

Test Questions - Exam III (Part 1)

1 8-4

2 8-7 (i)

3 8-7 (iv)

4 8-8

5 8-10

6 8-11

7 8-14

8 10-5 Give Examples to support your answer.

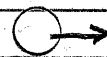
9 10-9

10 10-11

11 An object of mass 0.5 kg travelling horizontally at 5 m/s runs into a vertical wall.

What is the change in

the momentum of the wall



if the collision is a) totally elastic, b) totally inelastic

12. What is the angular momentum of an Earth

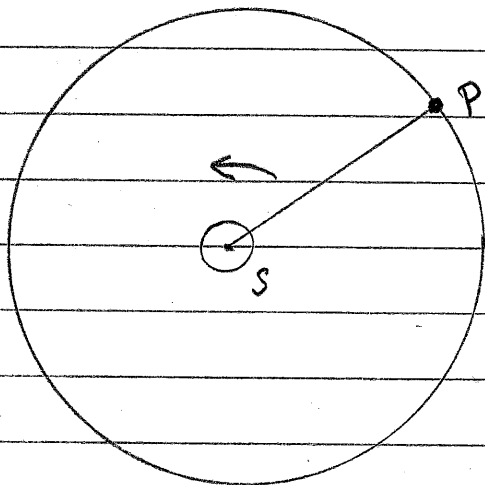
satellite whose period is one day and whose

mass is 100 kg. [hint: use Kepler's Law $\frac{T_{\text{sat}}^2}{R_{\text{sat}}^3} = \frac{4\pi^2}{GM_E}$,

$G = 6.7 \times 10^{-11} \text{ N}\cdot\text{m}^2/(\text{kg})^2$, $M_E = 6 \times 10^{24} \text{ kg}$]

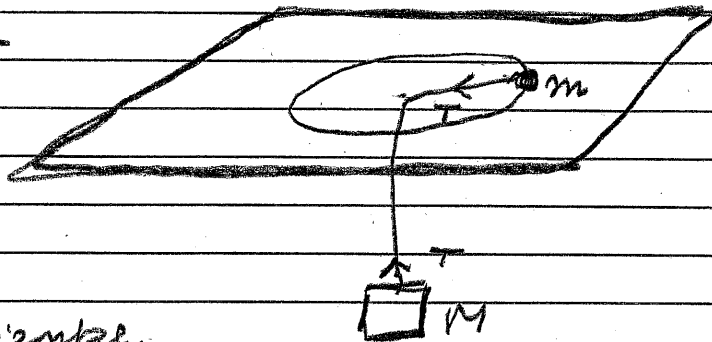
13. What is a rigid body? Describe the two kinds of motion it can have and specify which dynamical variables (velocity, acceleration, angular velocity, angular acceleration) are common and why?

14. Show that for circular orbits Kepler's 3rd law is a consequence of conservation of Angular momentum. [The third law says that the radius from Sun to Planet sweeps out equal areas in equal intervals of time.]



15. What is the relationship between the angular momentum (magnitude) and the rotational kinetic energy of a rigid body? [Compare it to relation between translational kinetic energy and linear momentum].

16 As shown an object of mass $m = 0.5 \text{ kg}$ is rotating with uniform speed on a smooth horizontal.



The mass $M = 5 \text{ kg}$ provides the centripetal force. If the radius of the circle is 1.5 m what is the angular velocity? Why?

(i) What is the angular momentum of m ? Why?

(ii) If you pull down on the 5 kg mass will the angular momentum change? Justify your answer.

(iii) In (ii) you pull until radius becomes 0.5 m . How much work will be done in this process.

17 11-2

18 11-9

19 11-10

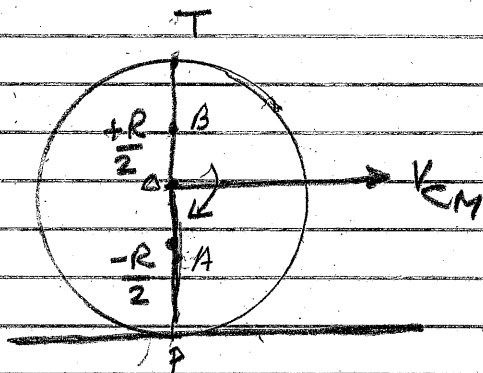
20 11-11

21. Compare the motion of the ring in problem 20 with that of your automobile tire when you first

engage the engine to move forward.

22. A disk is rolling

without slip on a horizontal surface.



What are the velocities

at the points P, A, O, B and T? why?

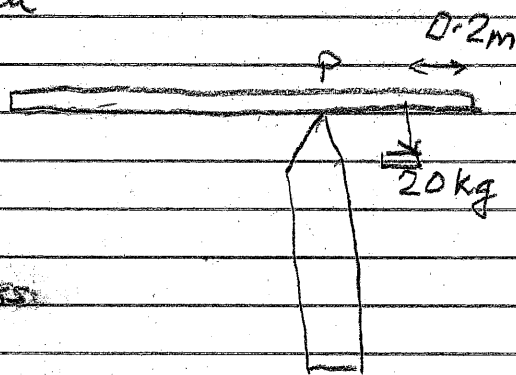
23. A uniform bar of length

2m is supported at

a point P located 0.5m

from the right end. A mass

of 20kg is placed 0.2m from



the end brings it into its horizontal position,

what is the weight of the bar? why?

24. A disk of radius 5cm is

rolling without slipping

on a horizontal surface

which is 1.5m high. If its

velocity is 2m/s what is its

angular velocity? As it rolls off

the table how long before it hits ground?

What is the velocity just before it hits?

What is the angle through which it

turns during the fall.

