

Fill in on the OPSCAN sheet:

- 1) Name
- 2) Student Identification Number
- 3) Exam Number as 02
- 4) Sign the OPSCAN sheet

Important: This test consists of 10 multiple-choice problems that are worth 15 points each.

Instructions: For each problem, choose the one answer that is correct or most nearly correct. Make a small mark, for your eyes only, near the letter of your choice. After you finish and check all the multiple-choice problems, transfer your answers to the computer sheet. Then, until you hand in the computer sheet, turn the sheet over and leave it face down.

Only answers on the computer sheet will be graded. As your OPSCAN answer sheet will not be returned, record the answers on the test paper that you will keep.

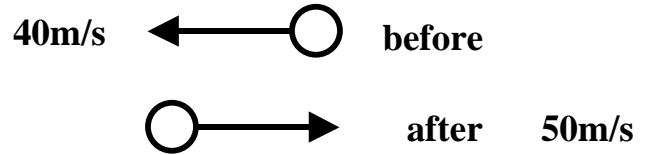
The correct answers will be displayed on the course web page, and you can find your score for this exam on CHIP.

This is a closed book exam. You may use a calculator and a formula sheet will be provided. You are not allowed to have information stored in your calculator, to have cell phones, pagers, PDA or any type of communication device.

You will need to show a valid I.D.

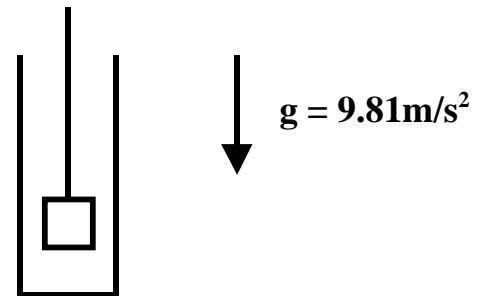
- 1) A 0.15 kg baseball is thrown with a speed of 40 m/s. It is hit straight back at the pitcher with a speed of 50 m/s. What is the average force in Newtons exerted by the bat if the two are in contact for 2.0×10^{-3} seconds?

- a) 6750
- b) 750
- c) 3000
- d) 3750
- e) 4500

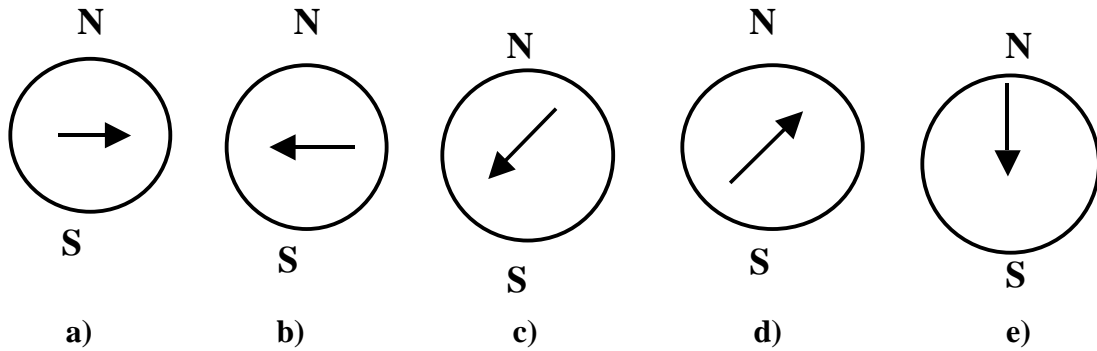


- 2) If a person lifts a 20 kg bucket from a well in 10 seconds and does 5000 joules of work. How deep is the well in meters? Assume the speed of the bucket remains constant as it is lifted.

- a) 2.55
- b) 255
- c) 21.25
- d) 25.5
- e) 23.75



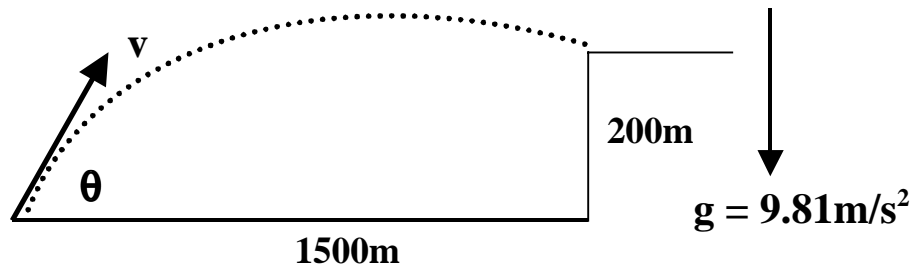
- 3) A synchronous satellite appears to be stationary above the earth's surface. For an observer in space looking at the earth which of the orbits shown is the most common for this type of satellite?



- a) Equatorial W → E
- b) Equatorial E → W
- c) 45° NE → NW
- d) 45° NW → NE
- e) Circumpolar N → S

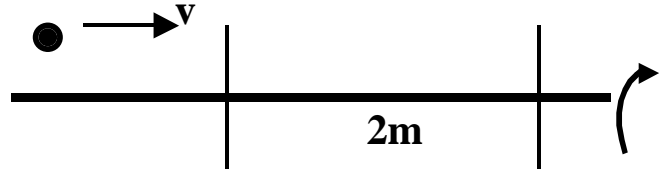
- 4) A projectile is fired with a speed of 200m/s to hit a target 1500 m away at a height of 200 m. What is the speed of the projectile just before impact in meters/sec?(ignore friction)

- a) 190
- b) 180
- c) 170
- d) 160
- e) 150



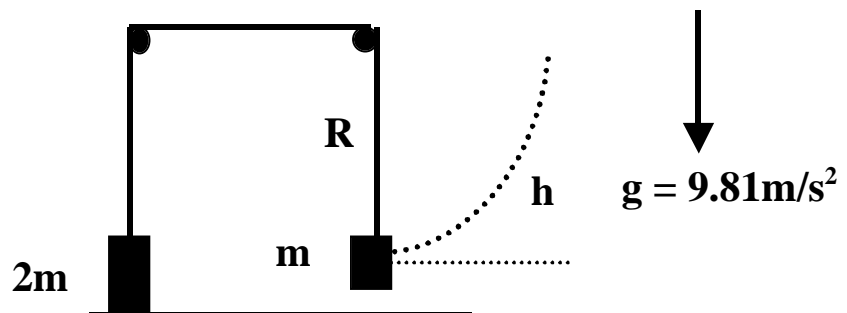
- 5) Two paper discs a distance of 2 meters apart are mounted on a shaft rotating at 500 rpm. A bullet is fired parallel to the shaft and the angular displacement of the second hole relative to the first is 55° . What is the speed of the bullet in meters/second?

- a) 85
- b) 352
- c) 109
- d) 526
- e) 206



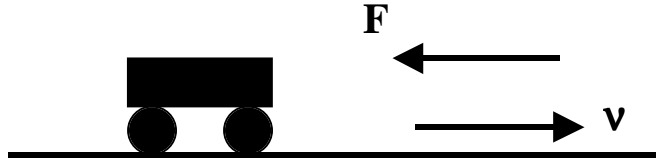
- 6) A mass m , which is free to swing in a circular path of radius R , is attached to a mass of $2m$ over two frictionless pulleys. The mass m is lifted to a height h and released. What is the minimum speed in m/s the mass m must have at its lowest point if the $2m$ mass is just lifted off the table? (Hint the required tension is $2mg$)

- a. \sqrt{Rg}
- b. $\sqrt{3Rg}$
- c. \sqrt{gh}
- d. $\sqrt{3gh}$
- e. $\sqrt{4Rg}$



- 7) Consider an automobile ($m = 1800 \text{ kg}$) traveling at a constant speed of 31 m/s . The net force on the automobile due to air friction (at this speed) is 2870 N . What is the minimum power required of the engine to overcome this resistance.

- a. 104 kW
- b. 4 kW
- c. 81 kW
- d. 63 kW
- e. 89 kW



- 8) A machine gun fires 50 gram bullets at the rate of $4 \text{ bullets per second}$. The bullets leave the gun at a speed of 1000 m/s . What is the average recoil force experienced by the machine gun?

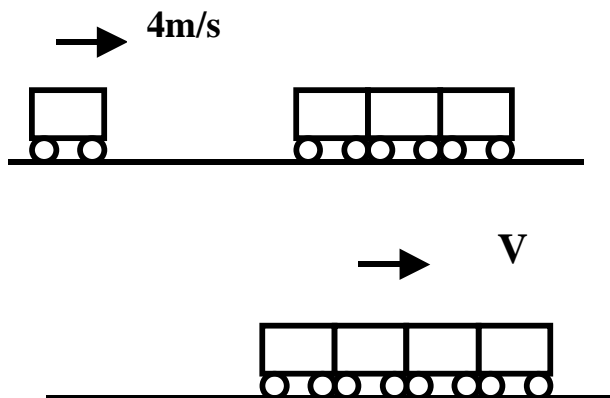
- a) 10 N
- b) 20 N
- c) 100 N
- d) 200 N
- e) 1000 N

9) A grindstone of radius 4.0 m is initially spinning with an angular speed of 8.0 rad/s. The angular speed is then increased to 10 rad/s over the next 4.0 seconds. Assume that the angular acceleration is constant. What is the angle turned through in radians?

- a) 48
- b) 12
- c) 60
- d) 36
- e) 24

10) A railroad car of mass 2.5×10^4 kg, moving with a speed of 4.0 m/s, collides and couples with three other coupled railroad cars which are at rest and each of the same mass as the single car. How much kinetic energy in joules is lost in the collision?

- a) 5×10^4
- b) 10×10^4
- c) 12×10^4
- d) 20×10^4
- e) 15×10^4



PHYSICS 218 EXAM 2 SOLUTIONS

W

$$1 \quad \Delta \vec{P} = \vec{F} \Delta t \quad \Delta \vec{P} = 90 \times 0.15$$
$$\vec{F} = \underline{6750 \text{ N}}$$

$$2 \quad mgh = 5000 \quad \underline{h = 25.5 \text{ m}}$$



$$4 \quad \frac{1}{2} m v_i^2 + 0 = \frac{1}{2} m v_f^2 + mgh$$
$$\underline{v_f = 190 \text{ m/s}}$$

$$5 \quad \omega = \Delta \theta / \Delta t = (500 \times 2\pi / 60) \text{ rads/sec}$$
$$\Delta t = (55\pi \times 60) / (180 \times 500 \times 2\pi)$$
$$v = 2 / \Delta t = \underline{109 \text{ m/s}}$$

$$6 \quad 2mg - mg = mv^2 / R \quad v = \underline{\sqrt{Rg}}$$

$$7 \quad P = Fv = \underline{89 \text{ kW}}$$

$$8 \quad F = \Delta p / \Delta t = (4 \times 50 \times 1000) / 1000 = \underline{200 \text{ N}}$$

$$9 \quad \theta = \frac{1}{2} (\omega_0 + \omega) t = \underline{36 \text{ radians}}$$

$$10 \quad mv = 4mV$$
$$E_{\text{LOST}} = \frac{1}{2} mv^2 - \frac{1}{2} (4mV^2)$$
$$= \frac{1}{2} m (3v^2/4) = 15 \times 10^4$$

