國立臺灣海洋大學一００學年度研究所碩士班暨碩士在職專班入學考試試題

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.)

1 A long line of charge with λ_1 charge per unit length runs along the cylindrical axis of a cylindrical shell which carries a charge per unit length of λ_c. The charge per unit length on the inner and outer surfaces of the shell, respectively are:

A. λ_1 and λ_c B. $-\lambda_1$ and $\lambda_c+\lambda_1$ C. $-\lambda_1$ and $\lambda_c-\lambda_1$

D. $\lambda_1+\lambda_c$ and $\lambda_1-\lambda_c$ E. $\lambda_1-\lambda_c$ and $\lambda_1+\lambda_c$

2 Which of the following types of electromagnetic radiation travels at the greatest speed in vacuum?

A. Radio waves B. visible light C. X rays

D. Gamma rays E. All of these travel at the same speed.

3 Monochromatic light, at normal incidence, strikes a thin film in air. If λ denotes the wavelength in the film, what is the thinnest film in which the reflected light will be a maximum?

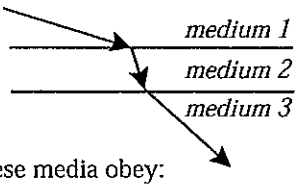
A. Much less than λ B. $\lambda/4$ C. $\lambda/2$

D. $3\lambda/4$ E. λ

4 Visible light has a frequency of about:

A. 5×10^{18} *Hz* B. 5×10^{16} *Hz*

C. 5×10^{12} *Hz* D. 5×10^{14} *Hz* E. 5×10^{10} *Hz*



5 A ray of light passes through three media as shown. The speed of light in these media obey:

A. $v_1>v_3>v_2$ B. $v_3>v_2>v_1$ C. $v_3>v_1>v_2$

D. $v_2>v_3>v_1$ E. $v_1>v_2>v_3$

6 A series *RL* circuit is connected to am emf source of angular frequency ω. The current:

A. lags the applied emf by $tan^{-1}(\omega L/R)$ B. leads the applied emf by $tan^{-1}(\omega L/R)$

C. lags the applied emf by $tan^{-1}(\omega R/L)$

D. leads the applied emf by $tan^{-1}(\omega R/L)$ E. is zero

7 The light intensity *10m* from a point source is $1000W/m^2$. The intensity *100m* from the same source is:

A. $1000W/m^2$ B. $100W/m^2$ C. $10W/m^2$

D. $1W/m^2$ E. $0.1W/m^2$

8 A simple pendulum is suspended from the ceiling of an elevator. The elevator is accelerating upwards with acceleration *a*. The period of this pendulum, in terms of its length *L*, *g*, and *a* is:

A. $2\pi\sqrt{L/g}$ B. $2\pi\sqrt{L/(g+a)}$ C. $2\pi\sqrt{L/(g-a)}$

D. $2\pi\sqrt{L/a}$ E. $(1/2\pi)\sqrt{g/L}$

9 A hair dryer is marked "*120V, 600W*". In normal use, the current in it is:

A. *2A* B. *4A* C. *0.2A* D. *5A* E. *7.2A*

10 Waves from two slits are in phase at the slits and travel to a distant screen to produce the second minimum of the interference pattern. The difference in the distance traveled by the waves is:
A. half a wavelength B. a wavelength C. three halves of a wavelength
D. two wavelengths E. five halves of a wavelength

11 A $2\mu F$ and a $1\mu F$ capacitor are connected in series and charged by a battery. They store energies P and Q, respectively. When disconnected and charged separately using the same battery, they store energies R and S, respectively. Then:
A. $R > P > S > Q$ B. $P > Q > R > S$ C. $R > P > Q > S$
D. $P > R > S > Q$ E. $R > S > Q > P$

12 A square loop of current-carrying wire with edge length a is in the xy plane, the origin being at its center. Along which of the following lines can a charge move without experiencing a magnetic force?
A. $x = 0, y = a/2$ B. $x = a/2, y = a/2$ C. $x = a/2, y = 0$
D. $x = 0, y = 0$ E. $x = -a/2, y = -a/2$

13 If λ is the wavelength of each of the component sinusoidal traveling waves that form a standing wave, the distance between adjacent nodes in the standing wave is:
A. $\lambda/4$ B. $\lambda/2$ C. $3\lambda/4$ D. λ E. 2λ

14 Ablock of mass m is initially moving to the right on a horizontal frictionless surface at a speed v. It then compresses a spring of spring constant k. At the instant when the kinetic energy of the block is equal to the potential energy of the spring, the spring is compressed a distance of:
A. $v\sqrt{m/2k}$ B. $v\sqrt{m/k}$ C. $(v/2)\sqrt{m/k}$
D. $v\sqrt{2m/k}$ E. $(v/4)\sqrt{m/k}$

15 Apistol of mass M is initially at rest but free to recoil. It fires a bullet of mass m and velocity v (relative to the ground). After firing, the velocity of the pistol (relative to the ground) is:
A. $-mv$ B. $-Mv/m$ C. $-mv/M$
D. $-v$ E. mv/M

16 The angular speed of the minute hand of a watch is:
A. $60/\pi$ m/s B. $1800/\pi$ rad/s C. $60/\pi$ rad/s
D. $\pi/1800$ rad/s E. $\pi/1800$ m/s

17 Two blocks with masses m and M are pushed along a horizontal frictionless surface by a horizontal applied force F as shown. The magnitude of the force of either of these blocks on the other is:
A. $mF/(m+M)$ B. mF/M C. $mF/(M-m)$
D. $MF/(m+M)$ E. MF/m

18 At time $t = 0$ a $2kg$ particle has a velocity of $(4m/s)\mathbf{i} - (3m/s)\mathbf{j}$. At $t = 3s$ its velocity is $(2m/s)\mathbf{i} - (3m/s)\mathbf{j}$. During this time the work done on it was:

A. $4J$ B. $-4J$ C. $-12J$

D. $-40J$ E. $(4J)\mathbf{i} - (3J)\mathbf{j}$

19 The tension in a string with a linear mass density of $0.0010kg/m$ is $0.4N$. A sinusoidal wave with a wavelength of $20cm$ on this string has a frequency of:

A. $100Hz$ B. $0.25Hz$ C. $0.0125Hz$

D. $630Hz$ E. $1000Hz$

20 In an oscillating LC circuit, the total stored energy is U and the maximum charge on the capacitor is Q. When the charge on the capacitor is $Q/2$, the energy stored in the inductor is:

A. $U/2$ B. $U/4$ C. $4U/3$

D. $3U/2$ E. $3U/4$

21 Electron (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:

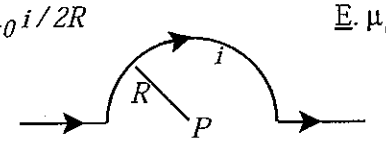
A. $(\sqrt{2eV/m})/B$ B. $B\sqrt{2eV/m}$ C. $(\sqrt{2mV/e})/B$

D. $B\sqrt{2mV/e}$ E. $(\sqrt{2e/mV})/B$

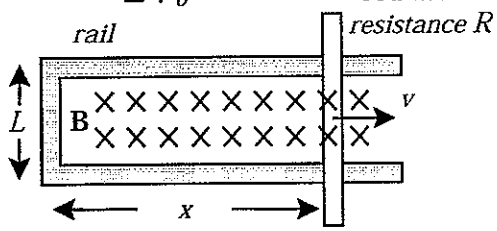
22 The magnitude of the magnetic field at point P, at the center of the semicircle shown, is given by:

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

D. $\mu_0 i/2R$ E. $\mu_0 i/4R$



23 A rod with resistance R lies across frictionless conducting rails in a constant uniform magnetic field **B**, as shown. Assume the rails have negligible resistance. The magnitude of the force that must be applied by a person to pull the rod to the right at constant speed v is:



A. 0 B. BLv C. BLv/R

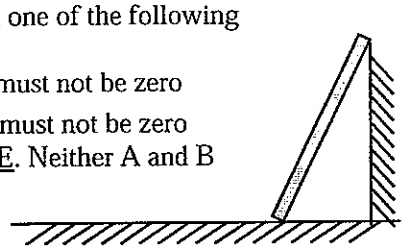
D. B^2L^2v/R E. B^2Lv^2/R

24 A ladder leans against a wall. If the ladder is not to slip, which one of the following must be true?

A. The coefficient of friction between the ladder and the wall must not be zero

B. The coefficient of friction between the ladder and the floor must not be zero

C. Both A and B D. Either A or B E. Neither A and B



25 The critical angle for total internal reflection at a diamond-air interface is $25°$. Suppose light is incident at an angle of θ with the normal. Total internal reflection will occur if the incident medium is:

A. air and $\theta = 25°$ B. air and $\theta > 25°$ C. air and $\theta < 25°$

D. diamond and $\theta < 25°$ E. diamond and $\theta > 25°$