Solutions Manual

UNIVERSITY PHYSICS

REVISED EDITION

HARRIS BENSON

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TO ACCOMPANY

UNIVERSITY PHYSICS

REVISED EDITION

HARRIS BENSON

Vanier College

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P R E F A C E

This manual contains brief solutions for UNIVERSITY PHYISCS, Revised Edition, Harris Benson, John Wiley and Sons, N.Y., 1996. The solutions outline the steps that were used to obtain the answers. They are not suitable for student use.

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CHAPTER 1

Exercises

1. (a) 55 mi/h x 5280 ft/mi x 1 h/3600 s = 80.7 ft/s;
   (b) 24.6 m/s

2. 13440 furlongs/fortnight

3. 10^{-3} kg/$(10^{-2}$ m$)^3$ = 10^3 kg/m^3.

4. 3.156 x 10^7 s

5. (a) 9.47 x 10^{12} km; (b) 7.2 AU/h

6. (a) 1.0073 u; (b) 1.67493 x 10^{-27} kg

7. 0.514 m/s

8. (a) 0.984 ft/ns; (b) 1.86 x 10^5 mi/s

9. 134 in^2

10. 30 mi/gal x 1 gal/3.79 L x 1.6 km/mi = 12.6 km/L or 7.85 L/100 km

11. (a) 5, (b) 3, (c) 4, (d) 2 to 4

12. (a) 6.5 x 10^{-9} s; (b) 1.28 x 10^{-5} m; (c) 2 x 10^{10} W;
    (d) 3 x 10^{-4} A; (e) 1.5 x 10^{-12} A

13. (a) $A = \pi r^2$ = 55.4 m^2, (b) $A = 4\pi r^2$ = 2.7 m^2,
    (c) $V = 4\pi r^3/3$ = 52.17 m^3.

14. (a) 2.5 x 10^{-1}; (b) 5.00 x 10^{-3}; (c) 7.6300 x 10^{-4}

15. 3.33 x 10^3.

16. (a) 48.0; (b) 403.2

17. (a) 1.495 x 10^{11} m, (b) 5.893 x 10^{-7} m, (c) 2 x 10^{-10} m,
    (d) 4 x 10^{-15} m.

18. (a) 15.69; (b) 25.9

19. (a) 91.440 m, (b) 0.40469 hectares

20. (a) 6.2×10^3; (b) 2.73×10^1; (c) 6.00000×10^2

21. (a) 2%, (b) 4%, (c) 6%.

22. 243 ± 4.5 cm^2

23. (a) $4\pi R^2 = 5 \times 10^{14}$ m^2, (b) $4\pi R^3/3 = 3 \times 10^{20}$ m^3
(c) $R_S/R_E = 100$, so $(R_S/R_E)^3 = 1 \times 10^6$

24. 2×10^5

25. 14.5 min. error in one day

26. 1670 km/h

27. For a 2-h movie at 30 frames/second, find 2×10^5 frames.

28. 3×10^{-5} m

29. (a) (2 km/d)(400 d/y)(70 y) $\approx 5 \times 10^4$ km.
(b) At 2 kg/d we find 5×10^4 kg.

30. 10^6

31. 10^9 m^3

32. 10^4 grains

33. 0.1 m^3

34. $M^{-1}L^3T^{-2}$

35. (a) Correct, (b) wrong, (c) correct

36. $[A] = LT^{-2}$, $[B] = LT^{-4}$

37. (a) (2.68 m, 2.25 m), (b) (-1.15 m, -1.38 m),
(c) (-1.80 m, 1.26 m), (d) (1.99 m, -1.67 m)

38. (a) 5.00 m, 53.1^o; (b) 3.61 m, 124^o; (c) 2.92 m, 329^o;
(d) 2.24 m, 206^o

39. $[\omega] = T^{-1}$, $[k] = M\,T^{-2}$

40. $V = 4\pi r^3/3$, so r = 9.14 cm.

41. (a) $V = \pi r^2 h$, $h = 14.5$ cm. (b) Area $= 2\pi rh + 2\pi r^2 = 330$ cm^2.

42. 1 y $= 3.15576 \times 10^7$ s and $\pi = 3.14159$. Thus error is 0.449%.

43. Using 3.786 L per gal. and 1 mi = 1.609 km, find 25.9 m.p.g.

44. For each person $\Delta x = 1.6$ m. Circumference $= 4 \times 10^7$ m, so we need 2.5×10^7 people.

45. (a) 4.96×10^2; (b) 2.6×10^4

46. Area $= 480$ ft$^2 = 44.595$ m^2, so cost is \$32.97.

47. $(4 \times 10^{-3}$ m$^3)/20$ m$^2 = 0.2$ mm.

48. (a) kg.m^2/s^2; (b) $E = (10^{-3}$ kg$)c^2 = 9 \times 10^{13}$ kg.m^2/s^2.

49. $\theta = s/R$ in radians, or $\sin(0.5") = 0.5$ AU/1 parsec, give 1 parsec $= 2.063 \times 10^5$ AU.

50. 64.206 cm^2.

51. 1 " = 2.54 cm exactly, so g = 32.1740 ft/s^2

52. 1 m$^2 = 10.764$ ft^2. Cost is 21.05 per m^2.

Problems

1. With a 0.5 m diameter, the circumference is C ≈ 1.5 m. If the tread lasts for 7×10^7 m, the number of revolutions is 7×10^7 m/1.5 m ≈ 4.5×10^7 rev. The tread depth is about 1 cm, so the loss per revolution is 0.01 m/(4.5×10^7) ≈ 2×10^{-10} m. This about roughly the size of an atom.

2. $a \alpha v^2/r$

3. $T = k^x m^y = M^x T^{-2x} M^y$. The unit of k is N/m, so $[k] = MT^{-2}$ Equating the exponents: $1 = -2x$; $0 = x + y$. Thus $x = -1/2$ and $y = +1/2$ and so $T = C(m/k)^{1/2}$

4. $x \alpha at^2$