臺灣綜合大學系統112學年度學士班轉學生聯合招生考試試題

科目名稱	普通物理C	類組代碼	共同考科
		科目碼	E0016

※本項考試依簡章規定所有考科均「不可」使用計算機。　　本科試題共計 3 頁

Some useful constants

Gas constant $R = 8.314$ J/mol·K

Mass of Sun $= 2.0 \times 10^{30}$ kg

Radius of Earth $= 6.4 \times 10^{6}$ m

Electron mass $m_e = 9.1 \times 10^{-31}$ kg

Electric constant (permittivity) $\epsilon_0 = 8.85 \times 10^{-12}$ C^2 /N·m^2

Magnetic constant (permeability) $\mu_0 = 4\pi \times 10^{-7}$ T·m/A

Plank's constant $h = 6.63 \times 10^{-34}$ J·s

Boltzmann constant $k_b = 1.380 \times 10^{-23}$ J·K^{-1}

Gravitational constant $G = 6.68 \times 10^{-11}$ N·m^2 /kg^2

Mass of Earth $= 6.0 \times 10^{24}$ kg

Radius of Sun $= 7.0 \times 10^{8}$ m

Electron charge $e = 1.6 \times 10^{-19}$ C

1 eV $= 1.6 \times 10^{-19}$ J

選擇題（單選，總分 100 分）

共 20 題，每題 5 分。

1. A jet plane in straight horizontal flight passes over your head. When the plane is directly above you, the sound seems to come from a point behind the plane in a direction 45° from the vertical. The speed of the sound is v_s. The speed of the plane is about: (A) v_s (B) $0.5v_s$ (C) $0.71v_s$ (D) $1.41v_s$ (E) $2v_s$.

2. A horizontal force of 10 N pushes a 0.5-kg block against a vertical wall. The book is initially at rest. If the static coefficient of friction (μ_s) is 0.6 and the kinetic coefficient of friction (μ_k) is 0.4, which of the following is true? (A) The frictional force is 4.9 N (B) The frictional force is 6.0 N (C) The frictional force is 4.0 N (D) The normal force is 4.9 N (E) The normal force is 10.9 N.

3. An ideal spring is hung vertically from the ceiling. When a 2.0-kg mass hangs at rest from it, the spring is extended 5.0 cm from its relaxed length. A downward external force is now applied to the mass to extend the spring an additional 10 cm. While the spring is being extended by the force, the work done by the spring is about: (A) -3.92 J (B) -1.96 J (C) 0 J (D) 1.96 J (E) 3.92 J.

4. A particle moves along the x axis. The net force on the particle, which is conservative, is given by $F = (8\ \text{N/m}^3)x^3$. If the potential energy is taken to be zero for $x = 0$ then the potential energy as a function of x is given by: (A) $(2\ \text{J/m}^4)x^4$ (B) $(-2\ \text{J/m}^4)x^4$ (C) $(24\ \text{J/m}^2)x^2$ (D) $(-24\ \text{J/m}^2)x^2$ (E) $(8\ \text{J/m}^2)x^2$.

5. Bullets from two guns are fired with the same velocity. The bullet from gun #1 is twice as heavy as the bullet from gun #2, and gun #1 weighs three times as much as gun #2. The ratio of the momentum imparted to gun #1 to that imparted to gun #2 is: (A) 2:3 (B) 3:2 (C) 3:1 (D) 2:1 (E) 6:1.

6. A forward force acting on the axle accelerates a rolling wheel on a horizontal surface. If the wheel does not slide, the frictional force of the surface on the wheel is: (A) zero. (B) in the forward direction and does zero work on the wheel. (C) in the forward direction and does positive work on the wheel. (D) in the backward direction and does zero work on the wheel. (E) in the backward direction and does negative work on the wheel.

科目名稱	普通物理C	類組代碼	共同考科
		科目碼	E0016

※本項考試依簡章規定所有考科均「不可」使用計算機。 本科試題共計 3 頁

7. A 2.0-kg block starts from rest on the positive x axis 3.0 m from the origin and thereafter has an acceleration given by $\vec{a} = 4.0\hat{\imath} - 3.0\hat{\jmath}$ m/s^2. The torque, relative to the origin, acting on it at the end of 2.0 s is: (A) (0 N·m) $\hat{k}$ (B) (–18 N·m) $\hat{k}$ (C) (+24 N·m) $\hat{k}$ (D) (–144 N·m) $\hat{k}$ (E) (+144 N·m) $\hat{k}$.

8. A stick of length 1.0 m is pivoted at a point a distance a from its center and swings as a physical pendulum. Of the following values for a, which results in the shortest period of oscillation? (A) a = 0.1 m (B) a = 0.2 m (C) a = 0.3 m (D) a = 0.4 m (E) a = 0.5 m.

9. The displacement of a string wave is given by: $y(x,t) = y_m\sin(kx + \omega t)$. The traveling wave velocity is: (A) $+2\pi k\omega\ \hat{\imath}$ (B) $-2\pi k\omega\ \hat{\imath}$ (C) $+k\omega\ \hat{\imath}$ (D) $+\omega/k\ \hat{\imath}$ (E) $-\omega/k\ \hat{\imath}$.

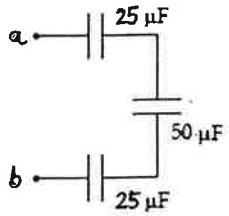
10. A hot object and a cold object are placed in thermal contact and the combination is isolated. They transfer energy until they reach a common temperature. The change ΔS_h in the entropy of the hot object, the change ΔS_c in the entropy of the cold object, and the change ΔS_{total} in the entropy of the combination are: (A) $\Delta S_h > 0$, $\Delta S_c > 0$, $\Delta S_{\text{total}} > 0$ (B) $\Delta S_h < 0$, $\Delta S_c > 0$, $\Delta S_{\text{total}} = 0$ (C) $\Delta S_h > 0$, $\Delta S_c < 0$, $\Delta S_{\text{total}} = 0$ (D) $\Delta S_h > 0$, $\Delta S_c < 0$, $\Delta S_{\text{total}} > 0$ (E) $\Delta S_h < 0$, $\Delta S_c > 0$, $\Delta S_{\text{total}} > 0$.

11. The units of $k = 1/(4\pi\varepsilon_0)$ are: (A) N^2/C^2, (B) N·m/C, (C) N^2·m^2/C^2, (D) N·m^2/C^2, (E) m^2/C^2.

12. Two infinite parallel surfaces carry uniform charge densities of 0.20 nC/m^2 and −0.60 nC/m^2. What is the magnitude of the electric field at a point between the two surfaces? (A) 30 N/C, (B) 5 N/C, (C) 45 N/C, (D) 10 N/C, (E) 90 N/C.

13. Which statement is always correct when applied to a charge distribution located in a finite region of space? (A) Electric potential is always zero at infinity, (B) Electric potential is always infinite at a boundary surface to a charge distribution, (C) Electric potential is always zero at a boundary surface to a charge distribution, (D) Electric potential is always zero at the origin, (E) The location where electric potential is zero may be chosen arbitrarily.

14. How much energy is stored in the 50-μF capacitor when $V_a - V_b$ = 22 V? (A) 0.85 mJ, (B) 0.28 mJ, (C) 0.70 mJ, (D) 0.48 mJ, (E) 0.10 mJ.

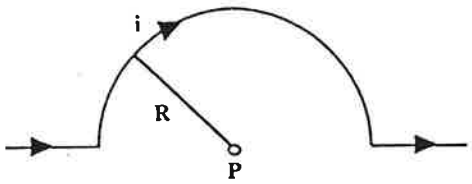


15. In the Drude model of electrical conduction, the current density is directly proportional to (A) the average time interval between successive collisions, (B) the number of charge carriers per unit volume, (C) the square of the electron charge, (D) the electric field present in the wire, (E) the product of all four quantities listed above.

科目名稱	普通物理C	類組代碼	共同考科
		科目碼	E0016

※本項考試依簡章規定所有考科均「不可」使用計算機。 本科試題共計 3 頁

16. The magnitude of the magnetic field at point P, at the center of the semicircle shown below is given by: (A) $\mu_0 i/R^2$, (B) $(\mu_0 i/2)R$, (C) $\mu_0 i/2R$, (D) $(\mu_0 i/4)R$, (E) $\mu_0 i/4R$.



17. The magnetic flux through a loop perpendicular to a uniform magnetic field will change (A) if the loop is replaced by two loops, each of which has half of the area of the original loop, (B) if the loop moves at constant velocity in a direction parallel to the axis of the loop while remaining in the uniform magnetic field, (C) if the loop moves at constant velocity while remaining perpendicular to and within the uniform magnetic field, (D) if the loop is rotated through 180 degrees about an axis through its center and in the plane of the loop, (E) in none of the above cases.

18. When a switch is closed to complete a DC series *RL* circuit, (A) the magnetic field outside the wires increases to a maximum value, (B) the electric field in the wires increases to a maximum value, (C) the rate of change of the electric and magnetic fields is greatest at the instant when the switch is closed, (D) all of the above are true, (E) only (A) and (C) above are true.

19. An astronaut traveling with a speed $v = 0.90c$ holds a meterstick in his hand. If he measures its length, he will obtain a value of (A) 1.0 m, (B) 2.5 m, (C) 0.10 m, (D) 0.50 m, (E) 3.80 m.

20. A stopping potential of 3.2 V is needed for radiation whose wavelength is 200 nm. What is the work function (in eV) of the material? (A) 4.5, (B) 3.0, (C) 5.8, (D) 8.0, (E) 1.0.