STE
Exam Review 4

Formulae:	$g = 9.8$ N/kg;	$F = mg$;	$W = \Delta E$;	$W = F*d$	$E_p = mgh$

1. In the following table, g_p/g_e, the ratio of a planet's gravitational acceleration to that of the earth, has been calculated for 3 planets and the earth's moon.

planet	**relative mass(earth =1)**	**relative size**	g_p/g_e
Mercury	0.0553	0.383	0.377
Venus	0.815	0.95	0.903
Earth	1	1	1
Earth's moon	0.0123	0.27	0.169

a) If a 30 kg piece of metal has that mass on earth, what will its mass be on the moon?

30 kg;

b) Why?

mass remains constant in different gravitational fields. The number of atoms don't change.

c) If the weight of an object is 400 N on Mercury, what will its weight be on the moon?

$g_{moon}/g_e = 0.169$
$g_{mercury}/g_e = 0.377$

$g_{moon}/ g_{mercury} = 0.169/0.377 = 0.448$, so things will weigh that many times less on the moon or 0.448(400) = .448*400 = 179.2 N. Don't like this method, try the green one:

or $g_{mercury}/g_e = 0.377$
$g_{mercury} = 0.377 * g_e = 0.377 * 9.8$ N/kg $= 3.6946$ N/kg

$F = mg_{mercury}$

$400\ N = m(3.6946\ N/kg)$

$m = 400N / 3.6946\ N/kg = 108.266\ldots kg$

$F = mg_{moon}$

$= 108.266\ldots kg(9.8)(0.169)$

$= 179\ N$

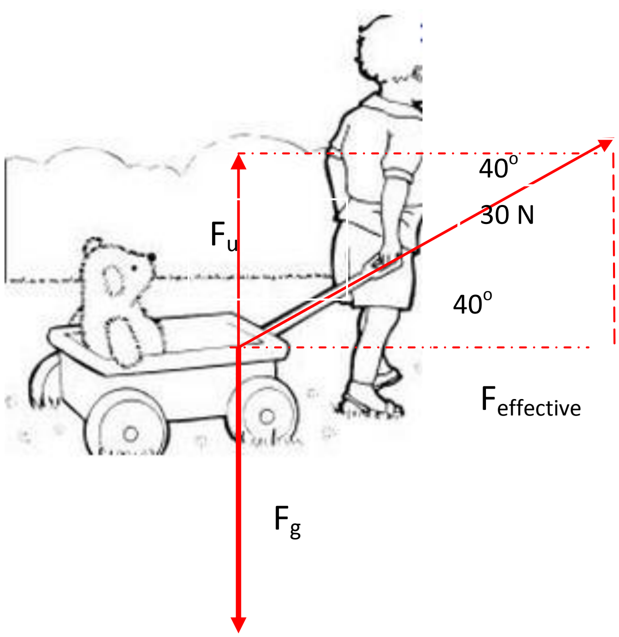
2. a) Find the net force acting on a box if it's being pulled on by a boy with a 39 N force and in the opposite direction by a girl exerting 45 N. Draw a diagram.

   45 N – 39 N = 6 N in the girl's direction

   b) How much work is being done by the boy and girl if the girl ends up dragging the boy for 2.0 m?

   W = F*d = 6N(2m) = 12 Nm = 12 J

3. A 20 kg wagon is pulled at an angle of 40° with a 30 N force.
   a) Show mathematically that there is not enough force to lift the wagon.



$F_u/30\ N = \sin 40$
$F_u = 30\ N \sin 40 = 30\ N * (0.64278760968653932632264340990726) = 19.3\ N$

$F_g = mg = 20\ kg*9.8\ N/kg = 196\ N$

196 N >19.3 N, so the wagon is not lifted.

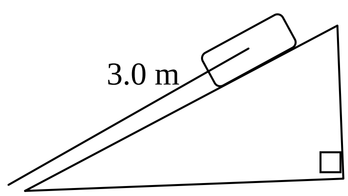
b) Find the acceleration of the wagon. (3 marks)

$F_{effective}/30\ N = \cos 40$

$F_{effective} = 30\ N* \cos 40 = 22.98\ N$

$F_{effective} = ma$
$22.98\ N = 20\ kg*a$
$a = 22.98\ N/20\ kg = 1.1\ m/s^2$

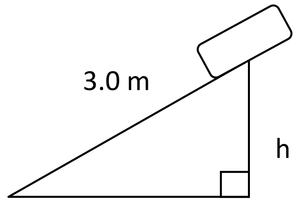
4. a) How much work is done to push a 22 kg mass up a 30 ^{o} inclined plane for a slanted distance of 3.0 m?



$F_{effective} = mg\sin\theta = 22\ kg\ (9.8\ N/kg)\sin 30 = 107.8\ N$

$W = F*d = 107.8\ N* 3\ m = 323.4\ J$

c) Use the change in potential energy to arrive at the same answer.



The height can be calculated by sin 30 = h/3 or h = 3 sin30

Originally the potential energy is zero, so at 3.0 m, the potential energy is mgh =

22kg*9.8*3 sin30 = 323.4 J

5. a) Calculate the gravitational potential energy of a 30.0 kg mass placed 100.0 m above the surface of Mars where g = 3.7 N/kg.

mgh =30.0 kg (3.7 N/kg) (100.0 m) = 11 100 J

b) Find the final velocity of the object (when it hits the ground) if it was dropped from that height.

$Ep_1 + Ek_1 = Ep_2 + Ek_2$; No potential energy at ground level

$11\ 100\ J + 0 = 0 + Ek_2$
$Ek_2 = 0.5\ mv^2 = 11\ 100\ J$
V = 27.2 m/s

d) Find the final velocity of the object if it was dropped from that height on Earth.

Notice that in the above the 2nd last step is:

$0.5\ mv^2 = mgh$
$0.5\ v^2 = gh$
$0.5\ v^2 = 9.8(100)$
V = 44.3 m/s