國立臺灣海洋大學一〇二學年度研究所碩士班暨碩士在職專班招生考試試題

考試科目： 普通物理

系所名稱： 光電科學研究所碩士班不分組　　**※可使用計算器**

1.答案以橫式由左至右書寫。2.請依題號順序作答。

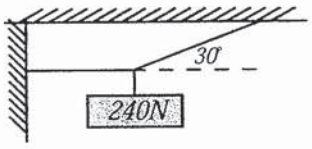
Single choice: 4 points each. (For each problem choose one proper answer from A. *to* E.)
Write down briefly the calculation steps.

1 A box rests on a rough board *10m* long. When one end of the board is slowly raised to a height of *6m* above the other end, the box begins to slide. The static friction coefficient is:
A. *0.8*　B. *0.25*　C. *0.4*　D. *0.6*　E. *0.75*

2 An ice skater with rotational I_0 is spinning with angular speed ω_0. She pulls her arms in, thereby increasing her angular speed to $4\omega_0$. Her rotational inertia is then:
A. I_0　B. $I_0/2$　C. $2I_0$　D. $I_0/4$　E. $4I_0$

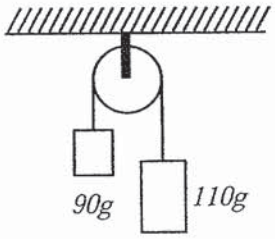
3 A thin circular hoop of mass *1.0kg* and radius *2.0m* is rotating about an axis through its center and perpendicular to its plane. It is slowing down at the rate of *7.0 rad/s²*. The net torque acting on it is:
A. *7.0 N•m*　B. *14.0 N•m*　C. *28.0 N•m*　D. *44.0 N•m*　E. *24 N•m*

4 A *240-N* weight is hung from two ropes as shown. The tension force of the horizontal rope has magnitude:
A. *0*　B. *656N*　C. *480N*　D. *416N*　E. *176N*

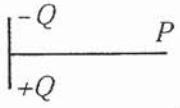


5 A stretched string, clamped at its end, vibrates in its fundamental frequency. To double the fundamental frequency, one can change the string tension by a factor of:
A. *2*　B. *4*　C. $\sqrt{2}$　D. *1/2*　E. $1/\sqrt{2}$

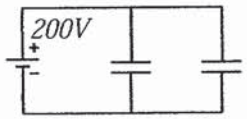
6 Two blocks are connected by a string and pulley as shown. Assuming that the string and pulley are massless, the magnitude of the acceleration of each block is:
A. *0.049m/s²*　B. *0.020m/s²*　C. *0.0098m/s²*　D. *0.54m/s²*　E. *0.98m/s²*



7 The diagram shows a particle with positive charge Q and a particle with negative charge $-Q$. The electric field at point P on the perpendicular bisector of the line joining them is:
A. ↑　B. ↓　C. →　D. ←　E. *0*



8 To store a total of *0.04J* of energy in the two identical capacitors shown, each should have a capacitance of:
A. *0.1μF*　B. *0.5μF*　C. *1.0μF*　D. *1.5μF*　E. *2.0μF*



9 A metal sphere carries a charge of $5\times 10^{-9}C$ and is at a potential of $400V$, relative to the potential far away. The potential at the center of the sphere is:

A. $400V$ B. $-400V$ C. $2\times 10^{-6}V$ D. 0 E. $-2\times 10^{-6}V$

10 Two long straight wires are parallel and carry current in the same direction. The currents are $8A$ and $12A$ and the wires are separated by $0.4cm$. The magnetic field in tesla at a point midway between the wires is:

A. 0 B. 4.0×10^{-4} C. 8.0×10^{-4} D. 1.2×10^{-3} E. 2.0×10^{-3}

11 An isolated charged point particle produces an electric field with magnitude E at a point $2m$ away. At a point $1m$ from the particle the magnitude of the field is:

A. E B. $2E$ C. $4E$ D. $E/2$ E. $E/4$

12 A $60W$ light bulb carries a current of $0.5A$. The total charge passing through it in one hour is:

A. $120C$ B. $3600C$ C. $3000C$ D. $2400C$ E. $1800C$

13 A cylindrical region of radius R contains a uniform magnetic field, parallel to its axis, with magnitude that is changing linearly with time. If r is the radial distance from the cylinder axis, the magnitude of the induced electric field inside the cylinder is proportional to:

A. R B. r C. r^2 D. $1/r$ E. $1/r^2$

14 An RLC series circuit has $R = 4\Omega$, $X_c = 3\Omega$, $X_L = 6\Omega$. The impedance of this circuit is:

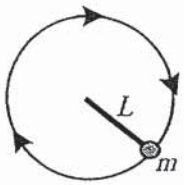
A. 5Ω B. 7Ω C. 9Ω D. 11Ω E. 13Ω

15 A glass ($n= 1.6$) lens is coated with a thin film ($n= 1.3$) to reduce reflection of certain incident light. If λ is the wavelength of the light in the film, the least film thickness is:

A. less than $\lambda/4$ B. $\lambda/4$ C. $\lambda/2$ D. λ E. more than λ

16 A ball of mass, at one end of a string of length L, rotates in a vertical circle just fast enough to prevent the string from going slack at the top of the circle. The speed of the ball at the bottom of the circle is:

A. $\sqrt{2gL}$ B. $\sqrt{3gL}$ C. $\sqrt{4gL}$ D. $\sqrt{5gL}$ E. $\sqrt{7gL}$



17 A string of length L is clamped at each end and vibrates in a standing wave pattern. The wavelengths of the constituent traveling waves CANNOT be:

A. L B. $2L$ C. $L/2$ D. $2L/3$ E. $4L$

18 A *1.0kg* ball moving at *2.0 m/s* perpendicular to a wall rebounds from the wall at *1.5 m/s*. The change in the momentum of the ball is:

A. *0* B. *0.5N•s*,away from wall
C. *0.5N•s*, towardwall D. *3.5N•s*, away from wall E. *3.5N•s*, toward wall

19 An electron traveling with speed v around a circle of radius r is equivalent to a current of:

A. $evr/2$ B. ev/r C. $ev/2\pi r$ D. $2\pi er/v$ E. $2\pi ev/r$

20 A ball is held *50cm* in front of a plane mirror. The distance between the ball and its image is:

A. *100cm* B. *150cm* C. *200cm* D. *0* E. *50cm*

21 A hoop rolls with constant velocity and without sliding along level ground. Let K_r be its rotational kinetic energy and K_t be its translational energy. The the relation between K_r and K_t is:

A. $2K_r = K_t$ B. $K_r = K_t$ C. $2K_t = K_r$ D. $4K_t = K_r$ E. $4K_r = K_t$

22 A point particle with charge q is at the center of a Gaussian surface in the form of a cube. The electric flux through any one face of the cube is:

A. q/ε_0 B. $q/4\pi\varepsilon_0$ C. $q/3\varepsilon_0$ D. $q/6\varepsilon_0$ E. $q/12\varepsilon_0$

23 In a plane electromagnetic wave in vacuum, the ratio *E/B* of the amplitudes in SI units of the two fields is:

A. the speed of light B. an increasing function of frequency
C. a decreasing function of frequency D. $\sqrt{2}$ E. $1/\sqrt{2}$

24 Assume the gravitational acceleration on Earth and on Moon is $9.8m/s^2$ and $1.6m/s^2$, respectively. An one hour interval recorded by a pendulum clock on Earth would be how many hours on Moon?

A. *(9.8/1.6)h* B. *1h* C. $\sqrt{9.8/1.6}\ h$ D. *(1.6/9.8)h* E. $\sqrt{1.6/9.8}\ h$

25 A long straight wire is in the plane of a rectangular conducting loop. The straight wire carries a constant current i, as shown. While the wire is being moved toward the rectangle the current in the rectangle is:

A. zero B. clockwise C. counterclockwise
D. clockwise in the left side and counterclockwise in the right side
E. counterclockwise in the left side and counterclockwise in the right side