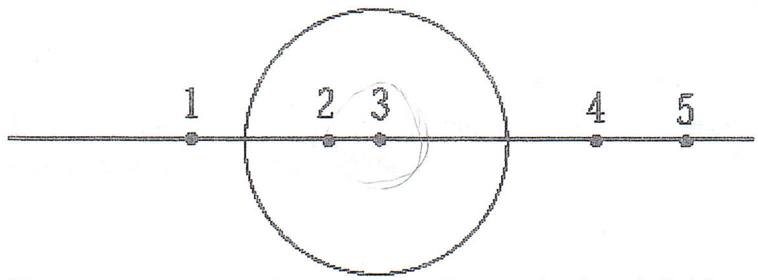
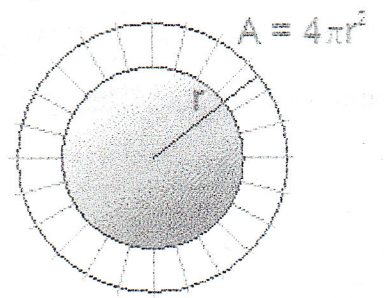
4 3.



Test masses are used to measure the gravitational field at various positions in and near a *solid sphere of uniform density.* The gravitational field will have its greatest value at point

A) 1
B) 2
C) 3
D) 4
E) 5

4 4. Earth's gravitational field is given by $\vec{g} = -\frac{GM_E}{r^2}\hat{r}$. The total flux (field times area) for a spherical surface area A that encloses all the field lines is



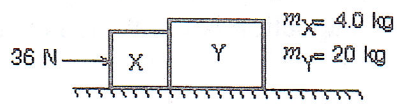
A) $-4\pi GM_E$
B) $-GM_E$
C) $-GM_E/4\pi$
D) $-2\pi GM_E$
E) $-4GM_E$

33. An object at the surface of Earth (at a distance R from the center of Earth) weighs 90 N. Its weight at a distance $3R$ from the center of Earth is:

A) 10 N
B) 30 N
C) 90 N
D) 270 N
E) 810 N

$F \propto \frac{1}{r^2}$

34. Two blocks (X and Y) are in contact on a horizontal frictionless surface. A 36-N constant force is applied to X as shown. The magnitude of the force of X on Y is:



$4+20=24$

$36=24\cdot a$

$a=1.5$

A) 1.5 N
B) 6.0 N
C) 29 N
D) 30 N
E) 36 N

$F_Y = m \cdot a$

$F_Y = 1.5 \cdot 20$

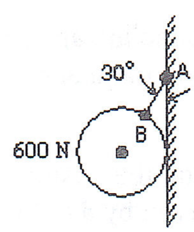
$F_Y = 30$

35. An inelastic collision is one in which:

A) momentum is not conserved but kinetic energy is conserved
B) total mass is not conserved but momentum is conserved
C) neither kinetic energy nor momentum is conserved
D) momentum is conserved but kinetic energy is not conserved
E) the total impulse is equal to the change in kinetic energy

36. The 600-N ball shown is suspended on a string AB and rests against the frictionless vertical wall. The string makes an angle of 30° with the wall. The magnitude of the tension for of string is:

ce

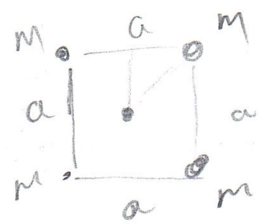


A) 690 N
B) 1200 N
C) 2100 N
D) 2400 N
E) none of these

$T \cos 30 = 600 \text{ N}$

$= 692.8$

26. Each of the four corners of a square with edge a is occupied by a point mass m. There is a fifth mass, also m, at the center of the square. To remove the mass from the center to a point far away the work that must be done be an external agent is given by:
A) $4Gm^2/a$
B) $-4Gm^2/a$
C) $4\sqrt{2}Gm^2/a$
D) $-4\sqrt{2}Gm^2/a$
E) $4Gm^2/a^2$



$PE = -\frac{GMm}{R} = \frac{-4\sqrt{2}GMm}{a}$

$R = \frac{a^2}{4} + \frac{a^2}{4} = \sqrt{\frac{a^2}{2}} = \frac{a}{\sqrt{2}}$

at ∞ $PE = 0$

need $\frac{4\sqrt{2}GMm}{a}$

27. A spaceship is returning to Earth with its engine turned off. Consider only the gravitational field of Earth and let M be the mass of Earth, m be the mass of the spaceship, and R be the distance from the center of Earth. In moving from position 1 to position 2 the kinetic energy of the spaceship increases by:

A) $GM\,m\left[\frac{1}{R_2}-\frac{1}{R_1}\right]GM\,m/R_2$

B) $GM\,m\left[\frac{1}{R_1}+\frac{1}{R_2}\right]$

C) $GM\,m\frac{R_1-R_2}{R_1}$

D) $GM\,m\frac{R_2-R_1}{R_1R_2}$

E) $GM\,m\frac{R_1-R_2}{R_1R_2}$

potential $= -\frac{GMm}{R}$

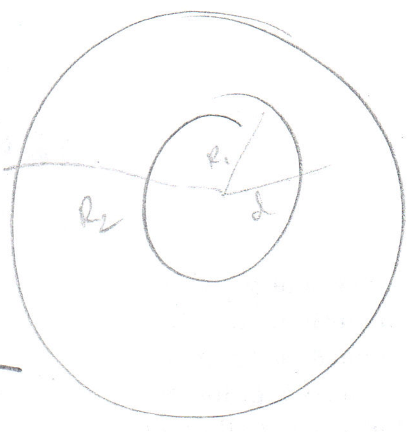
to go from r_f to r_i

$\Delta PE = -\frac{GMm}{r_f} - \frac{-GMm}{r_i}$

$\Delta KE = \frac{GMm}{r_f} - \frac{GMm}{r_i}$

$= \frac{r_i - r_f}{r_f r_i} \cdot -GMm$

28. A spherical shell has inner radius R_1, outer radius R_2, and mass M, distributed uniformly throughout the shell. The magnitude of the gravitational force exerted on the shell by a point particle of mass m, located a distance d from the center, outside the inner radius and inside the outer radius, is:
A) 0
B) GMm/d^2
C) $GMm/(R_2^3 - d^3)$
D) $GMm(d^3 - R_1^3)/d^2(R_2^3 - R_1^3)$
E) $GMm/(d^3 - R_1^3)$



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$g = \frac{G M_{enc}}{d^2}$ $M_{enc} = M\frac{(d^3 - r_1^3)}{(r_2^3 - r_1^3)}$

$F_g = \frac{GmM(d^3 - r_1^3)}{d^2(r_2^3 - r_1^3)}$

$\cancel{4\pi r^2}$ $g = -4\pi G$