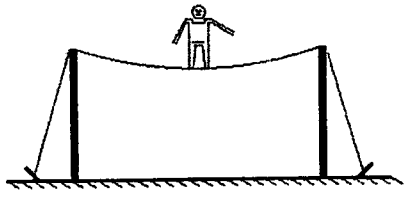
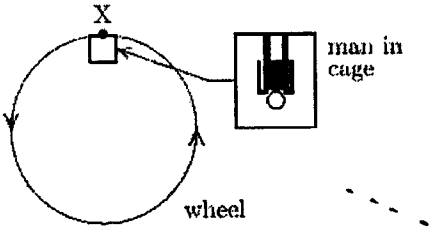
(配分)

(5) 1. A circus performer of weight W is walking along a "high wire" as shown in **Fig.1**. The tension in the wire:

A. is approximately W
B. is approximately W/2
C. is much less than W
D. is much more than W
E. depends on whether he stands on one foot or two feet



(Fig.1)



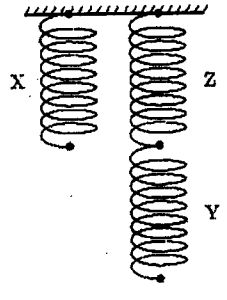
(Fig.2)

(5) 2. A giant wheel, having a diameter of 40 m, is fitted with a cage and platform on which a man of mass m stands. The wheel is rotated in a vertical plane at such a speed that the force exerted by the man on the platform is equal to his weight when the cage is at X, as shown in **Fig. 2**. The net force on the man at point X is:

A. 0
B. mg, down
C. mg, up
D. 2mg, down
E. 2mg, up
F. none of these

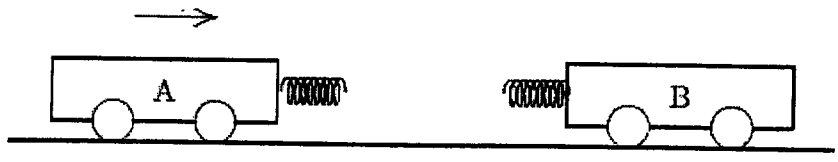
(5) 3.Three identical ideal springs (X,Y,Z) are arranged as shown in **Fig.3**. When a 4.0-kg mass is hung on X, the mass descends 3.0 cm. When a 6.0-kg mass is hung on Y, the mass descends:

A. 2.0 cm
B. 4.0 cm
C. C. 4.5 cm
D. 6.0 cm
E. 9.0 cm



(Fig.3)

(5) 4. Two carts (A and B), having spring bumpers, collide as shown in **Fig. 4**. Cart A has a mass of 2 kg and is initially moving to the right. Cart B has a mass of 3 kg and is initially stationary. When the separation between the carts is a minimum:

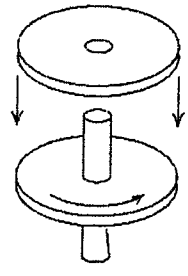


(Fig. 4)

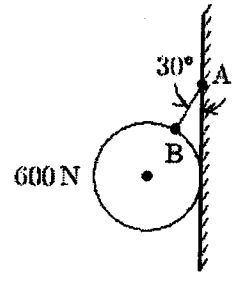
A. cart B is still at rest
B. cart A has come to rest
C. the carts have the same momentum
D. the carts have the same kinetic energy
E. the kinetic energy of the system is at a minimum

(5) 5. A wheel with rotational inertia I, mounted on a vertical shaft with negligible rotational inertia, is rotating with angular speed ω_0. A nonrotating wheel with rotational inertia 2I is suddenly dropped onto the same shaft as shown in **Fig. 5**. The resultant combination of the two wheels and shaft will rotate at:

A. $\omega_0/2$　B. $2\omega_0$　C. $\omega_0/3$　D. $3\omega_0$　E. $\omega_0/4$



(Fig. 5)



(Fig. 6)

(5) 6. The 600-N ball shown is suspended on a string AB and rests against a frictionless vertical wall. The string makes an angle of 30^0 with the wall as shown in **Fig. 6**. The magnitude of the tension force of the string is:

A. 690N　B. 1200N　C. 2100N　D. 2400N　E. none of these

(5) 7. A spherical shell has inner radius R_1, outer radius R_2, and mass M, distributed uniformly throughout the shell. The magnitude of the gravitational force exerted on the shell by a point particle of mass m located a distance d from the center, outside the inner radius and inside the outer radius, is:

A. 0
B. GMm/d^2
C. $GMm/(R_2^3 - d^3)$
D. $GMm(d^3 - R_1^3)/d^2(R_2^3 - R_1^3)$
E. $GMm/(d^3 - R_1^3)$

(5) 8. A sinusoidal wave $y(x, t) = y_m \sin(kx - \omega t)$ is incident on the fixed end of a string at x = L. The reflected wave is given by:

A. $y_m \sin(kx + \omega t)$
B. $y_m \sin(kx + \omega t)$
C. $y_m \sin(kx + \omega t - kL)$
D. $y_m \sin(kx + \omega t - 2kL)$
E. $y_m \sin(kx + \omega t + 2kL)$

(5) 9. Object A, with heat capacity C_A and initially at temperature T_A, is placed in thermal contact with object B, with heat capacity C_B and initially at temperature T_B. The combination is thermally isolated. If the heat capacities are independent of the temperature and no phase changes occur, the final temperature of both objects is:

A. $(C_A T_A - C_B T_B)/(C_A + C_B)$
B. $(C_A T_A + C_B T_B)/(C_A + C_B)$
C. $(C_A T_A - C_B T_B)/(C_A - C_B)$
D. $(C_A - C_B)|T_A - T_B|$
E. $(C_A + C_B)|T_A - T_B|$

(5) 10. The temperature of n moles of an ideal monatomic gas is increased by ΔT at constant pressure. The energy Q absorbed as heat, change ΔE_{int} in internal energy, and work W done by the environment are given by:

A. $Q = (5/2)nR\Delta T,\ \Delta E_{int} = 0,\ W = -nR\Delta T$
B. $Q = (3/2)nR\Delta T,\ \Delta E_{int} = (5/2)nR\Delta T,\ W = -(3/2)nR\Delta T$
C. $Q = (5/2)nR\Delta T,\ \Delta E_{int} = (5/2)nR\Delta T,\ W = 0$
D. $Q = (3/2)nR\Delta T,\ \Delta E_{int} = 0,\ W = -nR\Delta T$
E. $Q = (5/2)nR\Delta T,\ \Delta E_{int} = (3/2)nR\Delta T,\ W = -nR\Delta T$

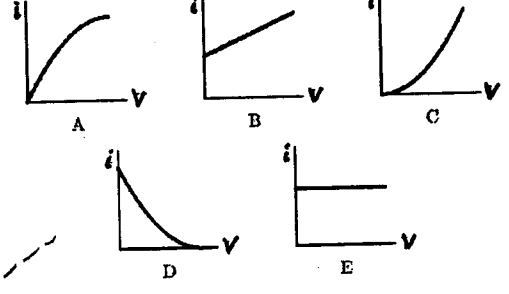
(5) 11. Let k be the Boltzmann constant. If the configuration of molecules in a gas changes from one with a multiplicity of M_1 to one with a multiplicity of M_2, then entropy changes by:

A. $\Delta S = 0$
B. $\Delta S = k(M_2 - M_1)$
C. $\Delta S = kM_2/M_1$
D. $\Delta S = k \ln(M_2 M_1)$
E. $\Delta S = k \ln(M_2/M_1)$

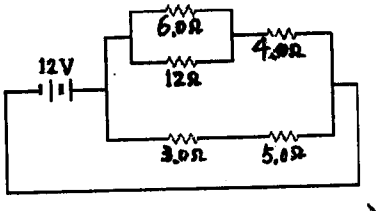
(5) 12. Charge Q is distributed uniformly throughout an insulating sphere of radius R. The magnitude of the electric field at a point R/2 from the center is:

A. $Q/4\pi\varepsilon_0 R^2$
B. $Q/\pi\varepsilon_0 R^2$
C. $3Q/4\pi\varepsilon_0 R^2$
D. $Q/8\pi\varepsilon_0 R^2$
E. none of these

(5) 13. Which of the following graphs (**Fig.7**) best represents the current-voltage relationship of an incandescent light bulb? (白光灯泡)



(Fig.7)



(Fig.8)

(5) 14. The current in the 5.0Ω resistor in the circuit shown in **Fig. 8** is:

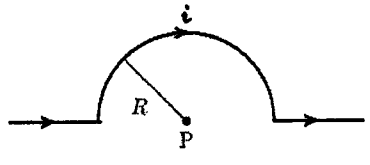
A. 0.42A
B. 0.67A
C. 1.5A
D. 2.4A
E. 3.0A

(5) 15. Electrons (mass m, charge e) are accelerated from rest through a potential difference V and are then deflected by a magnetic field B that is perpendicular to their velocity. The radius of the resulting electron trajectory is:

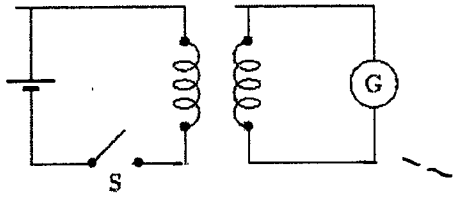
A. $(\sqrt{2eV/m})/B$
B. $B\sqrt{2eV}/m$
C. $(\sqrt{2mV/e})/B$
D. $B\sqrt{2mV}/e$
E. none of these

(5) 16. The magnitude of the magnetic field at point P, at the center of the semicircle shown in **Fig. 9**, is given by:

A. $2\mu_0 i/R$
B. $\mu_0 i/R$
C. $\mu_0 i/4\pi R$
D. $\mu_0 i/2R$
E. $\mu_0 i/4R$



(Fig. 9)

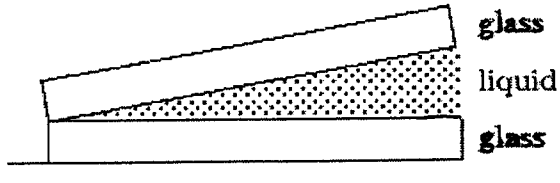


(Fig. 10)

(5) 17. In the circuit shown in **Fig. 10**, there will be a non-zero reading in galvanometer G:

A. only just after S is closed
B. only just after S is opened
C. only while S is kept closed
D. never
E. only just after S is opened or closed

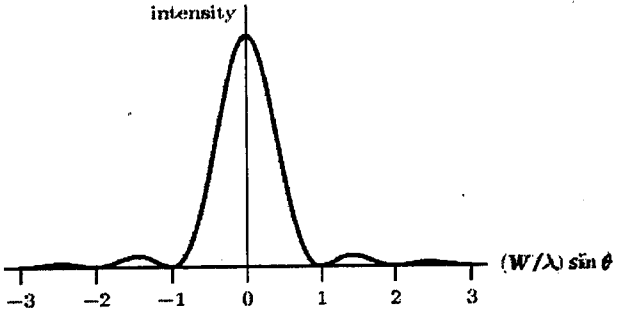
(5) 18. A liquid of refractive index n = 4/3 replaces the air between a fixed wedge formed from two glass plates as shown in **Fig. 11.** As a result, the spacing between adjacent dark bands in the interference pattern:



(Fig. 11)

A. increases by a factor of 4/3
B. increases by a factor of 3
C. remains the same
D. decreases to 3/4 of its original value
E. decreases to 1/3 of its original value

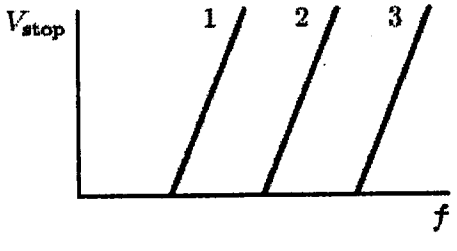
(5) 19. Light of wavelength is normally incident on some plane optical device. The intensity pattern shown in **Fig. 12** is observed on a distant screen (θ is the angle measured from the normal of the device).The device could be:



(Fig. 12)

A. a single slit of width W
B. a single slit of width 2W
C. two narrow slits with separation W
D. two narrow slits with separation 2W
E. a diffraction grating with slit separation W

(5) 20. **Fig. 13** shows the graphs of the stopping potential as a function of the frequency of the incident light for photoelectric experiments performed on three different materials. Rank the materials according to the values of their work functions, from least to greatest.



(Fig. 13)

A. 1, 2, 3
B. 3, 2, 1
C. 2, 3, 1
D. 2, 1, 3
E. 1, 3, 2