

2026 Physics Bowl Answers and Solutions

1. C $1.0 \text{ cm} = 0.01 \text{ m}; 1.0 \text{ mm} = 0.001 \text{ m}; (0.01 \text{ m}) / (0.001 \text{ m}) = 10$
2. D $v^2 = v_0^2 + 2a\Delta x; a = 5.0 \frac{\text{m}}{\text{s}^2}; v = v_0 + a\Delta t; t = 2.0 \text{ s}$
3. C $T = 2\pi \sqrt{\frac{l}{g}}; 2T = 2\pi \sqrt{\frac{4l}{g}}$
4. B $p = m\Delta v; F\Delta t = m\Delta v$
5. C Conservation of momentum: $m_1 v_1 = m_2 v_2; v_2 = \frac{(60 \text{ kg})(20 \frac{\text{m}}{\text{s}})}{6.0 \times 10^{24} \text{ kg}} = 2.0 \times 10^{-22} \frac{\text{m}}{\text{s}}$
6. D $a = \frac{\Delta v}{\Delta t};$ Slope of graph is $\frac{\Delta t}{\Delta v} = \frac{1}{a}$
7. C Maximum height on Earth can be calculated using the fact that half the hang time will be equal to the time the capsule takes to fall from the maximum height to landing. $x = h_{\text{max}} = v_0 \Delta t + \frac{1}{2} a \Delta t^2$. Using the same h_{max} on new planet, $t = 13 \text{ s}$.
8. D At $t_1: N - mg = ma; N = 805 \text{ N};$ At $t_2: N - mg = -ma; N = 595 \text{ N};$

$$\frac{N_1}{N_2} = \frac{805 \text{ N}}{595 \text{ N}} = 1.35 = 23:17$$
9. B Conservation of momentum: $m_A v_A = m_B v_B; v_B = \frac{(50 \text{ kg})(2 \frac{\text{m}}{\text{s}})}{75 \text{ kg}} = 1.33 \frac{\text{m}}{\text{s}}$
10. C Water reaches its maximum density at 4 °C. When surface water cools below this temperature, it becomes less dense so it stays on the surface. This top layer is then in direct contact with the cold air and loses heat and ice begins forming. The ice is less dense than the liquid water so it floats on top and acts like an insulator for the water below.
11. B On the way up, both gravity and air resistance are opposing the ball's motion. On the way down, only air resistance is opposing the ball's motion.
12. C $m_{\text{total}} = m + 3m = 4m; F = ma; a = \frac{F}{4m};$ The rope accelerates the 3m block, so:

$$T = (3m)a = (3m) \left(\frac{F}{4m} \right) = \frac{3F}{4}$$
13. B The peak wavelength (λ_{max}) emitted by a black body is inversely proportional to its temperature (T) according to Wien's Law: $\lambda_{\text{max}} T = \text{constant}$.
14. A $PE_g + KE_{\text{top}} = KE_{\text{bottom}} + W_{\text{friction}}; F_{\text{friction}} = \frac{PE_g + KE_{\text{top}} - KE_{\text{bottom}}}{\Delta x}$
15. D $I = \frac{1}{3} ML^2 = 5.33 \text{ kg m}^2; KE_R = \frac{1}{2} I \omega^2 = 24 \text{ J}$

16. B See: <https://www.britannica.com/biography/Jocelyn-Bell-Burnell>
17. B When light passes from glass to air, it travels from a denser medium to a less dense one, causing it to speed up and refract (bend) away from the normal line.
18. B $PV = nRT$; Since nRT is unchanged, P & V are inversely proportional.
19. C Perihelion is the point on the elliptical orbit where the planet is closest to the star it is orbiting. At this point, it will experience the largest gravitational force and acceleration.
20. D $T = F_C = mR\omega^2$
21. B $A = \pi r^2$; $A_1 v_1 = A_2 v_2$
22. B The initial speed of the projectile is found by considering momentum conservation during the collision and energy conservation during the sliding.
23. B, D $GPE = \frac{GMm}{r}$; $\Delta GPE = GPE_2 - GPE_1$
24. D $x_{com} = \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2}$
25. C $EPE = \frac{1}{2} k \Delta x^2$; $2x$ yields 4 GPE
26. E The speed of a transverse wave on a string is determined solely by the physical properties (tension and linear mass density) of the string.
27. A $W = F \Delta x$
28. D Astrophysicists utilize spectroscopy to study the spectrum of the light received from the star. This technique allows them to identify the elements in the outer layers of the star.
29. E The temperature of the gas is 0 K: This is the defining characteristic of an isothermal process.
30. B $L = I\omega$; $I_1 \omega_1 = I_2 \omega_2$
31. B $F_{buoy} = \rho g V$; When density (ρ) doubles, F_{buoy} doubles.
32. A As more lamps are connected in parallel in a circuit, the current in the power source increases. This occurs because each additional parallel branch provides a new path for current, lowering the total resistance of the circuit while the voltage remains constant, according to Ohm's law $V=IR$.
33. C $GPE = EPE$; $mgh = \frac{1}{2} k \Delta x^2$; $x = \sqrt{\frac{2mgh}{k}}$
34. A $x = vt$; $t = \frac{x}{v} = \frac{1.5 \times 10^9 \text{ m}}{3.0 \times 10^8 \frac{\text{m}}{\text{s}}}$
35. C If they are near each other and accelerate when released, they have the same charge. If they are separated and accelerate when released, they have opposite charge.

36. D $F_c = \frac{mv^2}{r}; v = \sqrt{\frac{F_c r}{m}}$
37. C The heat of fusion is the energy required to change a substance from a solid to a liquid at its constant melting point. For this substance, that value is $40 \frac{kJ}{kg}$.
38. A $W = Fd \cos \theta$
39. C Given that the angle of the incline doesn't change and that the ball still lands on the incline, the angle of impact is independent of the ball's initial speed since it is launched horizontally.
40. E To make a full revolution, the pendulum must reach the top of its arc. Therefore, the change in potential energy is $\Delta PE = M_{pend}gL + m_{ball}g2L = 160 J$;
 $\Delta PE = \frac{1}{2}I\omega^2$; $7.3 \frac{rad}{s}$; *Angular momentum is conserved: $L_{initial} = L_{final}$* ;
 $mvL = I\omega$
41. D First position: $\frac{1}{f} = \frac{1}{d_1} + \frac{1}{(L-d_1)}$; Second position: $\frac{1}{f} = \frac{1}{d_2} + \frac{1}{(L-d_2)}$;
 $\frac{1}{20} + \frac{1}{(L-20)} = \frac{1}{30} + \frac{1}{(L-30)}$; $L = 50 \text{ cm}$
42. A Torque on cylinder: $\tau - TR = I\alpha$; Motion of the block: $T - Mg = Ma$;
 $\tau - (Ma + Mg)R = I\alpha$
43. E $W = F_{friction}d = \Delta KE$; $\mu mgd = \frac{1}{2}mv^2$; $d = \frac{v^2}{2\mu g}$
44. C&D Period of mass on spring is unaffected by change in g: $T = 2\pi\sqrt{\frac{m}{k}}$
 Period of pendulum is partially dependent on g: $T = 2\pi\sqrt{\frac{l}{g}}$
45. C In a plane electromagnetic wave, the energy is distributed equally between the oscillating electric and magnetic fields. As a result, their average contributions to the total energy density are identical.
46. C $R_1 + R_2 = 72.0 \Omega$; $\frac{R_1 R_2}{72.0} = 16.0 \Omega$; $(16.0 \Omega)(72.0 \Omega) = 1152 \Omega^2$
 $x^2 - 72x + 1152 = 0$
47. A $F_g = mg \sin \theta$; $\varepsilon = BLv$; $I = \frac{BLv}{R}$; $F_B = BIL$
At terminal velocity: $mg \sin \theta = \frac{B^2 L^2 v}{R}$
48. B $1 V = \frac{(1 kg)(m^2)}{s^3 A}$
49. C Intended answer was C. However, P₂ and P₁ were switched in this option.
50. A $KE = \frac{p^2}{2m}$; $p = \sqrt{(2m)(KE)}$