1.1

- (a) 皮秒光学时间量级为 10^{-12} s, 飞秒光学时间量级为 10^{-15} s.
- (b) 纳米尺度为 10^{-9} m.
- (c) 1 MeV = 10^6 eV, 1 GeV = 10^9 eV.

1.3

地球质量
$$M=10 imes 6.02 imes 10^{23} ext{kg} = 6.02 imes 10^{24} ext{kg}$$

精度为
$$\frac{6.02 \times 10^{24} - 5.98 \times 10^{24}}{5.98 \times 10^{24}} = 0.67\%$$

1.4

百分误差为
$$\dfrac{365 imes 24 imes 60 imes 60 - \pi imes 10^7}{365 imes 24 imes 60 imes 60} imes 100\% = 0.38\%$$

1.5

对数居间
$$rac{\lg 10^{-15} + \lg 10^{26}}{2} = 5.5$$

即
$$10^{5.5} \mathrm{m} = \sqrt{10} imes 10^5 \mathrm{m} = 3.16 imes 10^5 \mathrm{m}$$

石家庄和天津的距离约为 $3.08 \times 10^5 \mathrm{m}$.

1.8

$$m :: G = 6.673 imes 10^{-11} N \cdot m^2/kg^2 = 6.673 imes 10^{-11} m^3/(kg \cdot s^2)$$

$$\therefore \dim G^{\alpha} m^{\beta} R^{\gamma} = v$$

$$\therefore L^{3\alpha+\gamma}M^{\beta-\alpha}T^{-2\alpha}=LT^{-1}$$

$$\therefore \alpha = \frac{1}{2}, \beta = \frac{1}{2}, \gamma = -\frac{3}{2}$$

$$\therefore v = (\frac{Gm}{R^3})^{\frac{1}{2}}$$

1.12

极低温下 $C_V = \alpha T^3 + \gamma T$ 和 $C_V = \gamma T$ 有相同的数量级.

1.14

 $B \times C$ 为轴矢量, $A \times (B \times C)$ 为极矢量叉乘轴矢量, 最终结果应为极矢量.

1.17

$$ec{b}_1 \cdot ec{a}_1 = 2\pi rac{ec{a}_2 imes ec{a}_3}{ec{a}_1 \cdot (ec{a}_2 imes ec{a}_3)} \cdot ec{a}_1 = 2\pi rac{ec{a}_1 \cdot (ec{a}_2 imes ec{a}_3)}{ec{a}_1 \cdot (ec{a}_2 imes ec{a}_3)} = 2\pi$$

$$ec{b}_1\cdotec{a}_2=2\pirac{ec{a}_2 imesec{a}_3}{ec{a}_1\cdot(ec{a}_2 imesec{a}_3)}\cdotec{a}_2=0$$

$$\vec{b}_1 \cdot \vec{a}_3 = 0$$

$$\vec{b}_2 \cdot \vec{a}_1 = 0$$

$$ec{b}_2 \cdot ec{a}_2 = 2\pi rac{ec{a}_2 \cdot (ec{a}_3 imes ec{a}_1)}{ec{a}_1 \cdot (ec{a}_2 imes ec{a}_3)} = 2\pi rac{ec{a}_1 \cdot (ec{a}_2 imes ec{a}_3)}{ec{a}_1 \cdot (ec{a}_2 imes ec{a}_3)} = 2\pi$$

$$\vec{b}_2 \cdot \vec{a}_3 = 0$$

$$\vec{b}_3 \cdot \vec{a}_1 = 0$$

$$\vec{b}_3 \cdot \vec{a}_2 = 0$$

$$ec{b}_3\cdotec{a}_3=2\pirac{ec{a}_3\cdot(ec{a}_1 imesec{a}_2)}{ec{a}_1\cdot(ec{a}_2 imesec{a}_3)}=2\pi$$

$$\therefore ec{b}_i \cdot ec{a}_i = egin{cases} 2\pi, & i=j \ 0, & i
eq j \end{cases}$$

1.19

$$\because m ec{a} = q ec{v} imes ec{B}, ec{a} = ec{w} imes ec{v}$$

$$\therefore m\vec{w}\times\vec{v}=q\vec{v}\times\vec{B}$$

$$\therefore \vec{w} \times \vec{v} = -\frac{q}{m} \vec{B} \times \vec{v}$$

$$\therefore ec{w} = -rac{q}{m}ec{B} + \lambda ec{v}$$
,其中 λ 是一个标量

1.22

(a)
$$ec{A} \cdot ec{B} = 12$$

(b)
$$ec{A} imesec{B}=(-2,5,-1)$$

(c)
$$ec{A} \cdot (ec{B} imes ec{C}) = 12$$

(d)
$$ec{A} imes (ec{B} imes ec{C}) = (-2,4,8)$$

(e)
$$ec{A} imes (ec{A}+ec{B} imes ec{C})=(-2,4,8)$$

(f)
$$ec{A} \cdot (ec{B} imes ec{C} - ec{A} imes ec{B}) = 12$$