Chapter 34

Problems & Exercises

1.

3×10^{41} kg

3.

(a) 3×10^{52} kg

(b) 2×10^{79}

(c) 4×10^{88}

5.

0.30 Gly

7.

(a) 2.0×10^{5} km/s

(b) $0.67c$

9.

2.7×10^{5} m/s

11.

6×10^{-11} (an overestimate, since some of the light from Andromeda is blocked by gas and dust within that galaxy)

13.

(a) 2×10^{-8} kg

(b) 1×10^{19}

15.

(a) $30\text{km/s} \cdot \text{Mly}$

(b) $15\text{km/s} \cdot \text{Mly}$

17.

960 rev/s

19.

89.999773^{o} (many digits are used to show the difference between 90^{o})

22.

23.6 km

24.

(a) 2.95×10^{12} m

(b) 3.12×10^{-4} ly

26.

(a) 1×10^{20}

(b) 10 times greater

27.

1.5×10^{15}

29.

$0.6m^{-3}$

31.

0.30 Ω

32.

(a) $v = H_0 d = (20 \text{ km/s})/\text{Mly } (2.00 \times 10^2 \text{ Mly}) = 4.00 \times 10^3 \text{ km/s}$

$$\begin{aligned} d &= \sqrt{(1.00 \times 10^2)^2 + (2.00 \times 10^2)^2} \text{ Mly} \\ &= 2.24 \times 10^2 \text{ Mly} \end{aligned}$$

(b) $v = (20 \text{ km/s})/\text{Mly } (2.24 \times 10^2 \text{ Mly}) = 4.48 \times 10^3 \text{ km/s}$

(c) The galaxies are separating mostly due to the expansion of space.

(d) Light from the third galaxy would have a red shift when detected in either of the other galaxies.