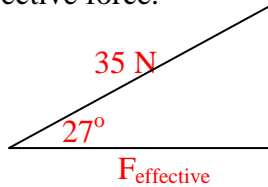


STE
More Physics/Genetics Practice

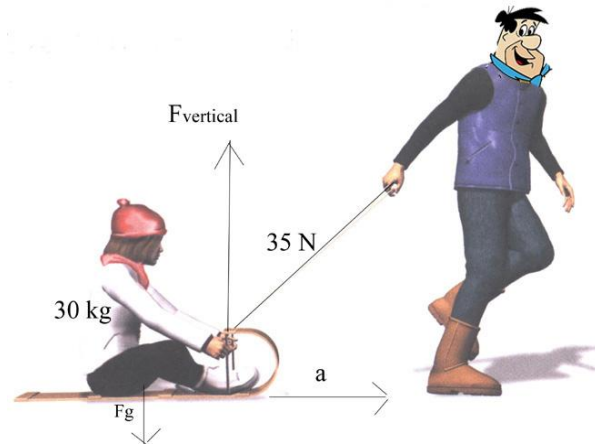
1.

- 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.

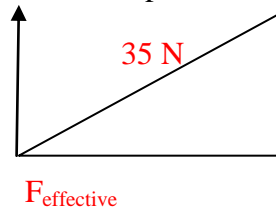


$$F_{\text{effective}}/35 = \cos 27$$

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



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



F_{vertical} (same as opposite side)

$$F_{\text{vertical}}/35 = \sin 27$$

$$F_{\text{vertical}} = 35 \sin 27 = 15.9 \text{ N}$$

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

$$\text{Weight} = F_g = mg$$

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

- d) Why doesn't the sled lift up?

$$294 \text{ N} > 15.9 \text{ N} (\text{the vertical component})$$

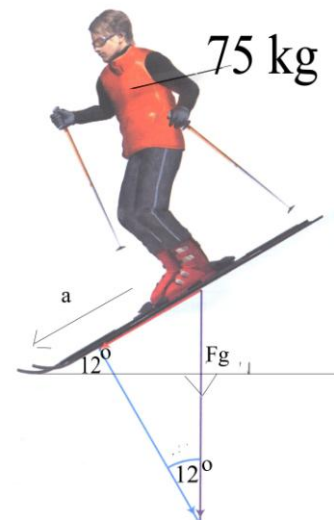
- a) Calculate the skier's effective force as he is pulled downhill.

$$\sin \theta = F_{\text{effective}}/F_g$$

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

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

- b) Calculate his acceleration.



$$F = ma$$

$$152.8 \text{ N} = 75 \text{ kg (a)}$$

$$a = 2.0 \text{ m/s}^2$$

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

$$E_p = mgh$$

$$= 75(9.8)(1000)$$

$$= 735000 \text{ J}$$

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:

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

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

$$= 735000 \text{ J}$$

At 400 m,

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

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

$$v = 108 \text{ m/s}$$

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

$$g_p/g_e = 0.378$$

$$g_p/9.8 = 0.378$$

$$g_p = 9.8 * 0.378 = 3.70 \text{ m/s}^2$$

$$F = mg$$

$$= 75 \text{ kg}(3.70 \text{ m/s}^2) = 277.8 \text{ N}$$

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: phe-leu-tyr-cys

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*.