

# PS 103 PUBLIC FINAL EXAM

## Embry-Riddle Aeronautical University

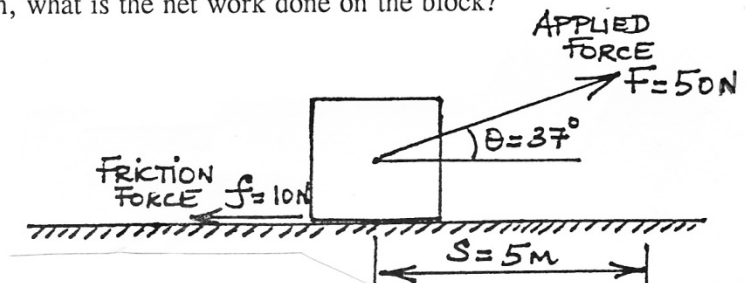
1. A football is kicked at an angle of  $60^\circ$  above the horizontal. Assuming up is positive and down is negative, which statement best describes the acceleration of the football during this event if air resistance is neglected?
- a) It is  $-9.8 \text{ m/s}^2$  at all times
  - b) It is zero at all times
  - c) It is zero when the football has reached the highest point in its trajectory
  - d) It is positive as the football rises and it is negative as the football falls
  - e) It starts at  $-9.8 \text{ m/s}^2$  and drops to some steady but lower value as the ball approaches the ground

2. A car, starting from rest, accelerates in a straight line at a constant rate of  $2.0 \text{ m/s}^2$ . How far will the car travel in 10 seconds?
- a) 100 m
  - b) 40 m
  - c) 2 m
  - d) 10 m
  - e) none of these

3. Suppose a robot atop a 200-meter tall cliff leans over and tosses a ball straight down at  $15 \text{ m/s}$ . How long is the ball in the ground before hitting the ground?
- a) 6 s
  - b) 7 s
  - c) 4 s
  - d) 5 s
  - e) none of these

4. A force of 50 Newtons is applied to a block at a  $37^\circ$  as shown. If 10 Newtons of friction retards the motion as the block moves 5 m, what is the net work done on the block?

- a) 250 J
- b) 200 J
- c) 150 J
- d) 100 J
- e) none of these



5. The coefficient of friction for race car tires on the track can be as high as 2.0. This means
- a) a maximum acceleration of  $2 \text{ m/s}^2$
  - b) a maximum friction of  $2 \text{ N/kg}$
  - c) that the friction is 2 times the normal force
  - d) that the normal force is 2 times the friction
  - e) that the weight increases 2 times

6. Which of the following is not a scalar-valued quantity?
- a) temperature
  - b) mass
  - c) volume
  - d) force
  - e) all of these are scalars
7. The Big Red Boat travels east from Port Canaveral traveling at 20 km/hr. Four hours later it turns, traveling 30 degrees east of south for another four hours at the same speed. How far from Port Canaveral is the ship?
- a) 56 km
  - b) 111 km
  - c) 139 km
  - d) 99 km
  - e) none of these
8. When the net force on an object is zero it will
- a) stay at rest or continue in uniform motion
  - b) travel in circles
  - c) come to rest and stay that way
  - d) be accelerated
  - e) none of these
9. A 1000 kg aircraft originally at rest accelerates from a catapult to a speed of 62 m/s in a distance of 62 m. The average force applied by the catapult is
- a) 62,000 Newtons
  - b) 15,500 Newtons
  - c) 31,000 Newtons
  - d) 46,500 Newtons
  - e) none of these
10. The wire on a rotating spool of electric cable is 0.8 m from the center of the spool. A worker pulls out a length of cable and the spool turns through 27 radians. What length of cable is unwound from the spool?
- a) 3.44 m
  - b) 21.6 m
  - c) 33.75 m
  - d) 135.7 m
  - e) none of these

11. Calculate the angular acceleration in  $\text{rad/s}^2$  if a wheel with a moment of inertia of  $4 \text{ kgm}^2$  about its axis which is being acted on by a torque of  $84 \text{ Nm}$ .
- a) 5.25
  - b) 21
  - c) 336
  - d) 0.048
  - e) none of these
12. A force of 200 Newtons acts tangentially on the rim of a wheel 0.25 m in radius. Find the torque.
- a) 400 Nm
  - b) 50 Nm
  - c) 800 Nm
  - d) 25 Nm
  - e) none of these
13. A bicycle with wheels of radius 0.4 m travels on a level road at a speed of 8 m/s. What is the angular speed of the wheels?
- a)  $\pi/10 \text{ rad/s}$
  - b)  $10\pi \text{ rad/s}$
  - c) 10 rad/s
  - d) 20 rad/s
  - e)  $20/\pi \text{ rad/s}$
14. A parrot flying horizontally at 5 m/s and 40 meters of height drops a peanut. How far does the peanut go horizontally before hitting the ground? (neglect air resistance)
- a) 25.6 m
  - b) 3.4 m
  - c) 18.9 m
  - d) 14.2 m
  - e) none of these
15. The turntable of a record player reaches 33.3 rpm in 1.8 s starting from rest. What is the average angular acceleration in  $\text{rad/s}^2$  during this time?
- a) 176.2
  - b) 5.71
  - c) 1.90
  - d) 18.5
  - e) none of these

16. A block of mass 10 kg is on a slope making an angle of  $53^\circ$  to the *vertical*. The coefficient of friction required to prevent it from sliding down the slope is

- a) 1.33
- b) 0.75
- c) 0.60
- d) 0.90
- e) none of these

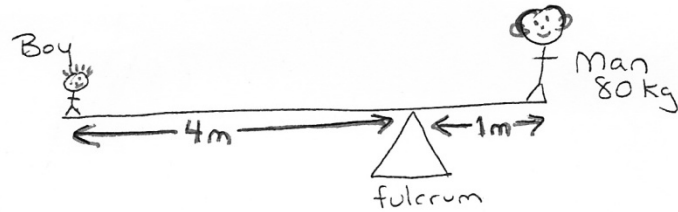
17. How much work is done in accelerating a 1000 kg sled on horizontal frictionless rails from 20 m/s to 40 m/s?

- a)  $2.00 \times 10^5$  J
- b)  $4.00 \times 10^5$  J
- c)  $6.00 \times 10^5$  J
- d)  $5.88 \times 10^6$  J
- e) none of these

18. A circular space station with a radius of 245 m is being designed. It is to have artificial gravity of  $9.8 \text{ m/s}^2$  inward on the outer rim. What angular speed of rotation is required?

- a) 2400 rad/s
- b) 0.04 rad/s
- c) 0.20 rad/s
- d) 7.00 rad/s
- e) none of these

19. An 80 kg man balances the boy on a teeter-totter (assume massless), as shown. What is the mass of the boy?



- a) 40 kg
- b) 45 kg
- c) 10 kg
- d) 20 kg
- e) none of these

20. What happens when a spinning ice skater draws in her outstretched arms?

- a) her angular momentum decreases
- b) her angular momentum increases
- c) her moment of inertia decreases causing her to slow down
- d) her moment of inertia decreases causing her to speed up

21. Machine A can do 10 J of work in 5 s. Machine B can do 50 J of work in 20 s. The ratio of power A to power B is

- a) 4/5
- b) 5/1
- c) 5/4
- d) 1/1
- e) none of these

22. An airplane traveling at 100 m/s makes a constant altitude turn with a radius of 2,000 m. Assuming the rudder is not used, what is the banking angle needed for such a turn?

- a) 31°
- b) 27°
- c) 63°
- d) 90°
- e) none of these