Weird Chemist

DPP–9 : Units and Measurements

Chapter: Some Basic Concepts of Chemistry

Complete Solution Sheet — Q.1 to Q.21

Quick Reference: Significant Figures Rules

Counting sig figs: **(1)** All non-zero digits are significant. **(2)** Zeros between non-zero digits are significant. **(3)** Leading zeros (before first non-zero digit) are NOT significant. **(4)** Trailing zeros after a decimal point ARE significant. **(5)** Exact/counted numbers (e.g., 5 students, 12 eggs) have infinite significant figures.

Operations: Addition/Subtraction: answer has same number of *decimal places* as the least precise number.
Multiplication/Division: answer has same number of *significant figures* as the least precise number.

TYPE 1 : SI Units & Basic Definitions

Q.1 Which one of the following forms part of seven basic SI units?

Explanation

The seven base SI units are:

Quantity	SI Unit
Length	metre (m)
Mass	kilogram (kg)
Time	second (s)
Electric current	ampere (A)
Temperature	kelvin (K)
Amount of substance	mole (mol)
Luminous intensity	**candela (cd)**

Among the options: Joule (energy), Newton (force), Pascal (pressure) are all **derived** units, not base units. **Candela** is the base SI unit for luminous intensity.

Approach / Analogy

Super easy memory trick for SI base units:

"My Kid Sells Apples, Keeps Mangoes Cool"

Word	SI Unit
My	metre (m)
Kid	kilogram (kg)
Sells	second (s)
Apples	ampere (A)
Keeps	kelvin (K)
Mangoes	mole (mol)
Cool	candela (cd)

Now check the options:
Joule $\rightarrow$ derived unit
Newton $\rightarrow$ derived unit
Pascal $\rightarrow$ derived unit
Candela $\rightarrow$ base SI unit

Common Mistake

Choosing Joule as a base SI unit. Joule = $kg{\cdot}m^2{\cdot}s^{-2}$ — it's a derived unit. Newton = $kg{\cdot}m{\cdot}s^{-2}$, Pascal = $kg{\cdot}m^{-1}{\cdot}s^{-2}$ — both derived. Only Candela is a genuine base unit among the options.

Answer

(2) Candela

Q.2 Numerical prefix used for 10^{12} is [NCERT Pg. 9]

Explanation

Standard SI prefixes (key ones to memorise):

Prefix	Symbol	Power
Giga	G	10^9
Tera	**T**	$\mathbf{10^{12}}$
Peta	P	10^{15}
Exa	E	10^{18}

Tera corresponds to 10^{12}.

Approach / Analogy

Memory trick for powers of 10^3: **"Kilo, Mega, Giga, Tera, Peta, Exa"** = $10^3, 10^6, 10^9, 10^{12}, 10^{15}, 10^{18}$. You likely know Giga (GHz in computers = 10^9 Hz). Tera is one step above Giga: Tera bytes (TB) in hard drives = 10^{12} bytes.

Common Mistake

Confusing Giga (10^9) with Tera (10^{12}). Giga is commonly encountered (GHz, GB) so students associate large numbers with Giga. Remember: Tera is one step *above* Giga. $10^9 \to 10^{12}$ = multiply by 10^3 = go one prefix higher = Giga $\to$ Tera.

Answer

(2) Tera

TYPE 2 : Unit Conversion

Q.3 20 dm^3 converted into mL is

Explanation

Unit conversion chain:

$$1 \text{ dm} = 10 \text{ cm} = 10^{-1} \text{ m}$$

$$1 \text{ dm}^3 = (10 \text{ cm})^3 = 10^3 \text{ cm}^3 = 10^3 \text{ mL} = 1 \text{ L}$$

Therefore:

$$20 \text{ dm}^3 = 20 \times 10^3 \text{ mL} = \mathbf{2} \times \mathbf{10^4} \text{ mL}$$

Approach / Analogy

1 dm^3 = 1 litre = 1000 mL. So 20 dm^3 = 20 litres = 20,000 mL = 2×10^4 mL. The key fact: dm^3 = litre is one of the most useful volume equivalences in chemistry.

Common Mistake

Converting linearly: $20 \times 10 = 200$ mL (using 1 dm = 10 cm without cubing). Volume units are cubic! 1 $\text{dm}^3 = (10)^3 \text{ cm}^3 = 1000$ mL, not 10 mL. Always cube the linear conversion factor for volume units.

Answer

(1) 2×10^4 mL

Q.4 59 F converted into °C is

Explanation

Fahrenheit to Celsius conversion formula:

$$^\circ\text{C} = \frac{^\circ\text{F} - 32}{1.8} = \frac{59 - 32}{1.8} = \frac{27}{1.8} = \mathbf{15}^\circ\text{C}$$

Approach / Analogy

Formula: $C = (F - 32)/1.8$. Always subtract 32 first, then divide by 1.8. Quick sanity check: 32°F = 0°C (freezing point of water), 212°F = 100°C (boiling point). 59°F is between these, so 15°C is a cool room temperature — makes sense!

Common Mistake

Using $C = (F - 32) \times 1.8$ instead of $\div 1.8$: $(59 - 32) \times 1.8 = 27 \times 1.8 = 48.6$°C. The formula divides by 1.8 (or equivalently multiplies by 5/9). Double-check: 0°C = $(32 - 32)/1.8 = 0$. Confirmed: divide, not multiply.

Answer

(1) 15°C

Q.5 2 atm converted into cm of Hg is

Explanation

Standard equivalence: 1 atm = 76 cm of Hg

$$2 \text{ atm} = 2 \times 76 = \mathbf{152} \text{ cm of Hg}$$

Approach / Analogy

1 atm = 76 cm Hg = 760 mm Hg = 760 torr. Simply multiply: 2 atm $\times$ 76 cm/atm = 152 cm Hg. This is the standard mercury barometer reading at sea level for one atmosphere.

Common Mistake

Using 1 atm = 760 cm Hg (confusing cm with mm). Standard pressure = 76 cm Hg = 760 mm Hg. In *centimetres*, it's 76 (not 760). $2 \times 760 = 1520$ cm Hg is wrong. Check your units: is it cm or mm?

Answer

(1) 152 cm

Q.6 2 litre atmosphere converted into erg is

Explanation

Standard conversion:

$$1 \text{ L} \cdot \text{atm} = 101.3 \text{ J} = 101.3 \times 10^7 \text{ erg}$$

(Since 1 J = 10^7 erg)

$$2 \text{ L} \cdot \text{atm} = 2 \times 101.3 \times 10^7 = \mathbf{202.6 \times 10^7} \text{ erg}$$

Approach / Analogy

Two-step conversion: L·atm $\to$ J $\to$ erg. Key facts: 1 L·atm = 101.3 J. 1 J = 10^7 erg. So 1 L·atm = 101.3×10^7 erg. For 2 L·atm: just double it.

Common Mistake

Using 1 L·atm = 101.3 J but forgetting to convert J to erg (forgetting the $\times 10^7$ factor). Reporting 2 L·atm = 202.6 J instead of 202.6×10^7 erg. Remember: 1 J = 10^7 erg (joule is a much larger unit than erg).

Answer

(1) 202.6×10^7 erg

TYPE 3 : Significant Figures — Counting

Q.7 The number 0.00001465 can be correctly expressed in scientific notation as [NCERT Pg. 11]

Explanation

Scientific notation: move decimal point until one non-zero digit is to the left.

0.00001465: the first significant digit is 1 (at position 10^{-5}).

$$0.00001465 = 1.465 \times 10^{-5}$$

The leading zeros (0.00001) are **not significant** — only 1, 4, 6, 5 are significant (4 sig figs).

Approach / Analogy

Count how many places you move the decimal right to get the first non-zero digit: $0.00001465 \to 1.465$ (moved 5 places right $\to 10^{-5}$). Scientific notation always has exactly one digit before the decimal point (between 1 and 9). Here: 1.465×10^{-5}.

Common Mistake

Writing 1.465×10^{-4} (off by one in the exponent). Count carefully: $0.0000\underline{1}465$ — the 1 is in the 10^{-5} position (5 places after the decimal). If you move the decimal right by 5 positions, the exponent is -5, not -4.

Answer

(3) 1.465×10^{-5}

Q.8 Counting numbers of objects, for example 4 balls and 10 eggs have [NCERT Pg. 12]

Explanation

When counting discrete objects (4 balls, 10 eggs), there is **no measurement uncertainty**. The number 4 means exactly 4 — not 3.9 or 4.1. Similarly, 10 eggs means exactly 10. These are **exact numbers** and have **infinite significant figures**.

Approach / Analogy

Think of it this way: if you count 10 eggs, you're 100% certain there are exactly 10 — not 10.0 or 10.00 or 9.99. Counted/exact numbers carry no measurement error, so they have infinite precision (infinite sig figs). This is different from measured values like "10.0 g" which has 3 sig figs.

Common Mistake

Saying 4 has 1 sig fig and 10 has 2 sig figs (treating them as measured numbers). This applies to *measured* values, not counted values. 4 balls is an exact count = infinite sig figs. 4.0 g (a measurement) = 2 sig figs. The distinction is exact (counted) vs measured.

Answer

(3) Infinite significant figures in both

Q.9 Given the numbers: 161 cm, 0.161 cm, 0.0161 cm. The number of significant figures for the three numbers is

Explanation

Apply the sig fig rules to each:

- **161 cm**: Digits 1, 6, 1 — all non-zero, all significant. **3 sig figs.**
- **0.161 cm**: Leading zero is NOT significant. Digits 1, 6, 1 are significant. **3 sig figs.**
- **0.0161 cm**: Leading zeros (0.0) are NOT significant. Digits 1, 6, 1 are significant. **3 sig figs.**

All three have **3 significant figures**.

Approach / Analogy

Leading zeros (zeros that appear before the first non-zero digit) are *never* significant — they just mark the position of the decimal point. Think of it like writing the number in scientific notation: 1.61×10^2, 1.61×10^{-1}, 1.61×10^{-2} — all have 3 sig figs. The power of 10 doesn't contribute sig figs.

Common Mistake

Counting the zeros before the decimal as significant for 0.161 and 0.0161. The zero before the decimal in 0.161 is just a writing convention (could write .161) — NOT significant. The zeros in 0.0161 are place-holders, not significant. Only the digits 1, 6, 1 count.

Answer

(4) 3, 3 and 3 respectively

Q.10 The number of significant figures in 2.653×10^4 is

Explanation

In scientific notation, only the **coefficient** (mantissa) determines significant figures. The power of 10 (10^4) carries no sig figs.

Coefficient = 2.653: digits 2, 6, 5, 3 — all non-zero, all significant. **4 significant figures.**

Approach / Analogy

2.653×10^4 = 26530. The digits 2, 6, 5, 3 are all significant (4 sig figs). The trailing zero in 26530 would be ambiguous, which is why scientific notation is used — it makes the sig figs unambiguous. Count only the digits in the coefficient: 2.653 has 4 digits = 4 sig figs.

Common Mistake

Counting all digits in the expanded form 26530 as 5 sig figs, or counting the exponent (4) as a separate significant figure to get 5 or more. In scientific notation, count *only* the digits in the mantissa (2.653 = 4 digits = 4 sig figs). The $\times 10^4$ part is not a sig fig.

Answer

(2) 4

Q.11 In which of the following measurements, the number of significant figures is infinite?

Explanation

Infinite significant figures occur for **exact** (counted or defined) numbers:

- (1) 0.0108 g: a measurement $\rightarrow$ finite sig figs (3 sig figs).
- (2) 0.0050060 g: a measurement $\rightarrow$ finite sig figs (5 sig figs).
- (3) 5.030×10^2 m: a measurement $\rightarrow$ finite (4 sig figs).
- **(4) 110 riders started, 60 finished**: exact counted numbers $\rightarrow$ **infinite sig figs.**

Approach / Analogy

Counted whole numbers (like counting people in a race) are exact with infinite precision. You counted 110 riders — not 110.3 or 109.7. It's exactly 110 with zero uncertainty = infinite sig figs. All the other options involve physical measurements (mass, distance) which always have some measurement uncertainty.

Common Mistake

Choosing option (2) because 0.0050060 has zeros that look "special" (thinking zeros = infinite). The trailing zeros after the last non-zero digit in a decimal ARE significant (5 sig figs here: 5, 0, 0, 6, 0). But the number is still a finite measurement. Only counted/defined numbers have infinite sig figs.

Answer

(4) In a bicycle race, 110 riders started but only 60 finished

Q.12 Number of significant figures in 6.62×10^{-34}

Explanation

Coefficient = 6.62: digits 6, 6, 2 — all non-zero. **3 significant figures.**

(This is Planck's constant $h \approx 6.626 \times 10^{-34}$ J·s — a fundamental physics constant.)

Approach / Analogy

Same rule: in scientific notation, count only the mantissa digits. 6.62 has three digits = 3 sig figs. The 10^{-34} is just a scale factor. Negative exponents don't add or reduce sig figs.

Common Mistake

Adding the exponent (34) to get sig figs, or thinking the negative sign in the exponent means fewer sig figs. The exponent is irrelevant to sig fig counting. Only the mantissa (6.62) matters: 3 digits = 3 sig figs.

Answer

(2) Three

TYPE 4 : Significant Figures — Rounding & Operations

Q.13 6.608792 expressed to four significant figures is

Explanation

Keep 4 significant figures: 6.608<u>7</u>92

The 4th sig fig is 8 (at the thousandths place). The next digit is **7** (≥ 5), so round up:

$$6.608\mathbf{7}92 \rightarrow 6.609$$

Answer: 6.609

Approach / Analogy

Identify the 4th significant digit (8), then look at the 5th digit (7). Since $7 \geq 5$, round the 4th digit up: $8 \rightarrow 9$. Result: 6.609. Rounding rule: ≥ 5 means round up; < 5 means leave unchanged.

Common Mistake

Stopping at 6.608 (truncating instead of rounding). Truncation just cuts off digits; rounding considers the next digit. Since the 5th digit is 7 (≥ 5), the 4th digit 8 rounds *up* to 9. Always look at the digit *after* the last kept digit to decide whether to round up.

Answer

(2) 6.609

Q.14 42.392800 expressed to four significant figures is

Explanation

4 sig figs of 42.392800: keep digits 4, 2, 3, 9

The 4th sig fig is 9 (at hundredths place: 42.39). The next digit is **2** (< 5), so leave unchanged:

$$42.3\mathbf{9}\underline{2}800 \rightarrow 42.39$$

Answer: 42.39

Approach / Analogy

Count 4 sig figs: 4, 2, 3, 9 (the 4th one is the second 9). Next digit = 2 (< 5) $\rightarrow$ don't round up. Result: 42.39. Note: the trailing zeros in 42.392800 are significant in the original number (7 sig figs), but when rounding to 4, they disappear.

Common Mistake

Choosing 42.40 (rounding up) when the next digit is 2 (which is < 5). Round up only when the dropped digit is ≥ 5. Here it's 2, so the 9 stays as 9: answer is 42.39, not 42.40.

Answer

(1) 42.39

Q.15 The sum of 3.368 kg and 2.02 kg expressed to correct significant figures is

Explanation

Addition rule: Answer must have the same number of *decimal places* as the number with fewest decimal places.

$$\begin{array}{rll} & 3.368 & \text{(3 decimal places)} \\ + & 2.02 & \text{(2 decimal places)} \\ \hline & 5.388 & \end{array}$$

Least decimal places = 2 (from 2.02). Round 5.388 to 2 decimal places:

$$5.38\mathbf{8} \rightarrow 5.39 \text{ kg (digit after 8 is 8, round up)}$$

Wait — 5.388 has 3 decimal places. Round to 2: look at 3rd decimal ($8 \geq 5$) $\rightarrow$ round 2nd decimal up: $5.38 \rightarrow 5.39$.
Answer: 5.39 kg

Approach / Analogy

For addition/subtraction: find the number with the *fewest decimal places* (2.02 has 2). The answer can only have 2 decimal places. $3.368 + 2.020 = 5.388$, rounded to 2 decimal places = 5.39 (since the 3rd decimal is $8 \geq 5$, round up).

Common Mistake

Applying the multiplication rule (fewest sig figs) to addition. For **addition**, use decimal places, not sig figs. 2.02 has 2 decimal places (not 3 sig figs) as the limiting factor. Answer = 5.39 kg (2 decimal places), not 5.4 kg (2 sig figs).

Answer

(2) 5.39 kg

Q.16 Add $(0.001 + 0.02)$ upto correct number of significant figures

Explanation

$$\begin{array}{rll} & 0.001 & \text{(3 decimal places)} \\ + & 0.02 & \text{(2 decimal places)} \\ \hline & 0.021 & \end{array}$$

Least decimal places = 2 (from 0.02). Round to 2 decimal places:

$$0.021 \to \mathbf{0.02}$$

(3rd decimal is $1 < 5 \to$ round down = drop it)
Answer: 0.02

Approach / Analogy

0.021 rounded to 2 decimal places: look at 3rd decimal = 1. Since $1 < 5$, the 2nd decimal stays as 2. So 0.021 $\to$ 0.02. The number 0.001 is less precise than 0.02 in terms of absolute uncertainty, so the answer is limited to 2 decimal places.

Common Mistake

Reporting 0.021 (the raw sum) without rounding. Addition requires the answer to have only as many decimal places as the least precise addend. 0.02 has 2 decimal places $\to$ answer must also have 2 decimal places $\to$ 0.02.

Answer

(2) 0.02

Q.17 The multiple 5×0.2 after rounding off will be

Explanation

$5 \times 0.2 = 1.0$

Multiplication rule: Answer has the same number of sig figs as the factor with fewest sig figs.

0.2 has **1 significant figure**. Therefore the answer should have **1 sig fig**.

$$1.0 \xrightarrow{\text{1 sig fig}} \mathbf{1}$$

Approach / Analogy

0.2 has only 1 sig fig (the leading zero is not significant, and there's only one digit: 2). So the product can have only 1 sig fig. $5 \times 0.2 = 1.0$, but expressed to 1 sig fig = 1 (not 1.0 which implies 2 sig figs, or 1.00 which implies 3 sig figs).

Common Mistake

Reporting 1.0 (option 2). Writing 1.0 implies 2 significant figures (the 1 and the trailing zero after the decimal). Since 0.2 has only 1 sig fig, the answer should also have 1 sig fig = just "1" with no decimal point.

Answer

(1) 1

Q.18 Round off 0.1576 upto one digit after decimal

Explanation

One digit after decimal means 1 decimal place.

$0.1\underline{5}76$: 1st decimal = 1, 2nd decimal = 5 (≥ 5) $\rightarrow$ round 1st decimal up:

$$0.1 \xrightarrow{\text{round up}} \mathbf{0.2}$$

Approach / Analogy

Keep only 1 digit after the decimal. The digit in the 1st decimal place is 1. Look at the 2nd decimal digit ($5 \geq 5$) $\rightarrow$ round up: $1 \rightarrow 2$. Result: 0.2. Also expressible as 2×10^{-1} or 1.6×10^{-1}... but 1.6×10^{-1} = 0.16 which has 2 decimal places — not what's asked. The answer in standard form is simply 0.2.

Common Mistake

Choosing 0.1 (truncating instead of rounding). The second decimal digit is 5, which means we must round *up* the first decimal digit from 1 to 2. Truncation (just cutting off) is incorrect — always round based on the digit being dropped.

Answer

(3) 0.2

Q.19 The value of $\frac{5.86 \times 3.96}{2.86}$ will be equal to

Explanation

First compute the value:

$$\frac{5.86 \times 3.96}{2.86} = \frac{23.2056}{2.86} = 8.113\ldots$$

Sig fig rule for multiplication/division: answer has as many sig figs as the factor with *fewest* sig figs.

All three numbers have **3 significant figures**. Answer should have 3 sig figs:

$$8.113\ldots \xrightarrow{\text{3 sig figs}} \mathbf{8.11}$$

Approach / Analogy

Calculate first: $5.86 \times 3.96 = 23.2056$, then $23.2056/2.86 = 8.113$. All input numbers have 3 sig figs $\rightarrow$ answer has 3 sig figs $\rightarrow$ 8.11. Notice option (3) says 8.11 which is correct.

Common Mistake

Choosing 8 (1 sig fig) or 8.113 (4 sig figs). The least number of sig figs in the inputs is 3 (all three numbers have 3 sig figs). So the answer must have exactly 3 sig figs: 8.11. Reporting 8 (1 sig fig) would lose information; 8.113 (4 sig figs) implies more precision than available.

Answer

(3) 8.11

Q.20 The correct answer of 2.2120×0.011 should be reported as

Explanation

Compute:

$$2.2120 \times 0.011 = 0.024332$$

Sig fig rule: both factors' sig figs:

- 2.2120: 5 sig figs (trailing zero after decimal is significant)
- 0.011: 2 sig figs (leading zeros not significant; only 1 and 1 count)

Answer has **2 sig figs**: $0.024332 \to \mathbf{0.024}$

Approach / Analogy

0.011 has only 2 sig figs (the two 1s — the leading zeros are just placeholders). 2.2120 has 5 sig figs. Limiting factor = 2 sig figs. Answer = 0.024332 rounded to 2 sig figs. The first sig fig is 2 (at hundredths), the second is 4 (at thousandths). Next digit = $3 < 5 \to$ don't round up. Answer: 0.024.

Common Mistake

Counting 0.011 as having 3 sig figs (counting all digits including the leading zeros). Leading zeros before the first non-zero digit are NEVER significant. In 0.011: the two zeros (0.0_) are not significant; only the two 1s (0.**011**) are. So 0.011 has 2 sig figs, not 3.

Answer

(4) 0.024

TYPE 5 : Accuracy & Precision

Q.21 Which of the following are correct statements? [NCERT Pg. 13]

Explanation

Evaluate each statement:

- **(a) "Precision refers to closeness of various measurements for the same quantity."**
  TRUE. Precision = reproducibility = how close repeated measurements are to each other.
- **(b) "Accuracy is the agreement of particular value to the true value of the result."**
  TRUE. Accuracy = closeness to the true/accepted value.
- **(c) "Accuracy is closeness of various measurements for the same quantity."**
  FALSE. This is the definition of *precision*, not accuracy.

Correct statements: **(a) and (b) only.**

Approach / Analogy

The classic archer analogy:
Accurate: arrows hit the bullseye (true value).
Precise: arrows are clustered tightly together (even if away from bullseye).
You can be precise without being accurate (all arrows in the same wrong spot), or accurate without being precise (scattered shots, but average near bullseye). Statement (c) swaps the definitions — it describes precision, not accuracy.

Common Mistake

Choosing option (4) — all three statements correct. Statement (c) is wrong: it defines *precision* (repeated measurements close to each other), not accuracy (measurements close to the true value). Don't mix up: Precision = repeatability (among measurements); Accuracy = correctness (vs true value).

Answer

(1) (a) & (b) only

— End of DPP-9 Complete Solution Sheet —

Units and Measurements · Q.1–Q.21 · All Questions Complete

"The difference between average and confident students is assignment completion."