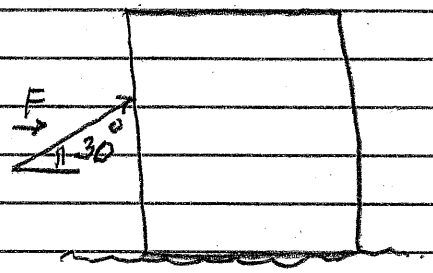
Test Questions - Exam II

1. 4-11

2. 4-14

3. 4-16

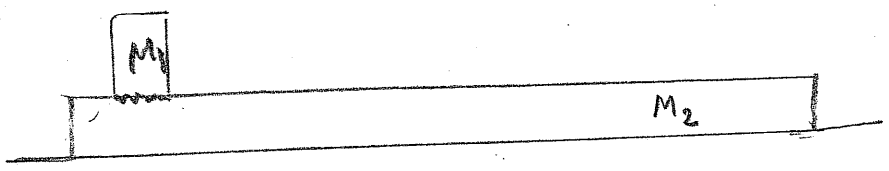
4. As shown, you are pushing a 300kg refrigerator using F = 600N at 30° above horizontal. If the refrigerator moves at a constant speed what must be the coefficient of kinetic friction? Why?



5. An object of mass 0.5kg is rotating clockwise at constant speed in the xy-plane. In order to describe its motion we need four vectors: $\vec{r}$, $\vec{v}$, $\vec{\omega}$, $\vec{a}_c$. (a) which of these do not change their direction with time. (b) how fast does it rotate?

b

The coefficient of static friction between M_1 and M_2 is $\mu_s = 0.2$ while M_2 is lying on a smooth horizontal frictionless table. If M_1=1kg and M_2=5kg what is the maximum value of $\underrightarrow{F} = F\hat{x}$ you can apply to M_1 so that M_1 and M_2 move together? Why?



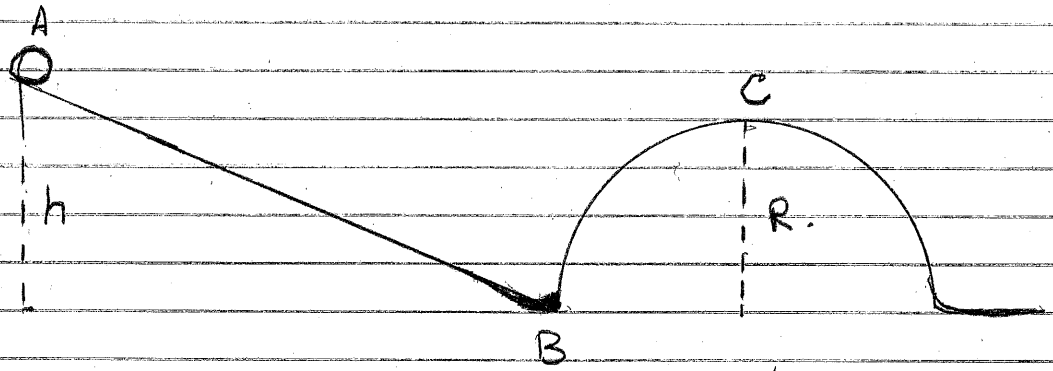
7 5-1

8. 5-3

9 5-5

9a 5-10

10.



Shown is a smooth frictionless track where the "hump" is a semicircle of radius R = 20m. The object A starts from rest at a height y = h. (i) What is the smallest value of h so that the object will go over the hump? why? (ii) If h is too large object will lose contact at C. What is the largest value of h so A does not lose contact at C? Why?

11 6-5

12 6-6

13 6-10

14 6-13

15 6-14

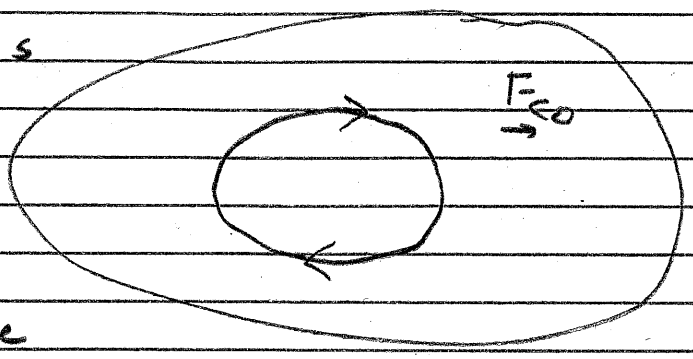
16 What is a "no work force"? Support your answer with examples.

17. What is a Conservative force?

18. Why is there a negative sign on the right side of the equation for the change in potential energy

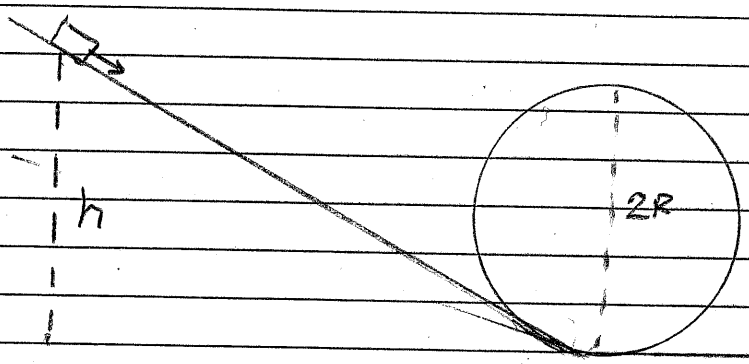
$$\Delta P = - \vec{F}_{co} \cdot \vec{\Delta s}$$

19 The picture shows a region of space in which there is a Conservative force at every point. Show that if an object is taken around the closed loop, the net work done is Zero.



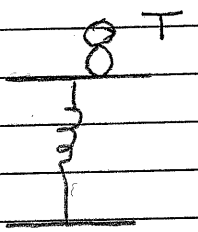
20. Why is it not possible to define a potential energy for the force of friction? Explain

21 In a loop-the-loop experiment what is the minimum value of h at which you must



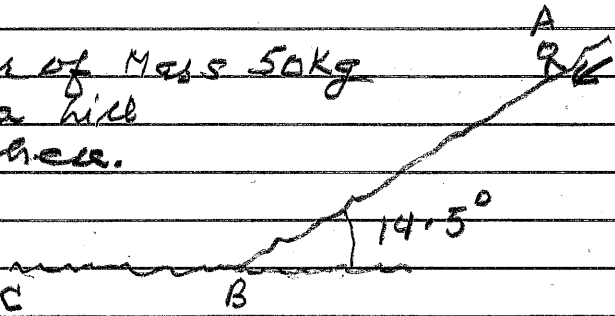
launch the object so it goes around the loop without dropping? Why?

22 A toy T is placed on a platform as shown. You squeeze the spring by 1mm and let go. If T has a Mass of 10^{-3} kg and goes up to a height of 3m before returning, What is the spring constant? Why?

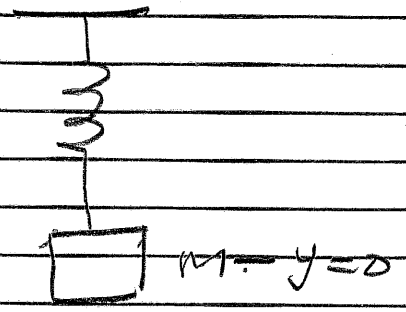


23 7-11

24 In the figure a skier of Mass 50kg is shown going down a hill where $\mu = 0.1$ every where. When she passes A she is moving at 15m/s. We are told that AB = 200m and she eventually stops at C. Calculate (a) potential energy at A, (b) Speed at B, (c) the distance BC.



25 Shown is a mass M hanging from a vertical spring of spring constant k. At $y=0$ spring is unstretched and you are holding the mass. There are two ways in which you can release the mass: i) lower M slowly while holding it and letting the spring stretch and finally remove your hand leaving the system in equilibrium. What is the change Δy_1 in the length of the spring? why?



ii) you release the mass at $y=0$, it drops by an amount Δy_2 before coming to rest momentarily. What is Δy_2? why?

26. Show that if you increase the angular velocity of Earth by a factor of 18, people living at the equator will become weightless.

27. Indeed, why are Astronauts inside a satellite which is in orbit said to be "weightless?

EXAM II — TEST QUESTIONS (Cont'd)

1 A mass m located at a distance r from the center of a uniform sphere of mass M and radius R has a Gravitational potential energy

$$P_G = -\frac{GMm}{r} \text{ if } r > R$$

If we assume that the Earth is a uniform sphere of radius $R_E = 6400$ km at what distances will the potential energy (magnitude) be (i) $\frac{1}{2}$, (ii) $\frac{1}{5}$ of the potential energy at the surface

1a What would your weight be if you were located at the center of the Earth? why?

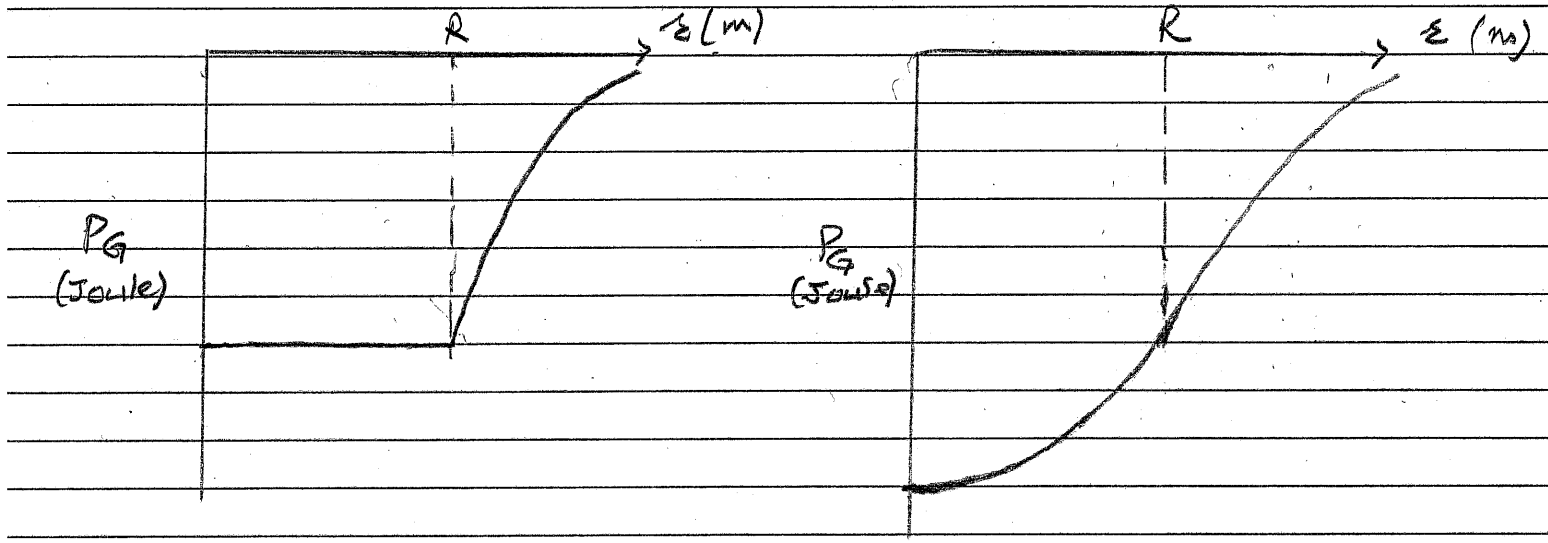
2. The moon has a radius which is about $\frac{R_E}{4}$ and a mass of about $\frac{M_E}{81}$ [$M_E = 6 \times 10^{24}$ kg, $R_E = 6400$ km]. Compare the potential energy of a mass on the surface of the moon with its potential energy on the surface of Earth.

3 Use the information in Probl. to solve problem 7-11

4. Use the information in Probl. to solve problem 7-12.

5. For a Black hole the gravitational attraction is so large that even light with a speed of 3×10^8 m/s cannot escape. Supposing we pretend that light can be thought of as a "particle" of mass m, estimate the radius of Earth if it were to turn into a black hole.

16 The pictures show the r dependence of the Gravitational potential energy of a point mass m located at a distance of r from the center of a sphere of radius R. Which of the spheres is hollow (like a shell)? Why?



17 Two objects of masses M and 3M have the same Kinetic Energy which one will have the larger linear momentum (magnitude). Why?

18. If the masses of Prob 18 have the same linear momentum (magnitude) which will have the larger Kinetic Energy and by what factor? Why?