1. **B** : Using $s = ut + \frac{1}{2} g t^2$ with s = 0.078 m and t = 0.040 s gives $u = (s : \frac{1}{2} g t^2)/t \approx 1.8$ m s^{-1}.

2. **B**: Distance during acceleration = $\frac{1}{2}at^2$ with a = 8.0 / 2.0 = 4.0 m s^{-2} → $\frac{1}{2} \times 4.0 \times (2.0)^2$ = 8 m. Distance at constant speed = 8.0 m s^{-1} × 4.0 s = 32 m. Total = 8 m + 32 m = 40 m

3. **C**: Solve $20 + 14t - \frac{1}{2}(9.8)t^2 = 0 \rightarrow t \approx 3.9$ s.

4. **B**: Using $v^2 = 2as \rightarrow a = 900 / 420 \approx 2.1$ m s^{-2}; then $t = v/a \approx 14$ s.

5. B : Work W = F s = (250 N)(0.40 m) = 100 J.

6. **C**: W = mgh = 2.0 kg × 9.8 m s^{-2} × 3.0 m ≈ 5.9×10^1 J.

7. **A** : Resolving the lift L: $L \cos \theta = mg$; horizontal component $L \sin \theta = m v^2 / r$. Dividing gives $\tan \theta = v^2 / (r g)$, so $v = \sqrt{(r g \tan \theta)}$.

8. **D**: Δp = 0.15 kg × (8 + 6) = 2.1 kg m s^{-1}; $F = \Delta p/\Delta t = 2.1 / 0.020 \approx 1.0 \times 10^2$ N.

9. **A** : Energy supplied Q = P t = (120 W)(300 s) = 3.6×10^4 J. Mass evaporated m = 0.034 kg. $L = Q/m \approx 1.1 \times 10^6$ J kg^{-1}.

10. **C**: Molecular kinetic energy ∝ absolute temperature; only option C raises T(K) (300 K → 400 K).

11. **A** : For an isothermal change, $p_1V_1 = p_2V_2$. Hence $p_2 = p_1 (V_1 / V_2) = (8.0 \times 10^5 \text{ Pa})/4 = 2.0 \times 10^5$ Pa.

12. **C** : $T = 2\pi\sqrt{(l/g)} = 2\pi\sqrt{(0.90 \text{ m}/9.8 \text{ m s}^{-2})} \approx 1.3$ s.

13. **B**: First destructive interference occurs for a path difference of $(n + \frac{1}{2})\lambda$; the smallest is $\lambda/2$.

14. **B** : $\lambda = s d/D = (3.2 \times 10^{-3} \text{ m})(2.5 \times 10^{-4} \text{ m})/4.0 \text{ m} \approx 6.3 \times 10^{-7}$ m.

15. **B** : Since PQ = λ = 0.80 m, v = f λ = (120 Hz)(0.80 m) = 60 m s^{-1}.

16. **C** : $E = V/d = 430 \text{ V}/0.067 \text{ m} \approx 6.4 \times 10^2$ V m^{-1}.

17. **D**: $R\_eq = (1/6 + 1/3)^{-1} = 2\ \Omega$; I = V/R = 9 V / 2 Ω = 4.5 A.

18. **B**: r = 0.06 m; $v = qBr/m = (1.6 \times 10^{-19} \text{ C})(0.20 \text{ T})(0.06 \text{ m})/(3.3 \times 10^{-26} \text{ kg}) \approx 5.8 \times 10^4$ m s^{-1}. KE = $\frac{1}{2}mv^2 \approx 5.6 \times 10^{-17}$ J = 3.5×10^2 eV.

19. **C**: $v\_e = \sqrt{(2GM/R)} = \sqrt{[2 \times 6.67 \times 10^{-11} \times 4.0 \times 10^{23} / 1.6 \times 10^6]} \approx 5.8 \times 10^3$ m s^{-1} = 5.8 km s^{-1}.

20. **C**: $(1/2)^\wedge(t/T_{1/2}) = 0.625 \rightarrow t/T_{1/2} = \ln 0.625 / \ln 0.5 \approx 0.677 \rightarrow T_{1/2} = 10 / 0.677 \approx 15$ days.

21. **C**: A neutron is electrically neutral and has a relative mass of 1.

22. B : Because most α-particles were undeflected, they encountered little mass or charge, implying the atom is largely empty; only a small, dense nucleus caused the occasional large-angle scatter.

23. B: $\tau = \tau_{\odot} / 6^{2.5} \approx 1 \times 10^{10} / 8.8 \times 10^{1} \approx 1.1 \times 10^{8}$ y.

24. B : From the graph the speed at 5600 m is about 4.5×10^{2} m s^{-1}. Hence $E_{\square} = \frac{1}{2} m v^2 = \frac{1}{2} (6.50 \times 10^{3}$ kg$)(4.5 \times 10^{2}$ m s$^{-1})^2 \approx 6.6 \times 10^{8}$ J.

25. C: $\lambda_{max} = b/T \approx 10$ μm; CO_2 absorption bands lie in the 4 - 20 μm thermal infrared where Earth emits most strongly, trapping heat.