PHY2053 Exam 2 (Practice)

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Abstract

This exam consists of xx multiple choice questions. **You must record your answers on a Scantron sheet.** Don't record your answers on this print-out; I will not accept it as a submission. Fill out the Scantron sheet in with a pencil, not a pen. **Don't forget to include your name, the course, and exam number on the Scantron sheet.**

1. A 3.5kg box is pushed along a flat surface by the following forces:

$$\vec{F}_1 = (10\text{N})\hat{i} - (5\text{N})\hat{j}$$
$$\vec{F}_2 = -(2\text{N})\hat{i} + (3\text{N})\hat{j}$$

   What is the normal force on the box? Consider the $+y$-direction to be upward.

   (a) 27N
   (b) 33N
   (c) 37N
   (d) 43N

2. Given the same 3.5kg box under the influence of the same forces $\vec{F}_1$ and $\vec{F}_2$ as in Problem 1, what is the acceleration of the box?

   (a) 2.29 m/s^2
   (b) 3.43 m/s^2
   (c) 8 m/s^2
   (d) 10 m/s^2

3. True or false: the weight pulling an object downward, and the equal/opposite normal force pushing the object upward, form an action/reaction pair as defined by Newton's third law?

   (a) True
   (b) False

4. Two boxes are stacked, with box B placed on top of box A. If box A is pushed such that both boxes move at a constant velocity, is there any friction on either box?

   (a) Kinetic friction on box A and no friction on box B
   (b) Kinetic friction on box A and static friction on box B
   (c) Kinetic friction on box A and kinetic friction on box B
   (d) Static friction on box A and kinetic friction on box B

5. Consider two boxes: box B, with a mass of 3kg, placed on top box A, with a mass of 10kg. If box A is pushed with a force of 70N, what is the force of friction on box B? The coefficients of friction **between boxes A and B** are $\mu_s = 0.7$ and $\mu_k = 0.4$, while friction is negligible **between box A and the ground**.

   (a) 12N
   (b) 16.2N
   (c) 21N
   (d) 70N

6. True or false: adaptive forces have simple formulas for their magnitudes.

   (a) True
   (b) False

7. A 1.5kg box is pushed up a 30^o incline with a force $F = 20$N. If the incline surface has coefficients of friction $\mu_s = 0.4$ and $\mu_k = 0.2$, what is the acceleration on the box?

   (a) 3.25 m/s^2
   (b) 5.84 m/s^2
   (c) 6.74 m/s^2
   (d) 9.44 m/s^2

8. A 3kg mass hangs vertically from a spring with a force constant of 150 N/m. If the spring's natural length is 30cm, what is the length of the spring when the 3kg mass is in equilibrium?

   (a) 20cm
   (b) 30cm
   (c) 40cm
   (d) 50cm

9. A 3.7kg mass is moving at 9 m/s when an unknown force acts on it. If, after some amount of time, the mass is moving at 14 m/s, how much work was done by the unknown force?

   (a) 149.9J
   (b) 212.8J
   (c) 362.6J
   (d) 512.5J

10. A 4.6kg boxes slides down a 35^o incline, with $\mu_s = 0.5$ and $\mu_k = 0.3$. If the box slides a distance of 10cm down the incline's surface, how much work was done by friction?

    (a) -1.13J
    (b) 1.13J
    (c) -1.88J
    (d) 1.88J

11. A box is placed inside an elevator. While the elevator is rising, the work done on the box by the normal force is:

    (a) Positive

    (b) Negative

    (c) Zero

    (d) Unable to determine with the given information

12. A box is pushed along a path of some length, causing friction to do work on the box. If the box were pushed along a path with a greater length, then:

    (a) Friction would do less work, because it is conservative

    (b) Friction would do less work, because it is non-conservative

    (c) Friction would do more work, because it is conservative

    (d) Friction would do more work, because it is non-conservative

13. A 5kg mass is dropped from a height of 1.2m. If it hits the ground with a speed of 4 m/s, how much work was done by air resistance?

    (a) 20J

    (b) -20J

    (c) 40J

    (d) -40J

FORMULA SHEET

- Vectors:

$$\begin{aligned}\vec{A}\cdot\vec{B} &= AB\cos\theta \\ &= A_xB_x + A_yB_y + A_zB_z \\ \left|\vec{A}\times\vec{B}\right| &= AB\sin\theta\end{aligned}$$

- Kinematics:

$$g = 10\ \text{m/s}^2$$

$$\vec{v}_{av} = \frac{\Delta\vec{x}}{\Delta t}$$

$$\vec{a}_{av} = \frac{\Delta\vec{v}}{\Delta t}$$

$$\Delta x = v_0 t + \frac{1}{2}at^2$$

$$v = v_0 + at$$

$$v^2 = v_0^2 + 2a\Delta x$$

- Forces:

$$\sum\vec{F} = m\vec{a}$$

$$W = mg$$

$$F_{\text{sp}} = kx$$

$$f_{\text{s,max}} = \mu_s N$$

$$f_{\text{k}} = \mu_k N$$

- Work & Energy:

$$W = \vec{F}\cdot\Delta\vec{x}$$

$$W_{\text{tot}} = \Delta K$$

$$W_{\text{cons}} = -\Delta U$$

$$K = \frac{1}{2}mv^2$$

$$U_{\text{g}} = mgy$$

$$U_{\text{sp}} = \frac{1}{2}kx^2$$

$$K_i + U_i + W_{nc} = K_f + U_f \quad \text{(general energy equation)}$$

ANSWERS

1. (c)
2. (a)
3. (b)
4. (a)
5. (b)
6. (b)
7. (c)
8. (d)
9. (b)
10. (a)
11. (a)
12. (d)
13. (b)