CLASS 11 PHYSICS EXTRA QUESTIONS

Class 11 Physics Chapter 1 Units and Measurements – HOTS & Extra Questions with Answers

These HOTS-level extra questions go beyond the NCERT exercise problems in Chapter 2 (Units and Measurements) — general/abstract proofs instead of one-off numeric substitutions, assertion-reason format, reverse-engineering from a given answer, and multi-step combined problems. See the NCERT Solutions for this chapt...

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HOTS & Extra Questions: Units and Measurements (Class 11 Physics Chapter 2)

Q1. General proof: pressure formula P = F/A in a new unit system

Show, in general (not for specific numbers), that if the unit of mass is α kg, unit of length β m and unit of time γ s, then a pressure of n_1 pascal becomes $n_1\alpha\beta^{-1}\gamma^2$ new units.
Answer: [Pressure] = $ML^{-1}T^{-2}$. So $n_2 = n_1(M_1/M_2)^1(L_1/L_2)^{-1}(T_1/T_2)^{-2} = n_1 \times \alpha^{-1} \times \beta^1 \times \gamma^{-2}$... working carefully: (L1/L2)^-1 = (1/β)^-1 = β, and (T1/T2)^-2=(1/γ)^-2=γ^2, (M1/M2)^1=1/α. So $n_2 = n_1\alpha^{-1}\beta\gamma^2$. This is harder than the textbook's Q2.3/2.4 because the target quantity (pressure, not energy) and its dimension have to be derived first, not looked up.

Q2. Reverse-engineering: what quantity has this dimensional formula?

A physical quantity X has the dimensional formula [$M L^2 T^{-3}$]. Identify X and give one real formula that produces this dimension.
Answer: [ML^2T^{-3}] = [Energy]/[Time] = **Power**. Verification: P = Fv has dimension [MLT^{-2}][LT^{-1}] = [ML^2T^{-3}]. ✓

Q3. Assertion-Reason

Assertion (A): Dimensional analysis can prove that a formula is completely correct.
Reason (R): Dimensional analysis only checks that both sides of an equation have matching dimensions; it cannot detect a missing dimensionless numerical constant (like π or ½).
(a) Both A and R are true and R correctly explains A (b) Both true, R does not explain A (c) A true, R false (d) A false, R true
Answer: (d). A is false (dimensional analysis is necessary but not sufficient for correctness); R is true and correctly states the actual limitation.

Q4. Multi-step error propagation with fresh numbers

The kinetic energy of a body is measured as KE = ½mv^2. If mass m = (2.50 ± 0.02) kg and speed v = (12.4 ± 0.3) m/s, find the percentage error and the absolute error in KE.
Answer: %error in m = (0.02/2.50)×100 = 0.8%. %error in v = (0.3/12.4)×100 ≈ 2.42%. Since KE ∝ mv^2, %error in KE = %error in m + 2(%error in v) = 0.8 + 2(2.42) = **5.64%**. KE = ½(2.50)$(12.4)^2$ = ½(2.50)(153.76) = 192.2 J. Absolute error ≈ 0.0564 × 192.2 ≈ **±10.8 J**, so KE = (192.2 ± 10.8) J.

Q5. Remainder-style unit-conversion word problem with fresh numbers

A new system defines its unit of length as 1.5 m and its unit of time as 0.8 s, keeping the kilogram as the unit of mass. What is the value of the standard gravitational acceleration g = 9.8 m/s^2 in this new system?
Answer: [g] = LT^{-2}. $n_2 = n_1(L_1/L_2)^{-1}(T_1/T_2)^{-2} = 9.8 \times (1/1.5)^{-1} \times (1/0.8)^{-2} = 9.8 \times 1.5 \times 0.64 =$ **9.408 new**

units.

Q6. General/abstract proof: why significant figures survive multiplication differently than addition

Prove, using the general error-propagation rule, why the RESULT of multiplying two measured numbers is limited by the LEAST number of significant figures among them, while the result of ADDING two measured numbers is limited by the LEAST number of DECIMAL PLACES (not significant figures) among them.
Answer: For a product $Z = AB$, the relative error adds: $\Delta Z/Z = \Delta A/A + \Delta B/B$, so the relative precision (and hence the count of significant figures) of Z can be no better than the least relatively-precise factor — i.e., limited by the operand with fewest significant figures. For a sum $Z = A + B$, the ABSOLUTE errors add: $\Delta Z = \Delta A + \Delta B$, which is independent of how many total digits each number has and depends only on the smallest place value each was measured to — i.e., limited by the operand with the fewest decimal places. This is why 4.5 + 0.023 = 4.5 (1 decimal place), not 4.523.

Q7. Reciprocal/rate word problem in the spirit of Q2.29-2.30

A ship sends a SONAR pulse that returns after 0.68 s from one object and, 4 s later, sends a second pulse to the same (stationary) object which returns after 0.64 s. If the speed of sound in seawater is 1500 m/s, find the average speed at which the ship is approaching the object.
Answer: Distance 1 = 1500 × 0.68/2 = 510 m. Distance 2 = 1500 × 0.64/2 = 480 m. Ship closed a gap of 30 m in 4 s ⇒ average approach speed = 30/4 = **7.5 m/s**.

Class 11 Physics Chapter 1 – Solutions and Notes

For complete step-by-step answers and a quick summary, check the Class 11 Physics Chapter 1 Solutions and Class 11 Physics Chapter 1 Revision Notes.