

诚信应考，考试作弊将带来严重后果！

期末考试《大学物理 III》A 卷

注意事项：1. 开考前请将密封线内各项信息填写清楚； 2. 所有答案请直接答在试卷上；
3. 考试形式：闭卷； 4. 本试卷共八大题，满分 100 分，考试时间 120 分钟。

题号	I	II	III	IV	V	VI	VII	VIII	总分
得分									

I. In each question, there is only one correct answer. Write your answers into the table. (30 points)

题号	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
答案															

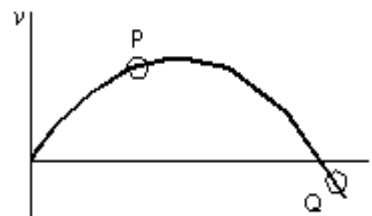
1. The SI base unit for mass is: []

A) gram B) pound C) kilogram D) ounce

2. A car travels 40 kilometers at an average speed of 80 km/h and then travels 40 kilometers at an average speed of 40 km/h. The average speed of the car for this 80 km trip is: []

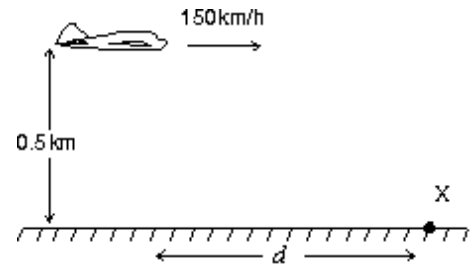
A) 40 km/h B) 45 km/h C) 48 km/h D) 53 km/h

3. The diagram shows a velocity-time graph for a car moving in a straight line. At point Q the car must be: []



- A) moving with zero acceleration
- B) traveling in the reverse direction to that at point P
- C) traveling below ground-level
- D) reducing speed

4. The airplane shown is in level flight at an altitude of 0.50 km and a speed of 150 km/h. At what distance d should it release a heavy bomb to hit the target X? Take $g = 10 \text{ m/s}^2$. []



- A) 150 m B) 295 m C) 417 m D) 2550 m

5. A stone is tied to a 0.50 m string and whirled at a constant speed of 4.0 m/s in a vertical circle. Its acceleration in m/s^2 at the top of the circle is: []

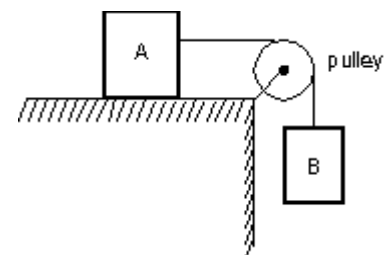
- A) 9.8, up B) 9.8, down C) 32, up D) 32, down

6. The block shown moves with constant velocity on a horizontal surface. Two of the forces acting on the block are shown. A frictional force exerted by the surface is the only other horizontal force acting on the block. The frictional force is: []



- A) 0 B) 2 N, leftward C) 2 N, rightward
D) slightly more than 2 N, leftward

7. Block A, with a mass of 50 kg, rests on a horizontal table top. The coefficient of static friction is 0.40. A horizontal string is attached to A and passes over a massless, frictionless pulley as shown. The smallest mass m_B that will start A moving when it is attached to the other end of the string is: []



- A) 20 kg B) 30 kg C) 40 kg D) 50 kg

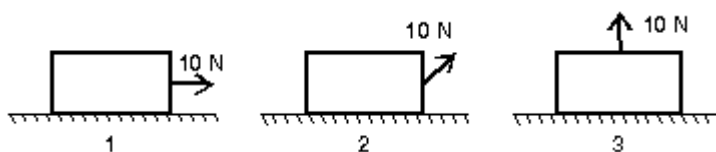
8. One end of a 1.0-m long string is fixed, the other end is attached to a 2.0-kg stone. The stone swings in a vertical circle, passing the **bottom** point at 4.0 m/s. The tension force of the string (in newtons) at this point is about: []

- A) 12 B) 20 C) 32 D) 52

9. An object of mass m and another object of mass $2m$ are each forced to move along a circle of radius 1.0 m at a constant speed of 1.0 m/s. The magnitudes of their accelerations are:

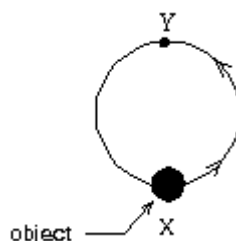
- A) equal
B) in the ratio of $\sqrt{2} : 1$
C) in the ratio of 2 : 1
D) in the ratio of 4 : 1

10. A crate moves to the right on a horizontal surface as a woman pulls on it with a 10-N force. Rank the situations shown below according to the work done by the 10-N force, least to greatest. The displacement is the same for all cases. []



- A) 3, 2, 1 B) 2, 1, 3 C) 1, 2, 3 D) 1, 3, 2

11. A man moves the 10-g object shown in a vertical plane from position X to position Y along a circular track of radius 20 m. The process takes 0.75 min. The work done by the man is about: []

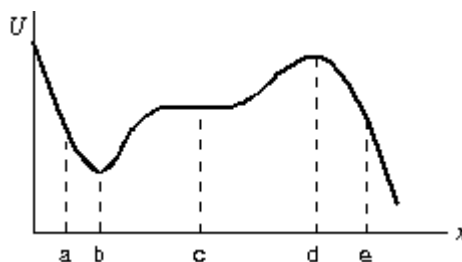


- A) 1 J B) 2 J C) 4 J D) 6 J

12. A block slides across a rough horizontal table top. The work done by friction changes:

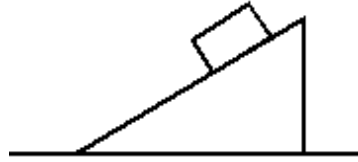
- A) only the kinetic energy
B) only the potential energy
C) only the internal energy
D) only the kinetic and internal energies

13. The diagram shows a plot of the potential energy as a function of x for a particle moving along the x axis. The points of unstable equilibrium are:



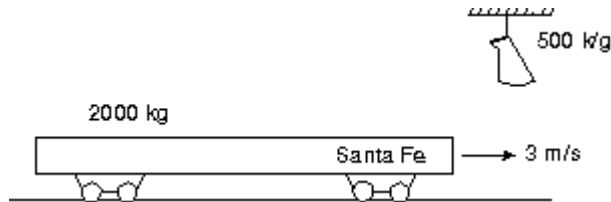
- A) only a B) only b C) only c D) only d

14. A large wedge rests on a horizontal frictionless surface, as shown. A block starts from rest and slides down the inclined surface of the wedge, which is rough. During the motion of the block the center of mass of the block and wedge:



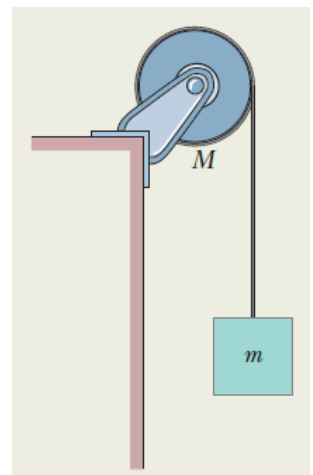
- A) moves horizontally with constant speed
- B) moves horizontally with increasing speed
- C) moves vertically with increasing speed
- D) moves both horizontally and vertically

15. A 500-kg sack of coal is dropped on a 2000-kg railroad flat car which was initially moving at 3 m/s as shown. After the sack rests on the flatcar, the speed of the flatcar is:



- A) 1.2 m/s
- B) 2.4 m/s
- C) 3.6 m/s
- D) 0.6 m/s

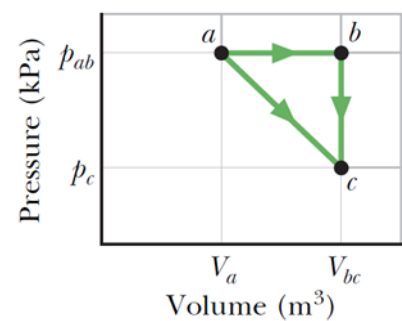
II (10pts) In the figure, a wheel of radius 0.20 m is mounted on a frictionless horizontal axis. The rotational inertia of the wheel about the axis is $0.40 \text{ kg}\cdot\text{m}^2$. A massless cord wrapped around the wheel's circumference is attached to a 6.0 kg box. The system is released from rest. When the box has a kinetic energy of 6.0 J, what are (a) the wheel's rotational kinetic energy and (b) the distance the box has fallen?



III (10pts) A 1.2 kg block sliding on a horizontal frictionless surface is attached to a horizontal spring with $k = 480 \text{ N/m}$. Let x be the displacement of the block from the position at which the spring is unstretched. At $t = 0$ the block passes through $x = 0$ with a speed of 5.2 m/s in the positive x direction. What are the (a) frequency and (b) amplitude of the block's motion? (c) Write an expression for x as a function of time.

IV (10pts) A sinusoidal transverse wave traveling in the negative direction of an x axis has an amplitude of 1.00 cm, a frequency of 550 Hz, and a speed of 330 m/s. If the wave equation is of the form $y(x, t) = y_m \sin(kx \pm \omega t)$, what are (a) y_m , (b) ω , (c) k , and (d) the correct choice of sign in front of ω ?

V (10pts) One mole of an ideal diatomic gas goes from a to c along the diagonal path in the figure. The scale of the vertical axis is set by $p_{ab} = 5.0 \text{ kPa}$ and $p_c = 2.0 \text{ kPa}$, and the scale of the horizontal axis is set by $V_{bc} = 4.0 \text{ m}^3$ and $V_a = 2.0 \text{ m}^3$. During the transition, (a) what is the change in internal energy of the gas, and (b) how much energy is added to the gas as heat? (c) How much heat is required if the gas goes from a to c along the indirect path abc ?



VI (10pts) A heat pump is used to heat a building. The outside temperature is 25°C , and the temperature inside the building is to be maintained at 22°C . The pump's coefficient of performance is 3.8, and the heat pump delivers 7.54 MJ as heat to the building each hour. If the heat pump is a Carnot engine working in reverse, at what rate must work be done to run it?

VII (10pts) White light is sent downward onto a horizontal thin film that is sandwiched between two materials. The indexes of refraction are 1.80 for the top material, 1.70 for the thin film, and 1.50 for the bottom material. The film thickness is 500 nm . Of the visible wavelengths (400 to 700 nm) that result in fully constructive interference at an observer above the film, which is the (a) longer and (b) shorter wavelength? The materials and film are then heated so that the film thickness increases. (c) Does the light resulting in fully constructive interference shift toward longer or shorter wavelengths?

VIII (10pts) A single slit is illuminated by light of wavelengths λ_a and λ_b , chosen so that the first diffraction minimum of the λ_a component coincides with the second minimum of the λ_b component. (a) If $\lambda_b = 350\text{ nm}$, what is λ_a ? For what order number m_b (if any) does a minimum of the λ_b component coincide with the minimum of the λ_a component in the order number (b) $m_a = 2$ and (c) $m_a = 3$?. Let m_a be the integer associated with a minimum in the pattern produced by light with wavelength λ_a , and m_b is defined in a similar way.