current keeping the resistance the same.
   Ⓒ double the resistance keeping the potential difference the same.
   Ⓓ double the resistance keeping the current the same.

29. If the cross-sectional area of a conductor is quadrupled (x 4), the resistance
   Ⓐ increases by a factor of 16　　Ⓑ increases by a factor of 4
   Ⓒ decreases by a factor of 1/4　　Ⓓ decreases by a factor of 1/16.

30. Consider a DVD system with an overall resistance of 15 Ω. Under normal operating conditions the system uses 58 W of power. The maximum power drawn by the system cannot exceed 65 W. What type of fuse will adequately protect the DVD system while still keeping it operational?
   Ⓐ Fuse rated at a maximum of 1 A
   Ⓑ Fuse rated at a maximum of 2 A.
   Ⓒ Fuse rated at a maximum of 3 A
   Ⓓ Fuse rated at a maximum of 4 A.

(背面仍有題目,請繼續作答)

科目名稱： 物理冶金

每題為 4 選 1，每一題答對得 1 分，答錯倒扣 0.25 分。

31. The Vogel-Futcher-Tammann equation for describing the temperature dependence of the viscosity is (v) of a typical glass is

Ⓐ $\log v = A + B/(T\text{-}To)$　　Ⓑ $v = A + B/\log(T\text{-}To)$

Ⓒ $v = A + \log[B/(T\text{-}To)]$　　Ⓓ $v = \log[A + B/(T\text{-}To)]$

32. The viscosity (v) is closely related to the rate at which a shear stress (s) can be relaxed in a typical glass with a shear modulus G according to the following equation (t is the relaxation time):

Ⓐ $v = \log(G\,t)$　　Ⓑ $v = \log(G\,s\,t)$

Ⓒ $v = G\,s\,t$　　Ⓓ $v = G\,t$

33. In low cycle fatigue, the relationship between the plastic strain range (rr) and the stress range (sr) is

Ⓐ $sr^n = A\exp(rr)$　　Ⓑ $sr^n = A\log(rr)$

Ⓒ $rr = A(sr)^n$　　Ⓓ $sr = A(rr)^n$,

where A is the strength coefficient and n is the cyclic strain hardening exponent.

34. The empirical relationship between the cell size (s) and the dislocation density (d) is

Ⓐ $s = k/d^{1/3}$　　Ⓑ $s = k/d^{1/2}$

Ⓒ $s = k/\log(d)$　　Ⓓ $s = k/\exp(d)$

35. For most alloys, the dendrite arm spacing (DAS) is related to the cooling rate, r, by

Ⓐ $DAS = k\exp(1/r)$　　Ⓑ $DAS = k\log(1/r)$

Ⓒ $\log(DAS) = k(1/r)$　　Ⓓ $DAS = k\,r^{-n}$

36. The primary mechanism involved in dynamic recovery is

Ⓐ dislocation cross-slip　　Ⓑ dislocation slip

Ⓒ dislocation climb　　Ⓓ twinning

37. When the dihedral angle between the interphase boundaries is greater than

Ⓐ 45^0　　Ⓑ 60^0　　Ⓒ 90^0　　Ⓓ 180^0,

the second phase no longer forms a continuous network unless it is present as the major phase.

38. The relationship between the creep strain rate (r) and the effective flow stress (s) is

Ⓐ $r = B\,s^n$　　Ⓑ $r = B\exp(s/RT)$　　Ⓒ $r = B\log(s)$　　Ⓓ $r = B\exp(s)$

39. Vacancies can be created by plastic formation. The variation of the concentration of these vacancies (c) with strain (s) is

Ⓐ $c = K\,s^m$　　Ⓑ $c = K\exp(s)$　　Ⓒ $c = K\log(s)$　　Ⓓ $s = K\log(c)$

40. The relationship among the diffusion coefficient for interstitial diffusion (D), lattice constant of solvent (a), the mean time of stay of a solute atom in an interstitial site (t) is
Ⓐ $D = k \log(a/t)$　Ⓑ $D = k \exp(a/t)$　Ⓒ $D = k a^2/t$　Ⓓ $D^2 = ka/t$

41. In continuous growth, the growth rate of the liquid-solid interface (V) is related to the undercooling (Tu) by
Ⓐ $V^3 = B\,Tu$　Ⓑ $V = B\,Tu$　Ⓒ $V = B\,Tu^2$　Ⓓ $V = B\,Tu^3$

42. In lateral growth, the growth rate of the liquid-solid interface (V) when many nuclei form simultaneously is related to the undercooling (Tu) by
Ⓐ $V = A \log(-B/3Tu)$　Ⓑ $V = A \log(-B/2Tu)$
Ⓒ $V = A \exp(-B/3Tu)$　Ⓓ $V = A \exp(-B/2Tu)$

43. The criterion for the stability of a planar interface during steady-state solidification in terms of the temperature gradient in the liquid (G), the solidification rate (R), the slope of the liquidus (m), the alloy composition (C), the redistribution coefficient (k), and the liquid diffusivity (D) is
Ⓐ $G/R = m\,C\,(1-k) / kD$　Ⓑ $G/R = m\,C\,(k-1) / kD$
Ⓒ $G/R = m\,C\,k / (1-k)D$　Ⓓ $G/R = m\,C\,k / (k-1)D$

44. The solubility of gases (c) in metals at a constant gas pressure in terms of the work to introduce a mole of gas atoms into the metals (Q) is
Ⓐ $c^{1/2} = B \exp(-Q/2RT)$　Ⓑ $c = B \exp(-Q/2RT)$
Ⓒ $c^{1/2} = B \exp(-Q/RT)$　Ⓓ $c = B \exp(-Q/RT)$

45. The relationship between the growth rate (R) and the eutectic lamellar spacing (s) is
Ⓐ $R = (B/As)^{1/2}$　Ⓑ $s = (B/AR)^{1/2}$　Ⓒ $R = \exp(B/sR)$　Ⓓ $s = \exp(B/AR)$

46. For a BCC crystal the extinct diffraction plane is
Ⓐ (1,1,-1)　Ⓑ (1,-1,0)　Ⓒ (2,0,0)　Ⓓ (2,2,0).

47. For FCC the primary slip system of an edge 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]　Ⓓ nonexistent.

48. For $Bi_{4-x}Ti_3O_{12}$ films, substitution of lower-valent cations for some Ti atoms would
Ⓐ increase oxygen vacancies　Ⓑ decrease oxygen vacancies
Ⓒ increase Bi vacancies　Ⓓ decrease Bi vacancies in the films.

49. A dislocation with the Burgers vector of
Ⓐ 1/2[1,1,0]　Ⓑ 1/6[-1,2,1]　Ⓒ 1/6[1,-2,1]　Ⓓ 1/3[1,-1,1]
can slip on the (1,-1,1) planes.

(背面仍有題目,請繼續作答)

50. 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[2,-1,1] and 1/6[0,2,0]　　Ⓑ 1/6[-1,2,1] and 1/6[1,-1,0]
Ⓒ 1/6[-1,2,1] and 1/6[-1,-1,0]　　Ⓓ 1/6[-2,0,-1] and [0,-1,0].

51. It is determined by experiment that the kirkendall markers placed at the interface of a diffusion couple, formed by welding a thin plate of metal A to a similar plate of metal B, move with a velocity of 4.5×10^{-12} m/s toward the A component when the concentration $N_A = 0.38$ and the concentration gradient, dN_A/dx, is 2.5×10^{-2} per m. The chemical diffusion coefficient under these conditions is 3.25×10^{-14} m^2/s. Determine the value of the intrinsic diffusivity of the B component.
Ⓐ 3.93×10^{-14}　Ⓑ 7.61×10^{-8}　Ⓒ3.89×10^{-11}　Ⓓ2.13×10^{-13} m^2/s

52. For substitutional diffusion in a face-centered cubic lattice, what is α in the diffusion equation

$D = \alpha a^2/\tau$?

Ⓐ 1/12　Ⓑ 1/24　Ⓒ 1/6　Ⓓ1/8.

53: Calculate the Madelung constant for an infinite chain of alternating positive and negative ions +-+-+ and so on.
Ⓐ 3ln2　Ⓑ 4ln2　Ⓒ 2ln2　Ⓓ5ln2.

54. Use the phase rule to predict the number of degrees of freedom for an alloy pf Pb+20 weight percent Sn at about 250 ^{0}C What is the degrees of freedom for this alloy at 183 ^{0}C?
Ⓐ 0　Ⓑ 1　Ⓒ 2　Ⓓ3.

55. Determine powder patterns, S, values for the {111} planes, if the specimen is a gold powder. Assume that copper $K_{\alpha1}$ radiation (λ= 0.1541 nm) is used and that the lattice parameter of the gold crystal is 0.4078 nm.
Ⓐ38.8　Ⓑ 34.4　Ⓒ 56.4　Ⓓ67.7 mm.

56. Which of the following is false about the theoretical shear strength of a particular set of crystal planes?
Ⓐ It increases as the shear modulus increases.
Ⓑ It increases as the interplanar distance increases.
Ⓒ It depends on temperature.
Ⓓ It depends on the interatomic potential of material.

57. The total line length of the dislocations in a 4cm by 4 cm TEM photograph, of a metal foil, taken at magnification of 25,000 X is 400 cm. The foil imaged by the picture had a thickness of 300nm. Determine the dislocation density in the foil.
Ⓐ 1.31×10^{12}　Ⓑ1.67×10^{14}　Ⓒ0.79×10^{11}　Ⓓ 2.13×10^{13} m/m^2.

58. The following Burgers vectors are for unit dislocations in NaCl. Which dislocation has the lowest elastic energy?
Ⓐ $(a_o/2)[001]$　Ⓑ$(a_o/2)[103]$　Ⓒ$(a_o/2)[110]$　Ⓓ$(a_o/2)[012]$

59. Using the Fermi function, evaluate the temperature at which there is a 1 % probability that an electron in a solid will have an energy 0.5 eV above the Fermi energy of 5 eV.
Ⓐ 1260　Ⓑ 2678　Ⓒ 3378　Ⓓ665 °K.

60. An experiment for the interdiffusion between two regions is performed using a mixture of 0.8 H_2-0.2 N_2 in region II and pure N_2 in region I. If the diffusion coefficient is 0.7×10^{-4} m^2/sec, at what distance from the interface in region I will the concentration of H_2 be 0.1 after 10^2 sec of diffusion?
Ⓐ 0.12　Ⓑ 0.23　Ⓒ 0.57　Ⓓ 0.46 m.

科目名稱：　近代物理

每題為 4 選 1，每一題答對得 1 分，答錯倒扣 0.25 分。

h = 6.63 x 10^{-34} J.s,

rest mass of an electron = 9.1 x 10^{-31} kg,

speed of light = 3 x10^{8} m/sec,

charge of an electron = 1.6 x 10^{-19} C,

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

61. Which of the following cannot a quantized quantity?
Ⓐ Angular-momentum direction, Ⓑ angular momentum,
Ⓒ position, Ⓓ energy.

62. Let n be the principal quantum number and l be the orbital quantum, then which of the following must be wrong? Ⓐ $n = l - 1$, Ⓑ $n = l + 1$, Ⓒ $n = l + 2$, or Ⓓ $n = l + 3$.

63. Ⓐ S state, Ⓑ p state, Ⓒ d state, or Ⓓ f state has an angular momentum of $\sqrt{2}\hbar$.

64. According to the selection rule,
Ⓐ $\Delta l = 0, \pm 1$, Ⓑ $\Delta m_l = \pm 1$, Ⓒ Δm_l is not restricted, Ⓓ Δn is not restricted.

65. If the azimuthal wave function for the hydrogen atom is $\Phi(\phi) = Ae^{1m_l\phi}$, then the value of the normalized constant is
Ⓐ $\frac{1}{\sqrt{2\pi}}$, Ⓑ $\sqrt{2\pi}$, Ⓒ $\frac{1}{\sqrt{\pi}}$, Ⓓ $\sqrt{\pi}$.

66. The probability of finding an atomic electron whose radial wave function is R(r) outside a sphere of radius r_0 centered on the nucleus is $\int_{r_0}^{\infty} |R(r)|^2 r^2 dr$. What is the probability of finding an 1s electron in a hydrogen atom at a distance greater than a_0 from the radius?
Ⓐ 36%, Ⓑ 52%, Ⓒ 68%, Ⓓ 0%.

67. If s is spin quantum number and S is the spin angular momentum, then
Ⓐ S = ½, Ⓑ $s = \frac{\sqrt{3}}{2}\hbar$, Ⓒ s = ½, or Ⓓ $s = \frac{\sqrt{2}}{3}\hbar$.

68. All particles that have odd half-integral spins have wave functions that are
Ⓐ symmetric Ⓑ antisymmetric,
Ⓒ either symmetric or antisymmetric, or Ⓓ none of the above.

69. The magnetic energy of an electron in the 2p state of a hydrogen atom is approximately
Ⓐ 10^{-10} eV　Ⓑ 10^{-30} J,　Ⓒ 10^{-5} eV,　Ⓓ 10^{-10} J.

70. How many possible orientations are there for the total atomic angular momentum when j = ½ and $l = 1$? Ⓐ 1,　Ⓑ 2,　Ⓒ 3,　Ⓓ 4.

71. The normal Zeeman effect is observed for atoms that have
Ⓐ an odd number of electrons,　Ⓑ an even number of electrons,
Ⓒ more than 1 electrons,　Ⓓ any number of electrons.

72. If j = 5/2, then l =　Ⓐ -1,　Ⓑ 0,　Ⓒ 1,　Ⓓ 2.

73. When 2 hydrogen atoms form a H_2, the electrons
Ⓐ are most likely to be found between the 2 hydrogen atoms,
Ⓑ are distributed evenly around the two hydrogen atoms,
Ⓒ have the same set of quantum numbers, or
Ⓓ can not have the same orbital quantum number.

74. Which of the following can be used to explain the formation of covalent bonds?
Ⓐ Quantum mechanics predicts non-zero probability for an electron to penetrate a finite potential wall.
Ⓑ Uncertainty principle dictates a lower energy state for the electrons when a covalent bond is formed.
Ⓒ All of the above.
Ⓓ None of the above.

75. If the bond energy for H_2^+ is 2.65 eV, the bond energy for H_2 is
Ⓐ also 2.65 eV,　Ⓑ 5.3 eV,　Ⓒ more than 5,3 eV,　Ⓓ less than 5.3 eV.

76. The $2d\sin\theta = n\lambda$, n represents
Ⓐ the quantum number　Ⓑ the order of the scattered beam
Ⓒ the order of crystal planes　Ⓓ the order of the incident beam.

77. Compton effect describes
Ⓐ photon can be created by the scattering of free electron
Ⓑ electromagnetic radiation due to the electron jumping between energy levels
Ⓒ electron emission from outer layer of atom due to excitation
Ⓓ all the above

(背面仍有題目,請繼續作答)

78. In the following effects or phenomena , which occurs at the lowest energy ?
Ⓐ Tunneling effect　Ⓑ Photo Electric effect
Ⓒ Compton effect　Ⓓ Pair production.

79. In the following particles, if all these particles have the same kinetic energy , which has the shortest wavelength ?
Ⓐ α particle　Ⓑ Neutron　Ⓒ Proton　Ⓓ Electron

80. Who derive the following equation $p = h/\lambda$?
Ⓐ Planck　Ⓑ Einstein　Ⓒ De Broglie　Ⓓ Schrodinger

81. The Moseley's Law $\sqrt{\nu} = C(Z - \sigma)$ is known to describe which of the following result?
Ⓐ photo electric effect　Ⓑ pair production effect
Ⓒ characteristic X-ray line　Ⓓ tunneling effect

82. Which of the following statement about the special relativity is incorrect?
Ⓐ it was first published on 1905 by Einstein.
Ⓑ There is a universal frame of reference that can be used everywhere
Ⓒ Relativity connects space and time, matter and energy, electricity and magnetism
Ⓓ All motion is relative; the speed of light in free space is the same for all observers

83. What is the mass of an electron with the speed of 0.99 c?
Ⓐ 64×10^{-31} kg　Ⓑ 9.0×10^{-31} kg　Ⓒ 90×10^{-31} kg　Ⓓ 9.1×10^{-31} kg

84. The total energy (E) of a subject, E_o is the rest mass, and $KE = mc^2 - m_oc^2 = \Delta mc^2$, then
Ⓐ $E = E_o + KE$, Ⓑ $E = mc^2$, Ⓒ $E = m_oc^2 / \sqrt{1 - v^2/c^2}$ Ⓓ all above are right.

85. Which of the following statement is correct as described in **Rutherford's experiment**
Ⓐ most α particles deviate much
Ⓑ most α particles scattered through very small angles
Ⓒ most α particles did not go right through the foil
Ⓓ most α particles scattered through very large angles

86. At what temperature would the average kinetic energy of the molecules of hydrogen be equal to their binding energy?
Ⓐ 10^2 K　Ⓑ 10^3 K　Ⓒ 10^4 K　Ⓓ 10^5 K

87. An electromagnetic wave with the energy of 10^{-3} eV is most likely emitted from which of the following mechanism.

Ⓐ Rotational Energy Levels　Ⓑ Vibration Energy Levels
Ⓒ Ka x-rays　Ⓓ Atomic spectra

88. Which of the following statement is called "Selection rule" for allowed transition?

Ⓐ The change in total quantum number $\Delta n = \pm 1$
Ⓑ The change in the orbital quantum number $\Delta l = \pm 1$
Ⓒ The change in the magnetic quantum number Δm_l is not restricted.
Ⓓ The change in the spin magnetic quantum number $\Delta m_s = \pm 1$

89. If the charge on a capacitor is doubled, the amount of energy the capacitor stores is

Ⓐ halved　Ⓑ doubled　Ⓒ unaffected　Ⓓ quadrupled

90. Which of the following type of light source does not involve excitation electrons over an energy gap to emit light.

Ⓐ Incandescence　Ⓑ Fluorescent Lamp　Ⓒ Light Emitting Diode　Ⓓ Solid state laser