B

Newton's Laws written

Name Key
Date
Period

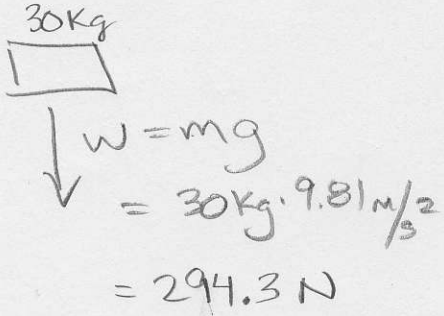
$F = ma$ $\mu_s = F_s/F_n$ $\mu_k = F_k/F_n$ $d = v_{average}t$ $d = v_{constant}t$

$d = v_i t + \frac{1}{2}at^2$ $V_f^2 = V_i^2 + 2ad$ $\Delta v = at$ $g = 9.81\ m/s^2$

Draw a diagram for each question (labeling all important numeric factors (ex velocity, forces, mass… ect.)
Write each numeric answer in the box to the right of the question, include units

1. A block has a mass of 30. kg what is the weight of the block?

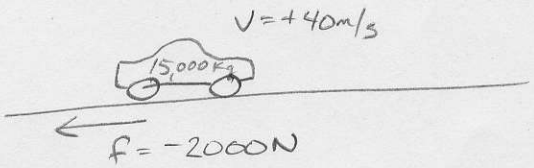
Weight = 294N



3. A 15,000. kg car going +40. m/s along the road has a braking force of 2000 Newtons, what is the rate of acceleration of the car?

$a = -0.13\ m/s^2$

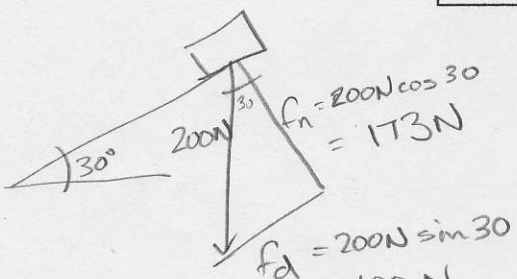
$a = \frac{f}{m} = \frac{-2000N}{15{,}000kg} = -0.13$



2. Given a 200. Newton block on a 30. degree slope:
a) What is the normal force?
b) What is the force down the ramp?

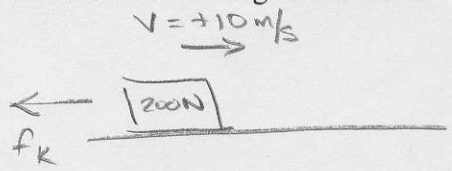
$f_{normal} = 173\ N$

$F_{down} = 100N$



4. A 200. Newton block is moving at 10m/s. If the surfaces in contact have a coefficient of friction of 0.25, what is the frictional force acting on the block?

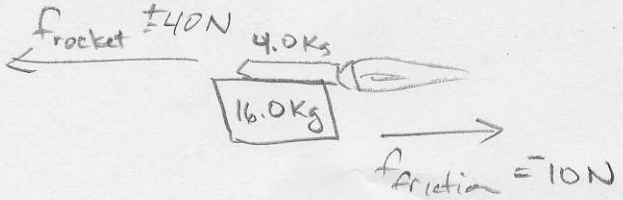
$F_{friction} = -50N$



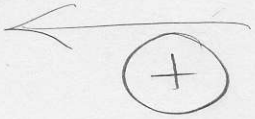
$f_k = \mu_k f_n$
$= 0.25(200N)$
$= 50N$

5. A 16.0 kg block, with a 4.0 kg rocket engine attached to it, has a frictional force of 10. Newtons to the right and while a model rocket engine pushes the block to the left with a force of 40. Newtons, what is the acceleration of the block?

$a = +1.5\ m/s^2$



$a = \frac{f_{net}}{m} = \frac{40N + -10N}{20kg}$
$= +1.5\ m/s^2$



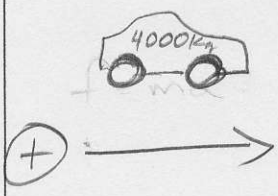
(B)

Write each numeric answer in the box to the right of the question, include units

6. What net force is needed to accelerate a 4000 kg car at a rate of 2.5 m/s^2

$F_{net} = {}^{+}10{,}000N$

$a = +2.5 m/s^2$



$f = ma$

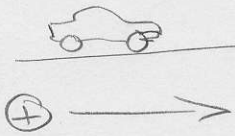
$= 4000Kg \cdot 2.5 m/s^2$

$= 10{,}000N$

8. If a car is traveling at +50 m/s then applies the brakes giving the car an acceleration of -5.0 m/s^2, how far will the car travel down the road before it stops?

distance $= {}^{+}250m$

$V_i = 50 m/s$ $\quad V_f = 0 m/s$ $\quad a = -5.0 m/s^2$



$$d = \frac{V_f^2 - V_i^2}{2a} = \frac{0 m/s^2 - (50 m/s)^2}{2(-5.0 m/s^2)}$$

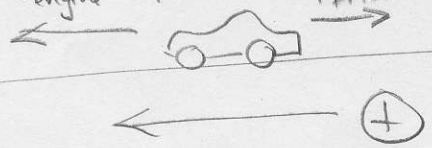
$= 250 m$

7. A car has a frictional force of 2000. Newtons to the right while its engine pushes it to the left with a force of 10,000. Newtons, if the cars acceleration is 0.50 m/s^2, what is the car's mass?

Mass $= {}^{+}16{,}000Kg$

$a = +0.50 m/s^2$

$f_{engine} = 10{,}000N$ $\quad f_{frict} = {}^{-}2000N$



$$m = \frac{f_{net}}{a} = \frac{10{,}000N + {}^{-}2000N}{0.50 m/s^2}$$

$= {}^{+}16{,}000Kg$

9. A car at rest accelerates at 5.0 m/s^2, how fast will a car be traveling after 15.0 seconds?

$V_{final} = 75 m/s$

$V_i = 0 m/s$ $\quad V_f = ?$ $\quad a = +5.0 m/s^2$ +

$V_f = V_i + at$

$= 0 m/s + (5.0 m/s^2)(15.0 s)$

$= 75 \frac{m}{s}$

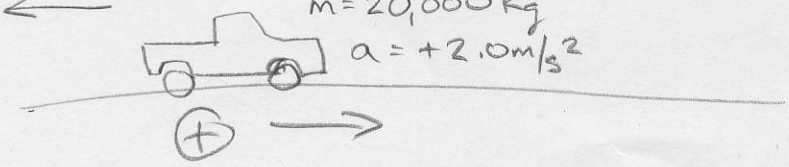
10. A 20,000. kg car accelerates at 2.0 m/s^2, if the car's engine is providing a force of 46,000. Newtons, what is the frictional force acting on the car?

$F_{friction} = {}^{-}6000N$

$f_{friction} = ?$ $\quad f_{engine} = +46{,}000N$

$m = 20{,}000 kg$

$a = +2.0 m/s^2$



$f_{friction} = ma - f_{engine}$

$= 20{,}000Kg \cdot 2.0 m/s - 46{,}000N$

$= -6{,}000N$