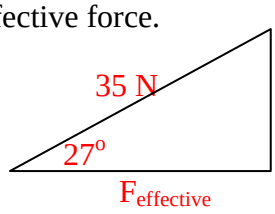
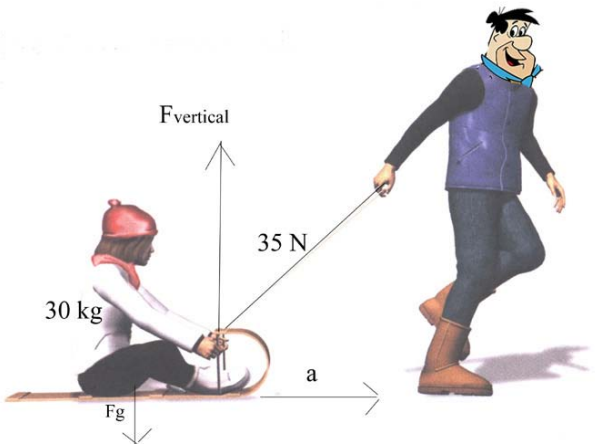
STE
More Physics/Genetics Practice

1.

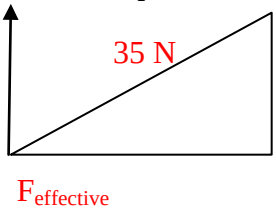
a) The effective force is in the direction of the acceleration. If the 35 N force is applied at angle of 27°, calculate the effective force.





$F_{effective}/35 = \cos 27$
$F_{effective} = 35 \cos 27 = 31.2$ N

b) What is the vertical component of the 35 N force?



$F_{vertical}$(same as opposite side)

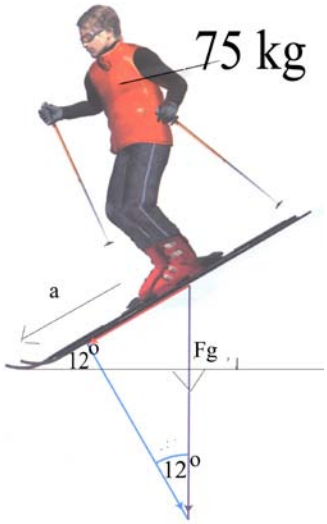
$F_{effective}/35 = \sin 27$
$F_{effective} = 35 \sin 27 = 15.9$ N

c) Find the combined weight of the girl and the sled if the combined mass is 30 kg.

Weight $= F_g = mg$
$= (30 \text{ kg})(9.8 \text{m/s}^2) = 294$ N

d) Why doesn't the sled lift up?

294 N > 15.9 N(the vertical component)



a) Calculate the skier's effective force as he is pulled downhill.

$\sin\theta = F_{effective}/F_g$
$\sin 12 = F_{effective}/(75 \text{ kg} * 9.8 \text{m/s}^2)$
$F_{effective} = 75 \text{ kg} * 9.8 \text{m/s}^2) \sin 12 = 152.8$ N

b) Calculate his acceleration.

$F = ma$

$152.8\ N = 75\ kg\ (a)$

$a = 2.0\ m/s^2$

c) Calculate his potential energy at the top of a 1000 m hill.

$Ep = mgh$

$= 75(9.8)(1000)$

$= 735000\ J$

d) The skier started from rest at the top of a hill 1000 m above sea level. If the bottom of the hill is still at an altitude of 400 m, how fast will he be moving at 400 m(if he would not slow himself down by digging his edges etc.)?

On top of hill:

$E_{total} = mgh + 0.5\ mv^2$

$= (75)(9.8)(\ 1000) + 0.5(75)(0)^2$

$=735000\ J$

At 400 m,

$E_{total} = mgh + 0.5\ mv^2$

$735000\ J = (75)(9.8)(\ 400) + 0.5(75)(v)^2$

$v = 108\ m/s$

e) What will the skier's weight be on Mars? The g_p/g_e ratio is 0.378.

g_e = the earth's gravitational acceleration = $9.8\ m/s^2$.
g_p = Mars' gravitational acceleration

$g_p/g_e = 0.378$
$g_p/9.8 = 0.378$
$g_p = 9.8*0.378 = 3.70\ m/s^2$
$F = mg$
$= 75\ kg(3.70\ m/s^2) = 277.8\ N$

2. Part of a messenger RNA code is AAA-AAU-AUG-ACG.

a) What was the matching DNA code?
TTT-TTA-TAC-TGC (remember uracil(U) is only for RNA)

b) How many amino acids will be connected from this code?
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c) What is the code for each of the transfer RNA's that will pick up these amino acids?
Go back to mRNA and match:

mRNA: AAA-AAU-AUG-ACG.
tRNA : UUU –UUA-UAC-UGC

d) What are the four amino acids?

Consult notes: lys-asn-met-thr

3.

	Dominant Trait in Animals	**Recessive Trait in Animals**
Cats	Tabby coat(T)	Black coat(t)
cattle	Horned(H)	Hornless (h)

a) How many chromosomes will contain the 2 allelic genes for coat colour in cats? 2

b) What is the genotype of a black cat? tt

c) What is the genotype of a heterozygous horned cattle? Hh

d) A black-coated cat had 6 kittens. Their paternal grandparents were black. How many kittens are tabby-coated? Zero. If dad's parents were black, he was tt. An if mom was also black(tt), all kittens will be tt.

e) A horned cow has 8 calves. Some are hornless. What are the possible genotypes for the calves' father? What is/are the possible genotype(s) for the cow?

Mom had to be *Hh* or else calves could not be *hh*. The other *h* came from father, so he could be *Hh* or *hh*.