

Dynamics Worksheet #2
Answers

1. $m = 45 \text{ kg}$, $a = 0.85 \text{ m/s}^2$, $F = ?$
 $F = ma$
 $F = (45)(0.85) = \underline{38.25 \text{ N}}$
2. $m = 1650 \text{ kg}$, $a = 4.0 \text{ m/s}^2$, $F = ?$
 $F = ma$
 $F = 1650(4.0) = \underline{6600 \text{ N}}$
3. $m = 68 \text{ kg}$, $F = 59 \text{ N}$, $a = ?$
 $F = ma$
 $59 = 68a$
 $a = \underline{0.87 \text{ m/s}^2}$
4. $a = 0.08 \text{ m/s}^2$, $F = 47 \text{ N}$, $m = ?$
 $F = ma$
 $47 = m(0.08)$
 $m = \underline{587.5 \text{ kg}}$
5. $F = (3)425 \text{ N} = 1275 \text{ N}$
 $a = 0.85 \text{ m/s}^2$, $m = ?$
 $F = ma$
 $1275 = m(0.85 \text{ m/s}^2)$
 $m = \underline{1500 \text{ kg}}$
6. $m = 0.314 \text{ kg}$, $a = 164 \text{ m/s}^2$, $F = ?$
 $F = ma$
 $F = (0.314)(164) = \underline{51.50 \text{ N}}$
7. $m = 8.18 \text{ kg}$, $a = 88.2 \text{ m/s}^2$, $F = ?$
 $F = ma$
 $F = 8.18(88.3) = \underline{722.29 \text{ N}}$
8. $v_f = 68.2 \text{ m/s}$, $v_i = 0$, $t = 2 \text{ s}$, $m = 29\,545 \text{ kg}$
 $v_f = v_i + at$
 $68.2 = 0 + a(2)$
 $a = 34.1 \text{ m/s}^2$
 $F = ma$
 $F = (29\,545)34.1 = \underline{1 \times 10^6 \text{ N}}$

9. $v_i = 0$, $v_f = 27 \text{ m/s}$, $t = 6.3 \text{ s}$, $F = 4106 \text{ N}$, $m = ?$
 $v_f = v_i + at$
 $27 = 0 + a(6.3)$
 $a = 4.2857 \text{ m/s}^2$
 $F = ma$
 $4106 = m(4.2857)$
 $m = 958.07 \text{ kg}$
10. $v_i = ?$, $v_f = 0$, $d = 15 \text{ m}$, $t = 23 \text{ s}$, $m = 52.5 \text{ kg}$
 $v_f = v_i + at$
 $0 = v_i + a(23)$
 $a = 0.0567 \text{ m/s}^2$
 $F = ma$
 $F = 52.5(0.0567) = \underline{2.98 \text{ N in the opposite direction of the motion}}$
11. $F = 10\,000 \text{ N}$, $m = 1267 \text{ kg}$,
 (a) $F = ma$
 $10\,000 = 1267a$
 $a = \underline{7.89 \text{ m/s}^2}$
 (b) $v_i = 0$, $d = 394.6 \text{ m}$, $t = 15 \text{ s}$
 $d = v_i t + \frac{1}{2}at^2$
 $394.6 = \frac{1}{2}a(15)^2$
 $a = \underline{3.51 \text{ m/s}^2}$
 (c) $7.89 - 3.51 = \underline{4.38 \text{ m/s}^2}$
 (d) friction
 (e) $F = ma$
 $F = (1267)(4.38) = \underline{5549 \text{ N in the direction opposite the motion}}$
12. The new acceleration is 5.6 times bigger than the old acceleration of 1.00 m/s^2 . Therefore, the new force will be 5.6 times bigger.
 $5.6(45) = \underline{252 \text{ N}}$
13. Four engines give four times the force with the same mass resulting in four times the acceleration.
 $4(8.9) = \underline{35.6 \text{ m/s}^2}$
14. Since force stays the same
 $F = m_1 a_1 = m_2 a_2$
 $m_2 = 3.81 m_1$
 $m_1 a_1 = 3.81 m_1 a_2$
 $a_2/a_1 = 0.26$
The new acceleration is 0.26 times the old acceleration.

15. The mass of the rocket remains constant

$$F_{\text{new}}/F_{\text{old}} = 46\,458/12\,482 = 3.72$$

$$a_{\text{new}}/a_{\text{old}} = 3.72$$

$$a_{\text{new}} = 3.72(9.8) = \underline{36.48 \text{ m/s}^2}$$

16. $m = 40 \text{ kg}$

(a) $F = 30 \text{ N}$

$$F = ma$$

$$30 = (40)a$$

$$a = \underline{0.75 \text{ m/s}^2}$$

(b) $v_f = 0$, $t = 10 \text{ s}$, $d = 15 \text{ m}$

$$d = (v_i + v_f)(t/2)$$

$$15 = v_i(10/2)$$

$$v_i = 3 \text{ m/s}$$

$$v_f = v_i + at$$

$$0 = 3 + a(10)$$

$$a = -0.3 \text{ m/s}^2$$

$$F = ma$$

$$F = 40(0.3) = \underline{12 \text{ N in the direction opposite the motion}}$$

17. $a = 0.524 \text{ m/s}^2$, $m = 842 \text{ kg}$, $F = ?$

$$F = ma$$

$$F = 0.542(842) = \underline{441.2 \text{ N}}$$

18. $m = 989 \text{ kg}$, $F = 342 \text{ N}$, $v_i = 0$

(a) $t = 12 \text{ s}$, $d = ?$

$$F = ma$$

$$342 = 989a$$

$$a = 0.346 \text{ m/s}^2,$$

$$d = v_i t + \frac{1}{2}at^2$$

$$d = \frac{1}{2}(0.346)(12)^2 = \underline{24.9 \text{ m}}$$

(b) If the pushing force is doubled, then the acceleration is doubled

$$a = 2(0.346) = 0.692 \text{ m/s}^2$$

The new distance is therefore

$$d = v_i t + \frac{1}{2}at^2$$

$$d = \frac{1}{2}(0.692)(12)^2 = \underline{49.8 \text{ m}}$$

19. $v_i = 5.4 \text{ m/s}$, $v_f = 16.3 \text{ m/s}$, $d = 107 \text{ m}$, $m = 1201 \text{ kg}$

$$v_f^2 = v_i^2 + 2ad$$

$$(16.3)^2 = (5.4)^2 + 2a(107)$$

$$a = 1.105 \text{ m/s}^2$$

$$F = ma$$

$$F = (1201)(1.105) = \underline{1327 \text{ N}}$$

20. Part 1

$$m = 1027 \text{ kg}, v_i = 0, F = 1528 \text{ N}, t = 22 \text{ s}$$

$$F = ma$$

$$1528 = 1027a$$

$$a = 1.488 \text{ m/s}^2$$

$$d = v_i t + \frac{1}{2} a t^2$$

$$d = \frac{1}{2}(1.488)(22)^2 = 360.1 \text{ m}$$

Part 2

$$v_f = v_i + at$$

$$v_f = (1.488)(22) = 32.74 \text{ m/s}$$

$$d = vt$$

$$d = (32.74)(10) = 327.4 \text{ m}$$

Part 3

$$F = 4056 \text{ m}$$

$$F = ma$$

$$4056 = 1027a$$

$$a = -3.95 \text{ m/s}^2$$

$$v_f^2 = v_i^2 + 2ad$$

$$0 = (32.74)^2 + 2(-3.95)d$$

$$d = 135.7 \text{ m}$$

$$\text{Total distance traveled} = 360.1 + 327.4 + 135.7 = \underline{\underline{823.2 \text{ m}}}$$