

系所組別： 全校

考試科目： 普通物理

考試日期：0714，節次：4

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Part I: 單一選擇題，每題5分，答錯不倒扣

1. A particle moves along the x axis according to the equation $v(t) = 4 - 2t$ where x is in meters and t is in seconds. Therefore:
 - A) the acceleration of the particle is not constant
 - B) the average velocity of the particle is -2m/s from $t=0$ to $t=2$ s
 - C) we can't calculate the average velocity because the initial position is not given
 - D) none of the above
2. A uniform disk has radius R and mass M . When it is spinning with angular velocity ω about an axis through its center and perpendicular to its face its angular momentum is $I\omega$. When it is spinning with the same angle velocity about a parallel axis a distance h away its angular momentum is:
 - A) $I\omega$
 - B) $(I + Mh^2)\omega$
 - C) $(I - Mh^2)\omega$
 - D) $(I + MR^2)\omega$
3. The displacement of a string is given by
$$y(x,t) = y_m \sin(kx + \omega t).$$
Which one is **not correct**?
 - A) the speed of a sinusoidal wave on a string depends on the tension in the string
 - B) the waveform moves in the positive x direction
 - C) the speed of the waveform is ω/k
 - D) it is a transverse wave
4. In an ideal gas case, according to the first law of thermodynamics and kinetic theoryWhich one is **not true**?
 - A) the increase in the internal energy during any process equals the heat input plus the work done on the gas
 - B) energy form of internal, heat and mechanic work can be transformed to each other, and total energy is conserved
 - C) the internal energy is simple the kinetic energy of gas in inert gas case
 - D) the internal energy is a state function of system

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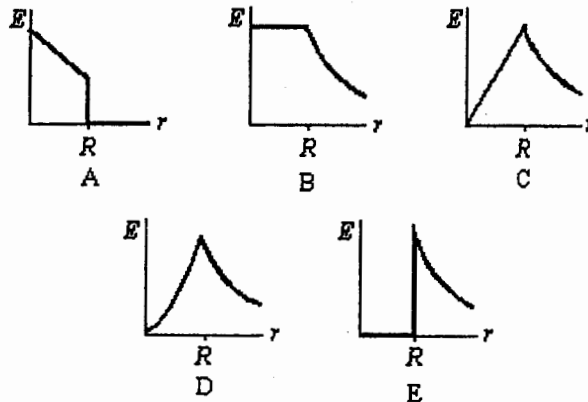
5. A quantity of an ideal gas is compressed to half its initial volume. The process may be adiabatic, isothermal or isobaric. Rank those three processes in order of the work required of an external agent, least to greatest.

- A) adiabatic, isothermal, isobaric
- B) adiabatic, isobaric, isothermal
- C) isothermal, adiabatic, isobaric
- D) isobaric, adiabatic, isothermal
- E) isobaric, isothermal, adiabatic

6. According to the second law of thermodynamics:

- A) heat energy cannot be completely converted to work
- B) work cannot be completely converted to heat energy
- C) for all cyclic processes we have $dQ/T < 0$
- D) we can find a thermodynamics process in nature if it obeys the first law of thermodynamics
- E) all of the above are true

7. Which of the following graphs represents the magnitude of the electric field as a function of the distance from the center of a solid charged conducting sphere of



radius R ?

- A) B
- B) C
- C) D
- D) E

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8. Parallel plate capacitor

Which one is **not correct**?

- A) the capacitance of a parallel-plate capacitor with plate area A and plate separation d is given by $\epsilon_0 A/d$
- B) if both the plate area and the plate separation of a parallel-plate capacitor are doubled, the capacitance is doubled
- C) the capacitance can be increased by inserting a high dielectric material into the space of parallel plate
- D) work done from charge process is stored in capacitor in term of electrical field energy

9. Ferromagnetism is closely associated with:

- A) the tendency of electron dipole moments to align with an applied magnetic field
- B) the tendency of electron dipole moments to align opposite to an applied magnetic field
- C) the tendency of electron dipole moments to change magnitude in an applied magnetic field
- D) the tendency of electron dipole moments to align with each other by themselves

10. Which one is **correct**?

- A) a "wave front" means a surface of maxima amplitude only
- B) coherence is the most important factor to produce an interference pattern
- C) phase of a wave is determined by frequency only
- D) Medium wave, E&M wave and matter wave, they have the same interference phenomena, therefore they have the same physics properties
- E) Young's double slit interference experiment **cannot** explained by photon concept

11. A basic postulate of Einstein's theory of relativity is:

- A) moving clocks run more slowly than when they are at rest
- B) moving rods are shorter than when they are at rest
- C) light has both wave and particle properties
- D) the laws of physics must be the same for observers moving with uniform velocity relative to each other
- E) visible light is one kind of E&M wave

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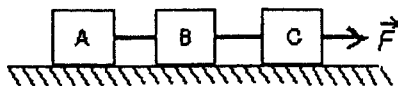
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12. Direct evidence for the wave nature of matter is:

- A) electron diffraction experiments of Davisson and Germer
- B) Thompson's measurement of e/m
- C) Young's double slit experiment
- D) the Compton effect
- E) Hydrogen atom spectrum

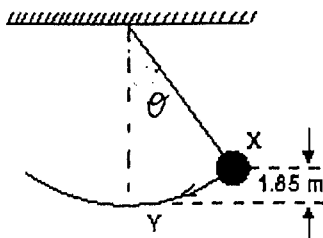
Part II: 計算題, 請依題號次序作答, 並寫出計算過程

1. (16分) Three blocks (A,B,C), each having mass 1Kg, 2Kg and 3Kg respectively, are connected by strings as shown. Block C is pulled to the right by a force $F=60$ newtons that causes the entire system to accelerate. Neglecting friction



Please calculate the following questions:

- A) the acceleration of system
 - B) the tension of a point between A and B
 - C) the tension of a point between B and C
 - D) the force exerting on block A
2. (12分) A simple pendulum consists of a 2.0 kg mass and a string with 50 cm long. θ is less than 10° . It is released from rest at X as shown. (ignore the string mass and dimension of mass)



Please calculate the following questions:

- A) Derive the motion equation of pendulum by force analysis
- B) Calculate the total energy of system
- C) The tension of string when the mass at lowest point

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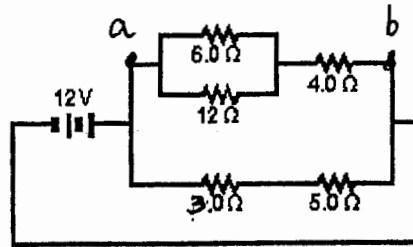
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3. (12分) A circuit is shown as figure



Please calculate

- A) The equilibrium resistance between a and b
- B) current in the $5.0\text{-}\Omega$ resistor

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