

國立臺北大學 105 學年度日間學士班暨進修學士班轉學生招生考試試題

系 別：電機工程學系日間學士班 2 年級

考試時間：80 分鐘

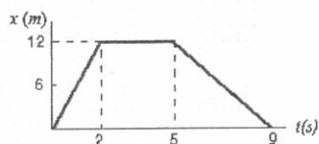
科 目：普通物理

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No calculator or computer is required for this test.

1. This graph shows the position of a particle as a function of time. What is its instantaneous velocity at $t = 7\text{s}$?

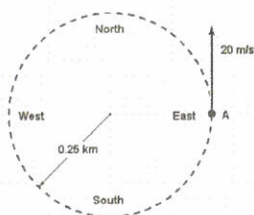


- a. 3 m/s
- b. -3 m/s
- c. 12 m/s
- d. -12 m/s
- e. Need additional information.

2. A rock is projected from the edge of the top of a building with an initial velocity of 12.2 m/s at an angle of 53° above the horizontal. The rock strikes the ground a horizontal distance of 25 m from the base of the building. Assume that the ground is level and that the side of the building is vertical. How tall is the building?

- a. 25.3 m
- b. 29.6 m
- c. 27.4 m
- d. 23.6 m
- e. 18.9 m

3. A car travels counterclockwise around a flat circle of radius 0.25 km at a constant speed of 20 m/s. When the car is at point A as shown in the figure, what is the car's acceleration?



- a. 1.6 m/s^2 , south
- b. Zero
- c. 1.6 m/s^2 , east
- d. 1.6 m/s^2 , north
- e. 1.6 m/s^2 , west

試題隨卷繳交

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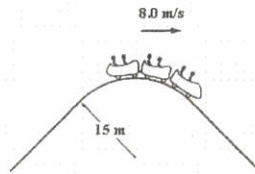
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4. A constant force F is applied to a body of mass m that initially is headed east at velocity v_0 until its velocity becomes $-v_0$. The total time of travel is $2t$. What is the total distance the body travels that time?

- a. $\frac{1}{2} \frac{F}{m} t^2$.
- b. $\frac{F}{m} t^2$.
- c. $v_0 t - \frac{1}{2} \frac{F}{m} t^2$.
- d. $v_0 t + \frac{1}{2} \frac{F}{m} t^2$.
- e. $2 \left(v_0 t + \frac{1}{2} \frac{F}{m} t^2 \right)$.

5. A roller-coaster car has a mass of 500 kg when fully loaded with passengers. The car passes over a hill of radius 15 m, as shown. At the top of the hill, the car has a speed of 8.0 m/s. What is the force of the track on the car at the top of the hill?



- a. 7.0 kN up
- b. 7.0 kN down
- c. 2.8 kN down
- d. 2.8 kN up
- e. 5.6 kN down

6. The horizontal surface on which the block slides is frictionless. The speed of the block before it touches the spring is 6.0 m/s. How fast is the block moving at the instant the spring has been compressed 15 cm? $k = 2.0 \text{ kN/m}$



- a. 3.7 m/s
- b. 4.4 m/s
- c. 4.9 m/s
- d. 5.4 m/s
- e. 14 m/s

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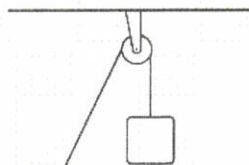
7. A neutron has a mass of 1.67×10^{-27} kg. Its de Broglie wavelength is 1.4×10^{-10} m. What is its kinetic energy (in eV)?

- a. 4
- b. 0.4
- c. 0.04
- d. 40
- e. 0.08

8. A 2.0-kg object moving 5.0 m/s collides with and sticks to an 8.0-kg object initially at rest. Determine the kinetic energy lost by the system as a result of this collision.

- a. 20 J
- b. 15 J
- c. 30 J
- d. 25 J
- e. 5.0 J

9. A wheel (radius = 0.20 m) is mounted on a frictionless, horizontal axis. A light cord wrapped around the wheel supports a 0.50-kg object, as shown in the figure. When released from rest the object falls with a downward acceleration of 5.0 m/s². What is the moment of inertia of the wheel?



- a. 0.023 kg·m²
- b. 0.027 kg·m²
- c. 0.016 kg·m²
- d. 0.019 kg·m²
- e. 0.032 kg·m²

10. A particle whose mass is 2.0 kg moves in the xy plane with a constant speed of 3.0 m/s along the direction $\hat{r} = \hat{i} + \hat{j}$. What is its angular momentum (in kg·m²/s) relative to the point (0, 5.0) meters?

- a. $12\hat{k}$
- b. $11\hat{k}$
- c. $13\hat{k}$
- d. $14\hat{k}$
- e. $21\hat{k}$

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11. A piano wire of length 1.5 m vibrates so that one-half wavelength is contained on the string. If the frequency of vibration is 65 Hz, the amplitude of vibration is 3.0 mm, and the density is 15 g/m, how much energy is transmitted per second down the wire?

- a. 21 W
- b. 11 W
- c. 5.4 W
- d. 2.2 W
- e. 1.1 W

12. Which of the following is not a possible thermometric property of a body?

- a. The change in length of a solid.
- b. The change in volume of a gas at constant pressure.
- c. The change in pressure of a gas at constant volume.
- d. The change in weight at constant pressure and volume.
- e. The change in electrical resistance of a conductor.

13. Three point charges, two positive and one negative, each having a magnitude of $20 \mu\text{C}$ are placed at the vertices of an equilateral triangle (30 cm on a side). What is the magnitude of the electrostatic force on the negative charge?

- a. 80 N
- b. 40 N
- c. 69 N
- d. 57 N
- e. 75 N

14. If the electric field just outside a thin conducting sheet is equal to 1.5 N/C , determine the surface charge density on the conductor.

- a. 53 pC/m^2
- b. 27 pC/m^2
- c. 35 pC/m^2
- d. 13 pC/m^2
- e. 6.6 pC/m^2

15. A particle (charge = $5.0 \mu\text{C}$) is released from rest at a point $x = 10 \text{ cm}$. If a $5.0\text{-}\mu\text{C}$ charge is held fixed at the origin, what is the kinetic energy of the particle after it has moved 90 cm?

- a. 1.6 J
- b. 2.0 J
- c. 2.4 J
- d. 1.2 J
- e. 1.8 J

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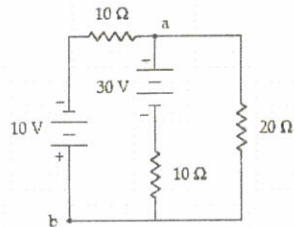
16. A $3.0\text{-}\mu\text{F}$ capacitor charged to 40 V and a $5.0\text{-}\mu\text{F}$ capacitor charged to 18 V are connected to each other, with the positive plate of each connected to the negative plate of the other. What is the final charge on the $3.0\text{-}\mu\text{F}$ capacitor?

- a. $11\ \mu\text{C}$
- b. $15\ \mu\text{C}$
- c. $19\ \mu\text{C}$
- d. $26\ \mu\text{C}$
- e. $79\ \mu\text{C}$

17. A $4.0\text{-}\Omega$ resistor has a current of 3.0 A in it for 5.0 min. How many electrons pass through the resistor during this time interval?

- a. 7.5×10^{21}
- b. 5.6×10^{21}
- c. 6.6×10^{21}
- d. 8.4×10^{21}
- e. 2.1×10^{21}

18. What is the potential difference $V_b - V_a$ shown in the circuit below.



- a. $-8.0\ \text{V}$
- b. $+8.0\ \text{V}$
- c. $-18\ \text{V}$
- d. $+18\ \text{V}$
- e. $-12\ \text{V}$

19. A straight wire of length 70 cm carries a current of 50 A and makes an angle of 60° with a uniform magnetic field. If the force on the wire is 1.0 N what is the magnitude of B?

- a. 41 mT
- b. 33 mT
- c. 55 mT
- d. 87 mT
- e. 57 mT

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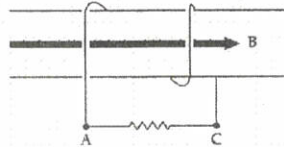
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20. Two long parallel wires separated by 4.0 mm each carry a current of 24 A. These two currents are in the same direction. What is the magnitude of the magnetic field at a point that is between the two wires and 1.0 mm from one of the two wires?

- a. 4.8 mT
- b. 6.4 mT
- c. 3.2 mT
- d. 9.6 mT
- e. 5.3 mT

21. The coil shown in the figure has 2 turns, a cross-sectional area of 0.20 m^2 , and a field (parallel to the axis of the coil) with a magnitude given by $B = (4.0 + 3.0t^2) \text{ T}$, where t is in s. What is the potential difference, $V_A - V_C$, at $t = 3.0 \text{ s}$?



- a. -7.2 V
- b. $+7.2 \text{ V}$
- c. -4.8 V
- d. $+4.8 \text{ V}$
- e. -12 V

22. A series LC circuit contains a 100 mH inductor, a 36.0 mF capacitor and a 12 V battery. The angular frequency of the electromagnetic oscillations in the circuit is

- a. $36.0 \times 10^{-4} \text{ rad/s}$.
- b. $6.00 \times 10^{-2} \text{ rad/s}$.
- c. 2.78 rad/s.
- d. 16.7 rad/s.
- e. 277 rad/s.

23. A current $I = 3 \sin(400t)$ amperes flows in a series RL circuit in which $L = 1 \text{ mH}$ and $R = 100\Omega$. What is the average power loss?

- a. 225 W
- b. 450 W
- c. 980 W
- d. 1.12 kW
- e. 900 W

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24. In the atmosphere, the shortest wavelength electromagnetic waves are called

- a. microwaves.
- b. infrared waves.
- c. ultraviolet waves.
- d. X-rays.
- e. gamma rays.

25. According to Einstein's theory, the energy of a photon is

- a. proportional to its wavelength.
- b. proportional to its frequency.
- c. constant, since the speed of light is a constant.
- d. quantized, since it always appears in bundles of size, 1.6×10^{-19} C.
- e. proportional to the square of the frequency.

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