AL AMAL LEARNING CENTER

PHYSICS CHAPTER 1

Class 9 | Unit 1 | Physical Quantities and Measurement

SIGNIFICANT FIGURES AND ROUNDING OFF PRACTICE

What is inside

Part	Contents
A	Quick concept: what significant figures are, the rules for zeros, rounding off, scientific notation and calculations
B	**171 practice questions** in seven levels (definitions, counting, rounding, scientific notation, calculations, past paper pattern, MCQs), questions only
C	**Mock test** in the FBISE paper pattern (10 MCQs and 6 short questions, with marks)
D	**Answer key** with every question written again, with answer and short explanation

Student Learning Outcomes covered

Define significant figures and identify the doubtful digit; count significant figures in a given number using the rules for zeros; round off a number to a given number of significant figures or decimal places; write numbers in scientific notation with the correct significant figures; add, subtract, multiply and divide measured quantities and state the answer with the correct decimal places or significant figures; apply significant figures to real-life measurements (area, volume, density, speed, vernier calliper and screw gauge readings).

Practice set written from Class 9 Physics, Unit 1 (Physical Quantities and Measurement), following the pattern of past FBISE papers. Al Amal Learning Center Physics Key Book.

PART A QUICK CONCEPT

What are significant figures?

Every measurement has some doubt in its **last** digit. **Significant figures (s.f.)** are all the digits that are known for sure plus the **first doubtful (estimated) digit**. Example: a ruler marked in millimetres gives a length of 4.56 cm. The digits 4 and 5 are sure and 6 is estimated, so the reading has **3 s.f.** More significant figures mean a more precise measurement.

Rule	Statement	Example	S.F.
1	Every non-zero digit is significant.	2.358	4
2	Zeros between non-zero digits are significant.	5.007	4
3	Leading zeros (to the left of the first non-zero digit) are **not** significant. They only fix the decimal point.	0.0045	2
4	Trailing zeros after a decimal point are significant.	2.500	4
5	Trailing zeros of a whole number with no decimal point are not counted as significant in this book. Use scientific notation to show them.	$4500 \rightarrow 4.50 \times 10^3$	2 → 3
6	In scientific notation count only the digits of the mantissa (a in $a \times 10^n$).	3.20×10^5	3
7	Exact numbers (counted objects, defined values) have unlimited significant figures.	12 students; 100 cm = 1 m	∞

Rounding off

To round a number to a required number of significant figures, look at the **first digit to be dropped**:

Digit to be dropped	What to do	Example (to 3 s.f.)
Less than 5	Leave the last kept digit as it is.	7.8349 → 7.83
More than 5 (or 5 followed by other non-zero digits)	Increase the last kept digit by 1.	3.4567 → 3.46
Exactly 5, nothing after it	Increase the last kept digit by 1 (round half up, used in this book). Follow your teacher if the odd-even rule is taught.	2.345 → 2.35

Significant figures in calculations

Operation	Rule for the answer	Example
Addition and subtraction	Same number of **decimal places** as the number with the fewest decimal places.	12.5 + 3.42 = 15.92 → **15.9**
Multiplication and division	Same number of **significant figures** as the number with the fewest significant figures.	3.2 × 1.25 = 4.00 → **4.0**

Remember: (1) Round only **at the end**, never in the middle of a calculation. (2) Exact numbers such as 2 in 2πr, or 10 oscillations, never limit the answer. (3) 2.5 and 2.50 are **not** the same: 2.50 shows a more precise measurement. (4) Changing units does not change the number of significant figures.

Worked examples

Example 1. How many s.f. are there in 0.050400?
Leading zeros (0.0) are not counted. The digits 5, 0, 4, 0, 0 all count (the zero after 5 is between non-zero digits and the last two zeros are after the decimal point). **Answer: 5 s.f.**

Example 2. Round off 0.0045678 to 3 s.f.
Leading zeros do not count, so the s.f. are 4, 5, 6, 7, 8. Keep 4, 5, 6. The next digit is 7 (more than 5), so 6 becomes 7. **Answer: 0.00457.**

Example 3. Find the area of a wrapper 7.6 cm long and 4.5 cm wide.
Area = 7.6 × 4.5 = 34.2 cm^2. Both numbers have 2 s.f., so the answer must have 2 s.f. **Answer: 34 cm^2.**

Example 4. Add 25.4 g, 3.75 g and 0.082 g.
Sum = 29.232 g. The fewest decimal places is 1 (25.4), so round to 1 decimal place. **Answer: 29.2 g.**

Example 5. Write 0.0000870 m in scientific notation.
The digits 8, 7, 0 are significant (the last zero is after the decimal point). Move the decimal point 5 places to the right. **Answer: 8.70×10^{-5} m.**

Common mistakes to avoid

- Counting leading zeros, such as the zeros in 0.0072, as significant.
- Dropping a final zero. Writing 2.50 as 2.5 changes the precision of the measurement.
- Using significant figures instead of decimal places for addition and subtraction.
- Rounding at each step of a long calculation instead of at the end.
- Letting an exact number (like 4 in the perimeter of a square) limit the answer.

Al Amal Learning Center Physics Key Book

PART B PRACTICE QUESTIONS

Solve all 171 questions in your copy. Check your work with the answer key in Part D.

Level 1: Easy (Definition-Based)

1. What are significant figures?
2. Why is the last digit of a measured value called the doubtful (uncertain) digit?
3. How many significant figures are there in 4.56 m?
4. State the rule for zeros that lie between two non-zero digits. Give an example.
5. Are the zeros on the left of the first non-zero digit (leading zeros) significant? Give an example.
6. Are the zeros written at the end of a number after the decimal point significant? Give an example.
7. What is meant by rounding off a number?
8. State the rule for rounding when the digit to be dropped is less than 5.
9. State the rule for rounding when the digit to be dropped is greater than 5.
10. What happens when the digit to be dropped is exactly 5 with nothing after it? (Follow the rule used in this book.)
11. How many significant figures does a counted number such as 12 students have?
12. What is scientific notation? Why is it useful when writing significant figures?
13. State the rule for significant figures in addition and subtraction.
14. State the rule for significant figures in multiplication and division.
15. Which instrument gives a reading with more significant figures, a metre rule or a vernier calliper? Why?
16. Does changing 4.5 cm into 0.045 m change the number of significant figures?
17. What is the difference between a reading of 2.5 cm and a reading of 2.50 cm?

Level 2: Counting Significant Figures

Write the number of significant figures in each of the following.

18. How many significant figures are there in 345?
19. How many significant figures are there in 3405?
20. How many significant figures are there in 0.0056?
21. How many significant figures are there in 0.05060?
22. How many significant figures are there in 2.00?
23. How many significant figures are there in 10.05?
24. How many significant figures are there in 100.0?
25. How many significant figures are there in 0.00800?
26. How many significant figures are there in 7.30×10^{3}?
27. How many significant figures are there in 1.2×10^{-4}?
28. How many significant figures are there in 6.0×10^{5}?
29. How many significant figures are there in 0.4?
30. How many significant figures are there in 90.07?
31. How many significant figures are there in 0.003040?
32. How many significant figures are there in 25.00?
33. How many significant figures are there in 5.020×10^{-3}?

Amal Learning Center Physics Key Book

34. How many significant figures are there in 1002?
35. How many significant figures are there in 0.1000?
36. How many significant figures are there in 808?
37. How many significant figures are there in 3.0×10^{8}?
38. How many significant figures are there in 9.109×10^{-31}?
39. How many significant figures are there in 0.0000072?
40. How many significant figures are there in 12.0?
41. How many significant figures are there in 4.0050?
42. How many significant figures are there in 6.626×10^{-34}?
43. How many significant figures are there in 0.007030?

Level 3: Rounding Off

Round off each quantity as asked. Use the rule: less than 5 drop, more than 5 raise the last digit by 1.

44. Round off 3.4567 to 3 significant figures.
45. Round off 7.8349 to 3 significant figures.
46. Round off 0.004567 to 2 significant figures.
47. Round off 12.987 to 2 significant figures.
48. Round off 5.6849 to 1 significant figure.
49. Round off 45.678 to 4 significant figures.
50. Round off 0.07351 to 2 significant figures.
51. Round off 9.996 to 3 significant figures.
52. Round off 2.9951 to 3 significant figures.
53. Round off 1234.5678 to 6 significant figures.
54. Round off 0.0009876 to 3 significant figures.
55. Round off 6.0249 to 3 significant figures.
56. Round off 0.65432 to 3 significant figures.
57. Round off 17.251 to 3 significant figures.
58. Round off 100.46 to 4 significant figures.
59. Round off 3.14159265 to 4 significant figures.
60. Round off 1.41421356 to 3 significant figures.
61. Round off 0.0020496 to 3 significant figures.
62. Round off 8.0451 to 2 significant figures.
63. Round off 0.9996 to 3 significant figures.
64. Round off 5.67 to 1 decimal place.
65. Round off 12.04 to 1 decimal place.
66. Round off 0.96 to 1 decimal place.
67. Round off 3.14159 to 2 decimal places.
68. Round off 2.718281 to 2 decimal places.
69. Round off 1.4142 to 2 decimal places.
70. Round off 0.0066 to 2 decimal places.
71. Round off 8.51 to the nearest whole number.
72. Round off 99.49 to the nearest whole number.
73. Round off 56,789 to the nearest hundred.

Al Amal Learning Center Physics Key Book

74. Round off 56,789 to the nearest thousand.

75. Round off 98,765 to 2 significant figures and write it in scientific notation.

76. Round off 4.5678×10^5 to 3 significant figures.

77. A year has 31,557,600 s. Round it to 3 significant figures.

78. The speed of light is 299,792,458 m s^{-1}. Round it to 3 s.f. and to 4 s.f.

Level 4: Scientific Notation and Significant Figures

79. Write 45,600 in scientific notation with 3 significant figures.

80. Write 0.000731 in scientific notation.

81. Write 0.0050 in scientific notation, keeping 2 significant figures.

82. Write 3,200,000 in scientific notation with 2 significant figures.

83. Write 7.5×10^{-3} as an ordinary decimal number.

84. Write 8.20×10^4 as an ordinary number. How many significant figures does 8.20×10^4 have?

85. Write 2500 m with 4 significant figures in scientific notation.

86. Write 2500 m with 2 significant figures in scientific notation.

87. The wavelength of yellow light is 589 nm. Write it in metres in scientific notation.

88. The mass of an electron is 9.11×10^{-31} kg. Write it in grams.

89. The Earth–Moon distance is 384,400 km. Write it in metres with 3 significant figures.

90. The radius of the Earth is 6378 km. Write it in metres with 2 significant figures.

91. The size of an atom is 0.00000000015 m. Write it in scientific notation.

92. Write 0.0000560 in scientific notation.

93. Convert 3.60×10^3 s into hours. Give the answer with correct significant figures.

94. Convert 4.50×10^{-3} kg into grams.

95. Which is more precise, 5.0×10^3 m or 5.00×10^3 m? Give a reason.

96. Planck's constant is 6.626×10^{-34} J s. Round it to 2 significant figures.

Level 5: Calculations with Significant Figures

Add and subtract using decimal places. Multiply and divide using significant figures. Round only at the end.

97. Find 12.5 + 3.42 + 0.127 and write the answer with the correct number of decimal places.

98. Find 45.6 + 2.345 and write the answer with the correct number of decimal places.

99. Find 120.5 − 3.27 and write the answer with the correct number of decimal places.

100. Find 0.0456 + 1.2 and write the answer with the correct number of decimal places.

101. Find 25.00 + 3.1 + 0.06 and write the answer with the correct number of decimal places.

102. Find 7.89 − 2.3 and write the answer with the correct number of decimal places.

103. Find 100.0 + 25.56 and write the answer with the correct number of decimal places.

104. Find 3.456 + 2.1 + 5.78 and write the answer with the correct number of decimal places.

105. Find 5.26 + 3.1 and write the answer with the correct number of decimal places.

106. Find 1.250 + 0.30 + 0.0075 and write the answer with the correct number of decimal places.

107. Find 0.356 − 0.0072 and write the answer with the correct number of decimal places.

108. Find 6.02 + 3.1 − 1.234 and write the answer with the correct number of decimal places.

109. Calculate 4.5 × 2.34 and give the answer with the correct number of significant figures.

110. Calculate 6.02 × 3.1 and give the answer with the correct number of significant figures.

111. Calculate 12.0 ÷ 3.0 and give the answer with the correct number of significant figures.

112. Calculate 25.4 ÷ 2.0 and give the answer with the correct number of significant figures.

Amal Learning Center

113. Calculate 0.0521 × 4.8 and give the answer with the correct number of significant figures.

114. Calculate 8.314 × 2.0 and give the answer with the correct number of significant figures.

115. Calculate 3.142 × 2.5 × 2.5 and give the answer with the correct number of significant figures.

116. Calculate 9.8 × 0.76 and give the answer with the correct number of significant figures.

117. Calculate $1.00 \times 10^2 \div 3.0$ and give the answer with the correct number of significant figures.

118. Calculate 4.56 × 1.2 × 2.00 and give the answer with the correct number of significant figures.

119. Calculate 0.250 × 0.40 and give the answer with the correct number of significant figures.

120. Calculate 56.78 ÷ 4.5 and give the answer with the correct number of significant figures.

121. Calculate 2.50 × 4.00 and give the answer with the correct number of significant figures.

122. Calculate 15.0 ÷ 4.00 and give the answer with the correct number of significant figures.

123. Calculate 6.4 × 0.025 and give the answer with the correct number of significant figures.

Level 6: Applications and Past Paper Pattern (Short Questions)

Marks are shown in brackets, as in FBISE papers. Give each answer to a reasonable number of significant figures.

124. A chocolate wrapper is 7.6 cm long and 4.5 cm wide. Calculate its area up to a reasonable number of significant figures. [3]

125. A tile is 12.7 cm long and 8.2 cm wide. Find its area with the correct number of significant figures. [3]

126. A book is 21.5 cm long and 14.2 cm wide. Find its area with the correct number of significant figures. [3]

127. The radius of a circular coin is 1.25 cm. Find its area using π = 3.14. [3]

128. A circular disc has a radius of 3.5 cm. Find its area using π = 3.142. [3]

129. Find the circumference of a circle of radius 2.50 cm using π = 3.14. [3]

130. The side of a cube is 2.5 cm. Find its volume with the correct significant figures. [3]

131. A box measures 5.2 cm × 3.1 cm × 2.0 cm. Find its volume with the correct significant figures. [3]

132. A metal block has a mass of 25.0 g and a volume of 5.2 cm^3. Find its density with the correct significant figures. [3]

133. A cube of side 4.0 cm has a mass of 125 g. Find its density with the correct significant figures. [3]

134. A car covers 45.6 m in 3.2 s. Find its speed with the correct significant figures. [3]

135. A runner covers 1.20×10^2 m in 8.0 s. Find the average speed with the correct significant figures. [3]

136. A beaker with liquid has a mass of 125.4 g. The empty beaker has a mass of 48.76 g. Find the mass of the liquid. [3]

137. Two rods of lengths 15.2 cm and 3.76 cm are joined end to end. Find the total length with the correct number of decimal places. [3]

138. A vernier calliper has a least count of 0.01 cm. The main scale reading is 2.4 cm and the 7th vernier division coincides with a main scale division. Find the reading. How many significant figures does it have? [3]

139. A screw gauge has a least count of 0.01 mm. The main scale reading is 5 mm and the circular scale reading is 37 divisions. Find the diameter of the wire. [3]

Al Amal Learning Center · Physics Key Book

140. The thickness of 20 sheets of paper (a counted number) is 9.0 mm. Find the thickness of one sheet. [3]

141. A pendulum takes 15.4 s for 10 oscillations. Find its time period with the correct significant figures. [3]

142. The side of a square is 3.46 cm. Find its perimeter and its area with the correct significant figures. [3]

143. A train moves at 72.0 km h^{-1} for 2.5 h. Find the distance travelled with the correct significant figures. [3]

144. Three readings of the length of a pencil are 2.54 cm, 2.56 cm and 2.55 cm. Find the mean length. [3]

145. The mass of 100 identical nails (a counted number) is 345.6 g. Find the mass of one nail. [3]

146. The total distance of a race is 150.0 m and the time taken is 12.5 s. Find the average speed with the correct significant figures. [3]

147. A person is 1.75 m tall. Express the height in centimetres and state its significant figures. [3]

148. A file has a size of 2.5 GB. Express it in kB with the correct significant figures. [3]

149. Convert 5.6 cm into metres. Keep the correct significant figures. [3]

150. Explain why the product 5.2 × 3.14 is written as 16 and not as 16.328. [3]

151. Differentiate between a length of 14.5 cm and a length of 14.50 cm in terms of significant figures and instrument used. [3]

Level 7: Past Paper Pattern MCQs

Choose the correct option.

152. The number of significant figures in 0.00450 is:

A) 2 B) 3 C) 4 D) 5

153. Which number has 4 significant figures?

A) 0.0450 B) 4.050 C) 4.5 D) 0.45

154. Round off 3.4567 to 2 significant figures:

A) 3.5 B) 3.46 C) 3.4 D) 3.45

155. The sum 12.5 + 3.26 should be written as:

A) 15.76 B) 15.8 C) 16 D) 15.7

156. The product 2.5 × 3.2 should be written as:

A) 8 B) 8.0 C) 8.00 D) 8.000

157. 0.000450 written in scientific notation with the correct significant figures is:

A) 4.5×10^{-4} B) 4.50×10^{-4} C) 45.0×10^{-5} D) 4.5×10^{-3}

158. The number of significant figures in 100.05 is:

A) 2 B) 3 C) 4 D) 5

159. The last digit in a measured value is called:

A) an exact digit B) a doubtful digit C) a zero digit D) a prefix

160. Which of the following zeros is NOT significant?

A) The zeros in 2005 B) The last zero in 2.50 C) The zeros in 0.025 D) The zero in 3.0

161. Round off 0.005049 to 2 significant figures:

A) 0.0050 B) 0.0051 C) 0.005 D) 0.00505

162. The number of significant figures in 6.0×10^{-3} is:

A) 1 B) 2 C) 3 D) 4

163. A rectangle is 5.0 cm long and 2.6 cm wide. Its area is:

A) 13 cm^2 B) 13.0 cm^2 C) 13.00 cm^2 D) 1.3 cm^2

Al Amal Learning Center Physics Key Book

164. The speed of light 3.00×10^8 m s^{-1} has how many significant figures?

A) 1 B) 2 C) 3 D) 4

165. 456.78 rounded to 4 significant figures is:

A) 456.7 B) 456.8 C) 457 D) 456.78

166. Which measurement is the most precise?

A) 5 cm B) 5.0 cm C) 5.00 cm D) 5.000 cm

167. How many significant figures are in the counted number 25 students?

A) 1 B) 2 C) 3 D) Unlimited (exact)

168. The difference $8.76 - 3.1$ should be written as:

A) 5.66 B) 5.7 C) 5.6 D) 6

169. The area of a circle of radius 2.0 cm ($\pi = 3.14$) with correct significant figures is:

A) 12.56 cm^2 B) 12.6 cm^2 C) 13 cm^2 D) 12 cm^2

170. The number of significant figures in 0.04050 is:

A) 2 B) 3 C) 4 D) 5

171. 7.46 rounded to the nearest tenth is:

A) 7.4 B) 7.5 C) 7.6 D) 7.0

Amal Learning Center
Physics Key Book

PART C MOCK TEST (FBISE PAPER PATTERN)

Suggested time: 30 minutes. Total marks: 25. Attempt all questions; in a choice marked (OR) attempt either one.

Section A: MCQs (1 mark each)

Q1. The number of significant figures in 0.003060 is:

A) 3 B) 4 C) 5 D) 6

Q2. Round off 8.7654 to 3 significant figures:

A) 8.76 B) 8.77 C) 8.8 D) 8.765

Q3. 15.2 + 3.456 should be written as:

A) 18.656 B) 18.66 C) 18.7 D) 19

Q4. 4.0 × 1.25 should be written as:

A) 5 B) 5.0 C) 5.00 D) 5.000

Q5. The number of significant figures in 6.02×10^{23} is:

A) 2 B) 3 C) 4 D) 23

Q6. Which zero is NOT significant?

A) The zero in 2005 B) The last zero in 2.50 C) The zeros in 0.025 D) The zero in 3.0

Q7. Which is the most precise reading?

A) 0.5 g B) 0.50 g C) 0.500 g D) 0.5000 g

Q8. Round off 0.0074951 to 2 significant figures:

A) 0.0074 B) 0.0075 C) 0.007 D) 0.0070

Q9. The area of a circle of radius 1.5 cm (π = 3.14) with correct significant figures is:

A) 7.0 cm^2 B) 7.1 cm^2 C) 7.07 cm^2 D) 7.065 cm^2

Q10. The number of significant figures in 4.50×10^{-5} is:

A) 2 B) 3 C) 4 D) 5

Section B: Short Questions (marks in brackets)

Q11. State the rules for counting zeros as significant figures. Give one example of each rule. [3]

Q12. (a) How many significant figures are there in 0.0504, 7.200 and 3.0×10^5? (b) Write 0.0000870 in scientific notation. [1.5+1.5]

Q13. (OR) A tile is 12.7 cm long and 8.2 cm wide. Find its area up to the correct number of significant figures. [3]

Q14. (OR) Add 25.4 g, 3.75 g and 0.082 g with the correct number of decimal places. [3]

Q15. The diameter of a wire measured with a screw gauge is 1.25 mm. Find the area of its cross-section using area = $\pi d^2/4$ and π = 3.14. [3]

Q16. Round off the following to 3 significant figures: (a) 0.0065478 (b) 29.96 (c) 1,234,567. [1+1+1]

Amal Learning Center Physics Key Book

PART D ANSWER KEY

Each question is written again with its answer and a short explanation.

Level 1: Easy (Definition-Based)

1. **What are significant figures?**
   Answer: All the digits of a measurement that are known with certainty plus the first doubtful (estimated) digit.
   Explanation: They show how precisely a quantity has been measured. More significant figures mean a more precise measurement.
2. **Why is the last digit of a measured value called the doubtful (uncertain) digit?**
   Answer: Because it is estimated by eye between two marks of the scale.
   Explanation: In a reading of 4.56 cm the digits 4 and 5 are sure, but 6 is only an estimate.
3. **How many significant figures are there in 4.56 m?**
   Answer: 3.
   Explanation: All three digits are non-zero, and every non-zero digit is significant.
4. **State the rule for zeros that lie between two non-zero digits. Give an example.**
   Answer: Such zeros are significant.
   Explanation: Example: 5.007 has 4 significant figures because the two zeros are between 5 and 7.
5. **Are the zeros on the left of the first non-zero digit (leading zeros) significant? Give an example.**
   Answer: No.
   Explanation: They only show where the decimal point is. Example: 0.0072 has 2 significant figures (7 and 2).
6. **Are the zeros written at the end of a number after the decimal point significant? Give an example.**
   Answer: Yes.
   Explanation: They show that the measurement was made to that place. Example: 2.500 has 4 significant figures.
7. **What is meant by rounding off a number?**
   Answer: Dropping unwanted digits of a number by a fixed rule so that the number has fewer digits but stays close to its true value.
   Explanation: Rounding is used to keep the answer of a calculation within the precision of the measured values.
8. **State the rule for rounding when the digit to be dropped is less than 5.**
   Answer: Leave the last retained digit unchanged.
   Explanation: Example: 3.42 rounded to 2 s.f. is 3.4, because the dropped digit 2 is less than 5.
9. **State the rule for rounding when the digit to be dropped is greater than 5.**
   Answer: Increase the last retained digit by 1.
   Explanation: Example: 3.46 rounded to 2 s.f. is 3.5, because the dropped digit 6 is greater than 5.
10. **What happens when the digit to be dropped is exactly 5 with nothing after it? (Follow the rule used in this book.)**
    Answer: The last retained digit is increased by 1 (round half up).
    Explanation: Example: 2.45 rounded to 2 s.f. is 2.5. If your teacher uses the odd-even rule, follow your teacher.
11. **How many significant figures does a counted number such as 12 students have?**
    Answer: Unlimited (it is an exact number).
    Explanation: Counted numbers and defined numbers (such as 100 cm = 1 m) have no uncertainty, so they never limit the significant figures of an answer.
12. **What is scientific notation? Why is it useful when writing significant figures?**
    Answer: Writing a number as $a \times 10^n$, where a is a number between 1 and 10 and n is an integer.
    Explanation: It shows exactly how many significant figures a value has. For example 4.50×10^3 has 3 s.f. while 4.5×10^3 has 2 s.f.

Al Amal Learning Center Physics Key Book

13. **State the rule for significant figures in addition and subtraction.**
Answer: The answer must have the same number of decimal places as the number with the fewest decimal places.
Explanation: The least precise measurement decides how precise the sum or difference can be.

14. **State the rule for significant figures in multiplication and division.**
Answer: The answer must have the same number of significant figures as the number with the fewest significant figures.
Explanation: The least precise factor decides how many digits of the answer can be trusted.

15. **Which instrument gives a reading with more significant figures, a metre rule or a vernier calliper? Why?**
Answer: Vernier calliper.
Explanation: Its least count (0.01 cm) is smaller than that of a metre rule (0.1 cm), so it measures to one more decimal place.

16. **Does changing 4.5 cm into 0.045 m change the number of significant figures?**
Answer: No. Both have 2 significant figures.
Explanation: Changing units only moves the decimal point. The zeros in 0.045 are leading zeros and are not significant.

17. **What is the difference between a reading of 2.5 cm and a reading of 2.50 cm?**
Answer: 2.5 cm has 2 s.f.; 2.50 cm has 3 s.f. and is the more precise reading.
Explanation: The final zero in 2.50 shows that the length was measured to the nearest 0.01 cm, not just 0.1 cm.

Level 2: Counting Significant Figures

18. **How many significant figures are there in 345?**
Answer: 3.
Explanation: All three digits are non-zero.

19. **How many significant figures are there in 3405?**
Answer: 4.
Explanation: The zero is between 4 and 5, so it counts.

20. **How many significant figures are there in 0.0056?**
Answer: 2.
Explanation: Leading zeros do not count. Only 5 and 6 count.

21. **How many significant figures are there in 0.05060?**
Answer: 4.
Explanation: Leading zeros do not count. The digits 5, 0, 6, 0 count: the first 0 is between non-zero digits and the last 0 is after the decimal point.

22. **How many significant figures are there in 2.00?**
Answer: 3.
Explanation: Trailing zeros after the decimal point count.

23. **How many significant figures are there in 10.05?**
Answer: 4.
Explanation: The zeros lie between non-zero digits, so all 4 digits count.

24. **How many significant figures are there in 100.0?**
Answer: 4.
Explanation: The zeros are between 1 and the last zero, which is after a decimal point, so all digits count.

25. **How many significant figures are there in 0.00800?**
Answer: 3.
Explanation: Leading zeros do not count. 8 and the two trailing zeros count.

26. **How many significant figures are there in 7.30×10^3?**
Answer: 3.
Explanation: Count the digits of 7.30 only. The trailing zero counts.

Amal Learning Center Physics Key Book

27. **How many significant figures are there in 1.2×10^{-4}?**
Answer: 2.
Explanation: Only the mantissa 1.2 is counted.

28. **How many significant figures are there in 6.0×10^{5}?**
Answer: 2.
Explanation: Only the mantissa 6.0 is counted, and its zero counts.

29. **How many significant figures are there in 0.4?**
Answer: 1.
Explanation: The leading zero does not count. Only 4 counts.

30. **How many significant figures are there in 90.07?**
Answer: 4.
Explanation: Both zeros are between non-zero digits.

31. **How many significant figures are there in 0.003040?**
Answer: 4.
Explanation: The digits 3, 0, 4, 0 count. The last zero comes after the decimal point.

32. **How many significant figures are there in 25.00?**
Answer: 4.
Explanation: Trailing zeros after the decimal point count.

33. **How many significant figures are there in 5.020×10^{-3}?**
Answer: 4.
Explanation: The mantissa 5.020 has four digits that count.

34. **How many significant figures are there in 1002?**
Answer: 4.
Explanation: The two zeros are between non-zero digits.

35. **How many significant figures are there in 0.1000?**
Answer: 4.
Explanation: The leading zero does not count. 1, 0, 0, 0 count.

36. **How many significant figures are there in 808?**
Answer: 3.
Explanation: The zero is between 8 and 8.

37. **How many significant figures are there in 3.0×10^{8}?**
Answer: 2.
Explanation: The mantissa 3.0 has two digits that count.

38. **How many significant figures are there in 9.109×10^{-31}?**
Answer: 4.
Explanation: The mantissa 9.109 has four digits that count.

39. **How many significant figures are there in 0.0000072?**
Answer: 2.
Explanation: All the zeros are leading zeros. Only 7 and 2 count.

40. **How many significant figures are there in 12.0?**
Answer: 3.
Explanation: The trailing zero after the decimal point counts.

41. **How many significant figures are there in 4.0050?**
Answer: 5.
Explanation: The zeros between 4 and 5 and the final zero after the decimal point all count.

42. **How many significant figures are there in 6.626×10^{-34}?**
Answer: 4.
Explanation: The mantissa 6.626 has four digits that count.

43. **How many significant figures are there in 0.007030?**
Answer: 4.
Explanation: Leading zeros do not count. The digits 7, 0, 3, 0 count.

Amal Learning Center Physics Key Book

Level 3: Rounding Off

44. Round off 3.4567 to 3 significant figures.
Answer: 3.46.
Explanation: Keep the first 3 s.f. (345). The next digit is 6 (followed by 7), which is 5 or more, so the last kept digit goes up by 1.

45. Round off 7.8349 to 3 significant figures.
Answer: 7.83.
Explanation: Keep the first 3 s.f. (783). The next digit is 4, which is less than 5, so the last kept digit does not change.

46. Round off 0.004567 to 2 significant figures.
Answer: 0.0046.
Explanation: Keep the first 2 s.f. (45). The next digit is 6 (followed by 7), which is 5 or more, so the last kept digit goes up by 1.

47. Round off 12.987 to 2 significant figures.
Answer: 13.
Explanation: Keep the first 2 s.f. (12). The next digit is 9 (followed by 87), which is 5 or more, so the last kept digit goes up by 1.

48. Round off 5.6849 to 1 significant figure.
Answer: 6.
Explanation: Keep the first 1 s.f. (5). The next digit is 6 (followed by 849), which is 5 or more, so the last kept digit goes up by 1.

49. Round off 45.678 to 4 significant figures.
Answer: 45.68.
Explanation: Keep the first 4 s.f. (4567). The next digit is 8, which is 5 or more, so the last kept digit goes up by 1.

50. Round off 0.07351 to 2 significant figures.
Answer: 0.074.
Explanation: Keep the first 2 s.f. (73). The next digit is 5 (followed by 1), which is 5 or more, so the last kept digit goes up by 1.

51. Round off 9.996 to 3 significant figures.
Answer: 10.0.
Explanation: Keep the first 3 s.f. (999). The next digit is 6, which is 5 or more, so the last kept digit goes up by 1. The carry changes the digits to 10.0.

52. Round off 2.9951 to 3 significant figures.
Answer: 3.00.
Explanation: Keep the first 3 s.f. (299). The next digit is 5 (followed by 1), which is 5 or more, so the last kept digit goes up by 1.

53. Round off 1234.5678 to 6 significant figures.
Answer: 1234.57.
Explanation: Keep the first 6 s.f. (123456). The next digit is 7 (followed by 8), which is 5 or more, so the last kept digit goes up by 1.

54. Round off 0.0009876 to 3 significant figures.
Answer: 0.000988.
Explanation: Keep the first 3 s.f. (987). The next digit is 6, which is 5 or more, so the last kept digit goes up by 1.

55. Round off 6.0249 to 3 significant figures.
Answer: 6.02.
Explanation: Keep the first 3 s.f. (602). The next digit is 4, which is less than 5, so the last kept digit does not change.

56. Round off 0.65432 to 3 significant figures.
Answer: 0.654.
Explanation: Keep the first 3 s.f. (654). The next digit is 3, which is less than 5, so the last kept digit does not change.

Amal Learning Center Physics Key Book

57. **Round off 17.251 to 3 significant figures.**
Answer: 17.3.
Explanation: Keep the first 3 s.f. (172). The next digit is 5 (followed by 1), which is 5 or more, so the last kept digit goes up by 1.

58. **Round off 100.46 to 4 significant figures.**
Answer: 100.5.
Explanation: Keep the first 4 s.f. (1004). The next digit is 6, which is 5 or more, so the last kept digit goes up by 1.

59. **Round off 3.14159265 to 4 significant figures.**
Answer: 3.142.
Explanation: Keep the first 4 s.f. (3141). The next digit is 5 (followed by 9265), which is 5 or more, so the last kept digit goes up by 1.

60. **Round off 1.41421356 to 3 significant figures.**
Answer: 1.41.
Explanation: Keep the first 3 s.f. (141). The next digit is 4, which is less than 5, so the last kept digit does not change.

61. **Round off 0.0020496 to 3 significant figures.**
Answer: 0.00205.
Explanation: Keep the first 3 s.f. (204). The next digit is 9 (followed by 6), which is 5 or more, so the last kept digit goes up by 1.

62. **Round off 8.0451 to 2 significant figures.**
Answer: 8.0.
Explanation: Keep the first 2 s.f. (80). The next digit is 4, which is less than 5, so the last kept digit does not change.

63. **Round off 0.9996 to 3 significant figures.**
Answer: 1.00.
Explanation: Keep the first 3 s.f. (999). The next digit is 6, which is 5 or more, so the last kept digit goes up by 1. The carry changes the digits to 1.00.

64. **Round off 5.67 to 1 decimal place.**
Answer: 5.7.
Explanation: 7 is more than 5, so 6 becomes 7: 5.7.

65. **Round off 12.04 to 1 decimal place.**
Answer: 12.0.
Explanation: The dropped digit 4 is less than 5, so 12.0 stays (the zero is kept).

66. **Round off 0.96 to 1 decimal place.**
Answer: 1.0.
Explanation: The dropped digit 6 is more than 5, so 0.9 becomes 1.0.

67. **Round off 3.14159 to 2 decimal places.**
Answer: 3.14.
Explanation: The dropped digit 1 is less than 5.

68. **Round off 2.718281 to 2 decimal places.**
Answer: 2.72.
Explanation: The dropped digit 8 is more than 5, so 2.71 becomes 2.72.

69. **Round off 1.4142 to 2 decimal places.**
Answer: 1.41.
Explanation: The dropped digit 4 is less than 5.

70. **Round off 0.0066 to 2 decimal places.**
Answer: 0.01.
Explanation: The dropped digit 6 is more than 5, so 0.00 becomes 0.01.

71. **Round off 8.51 to the nearest whole number.**
Answer: 9.
Explanation: The first decimal digit is 5 followed by 1, which is more than half, so 8 becomes 9.

Amal Learning Center Physics Key Book

72. **Round off 99.49 to the nearest whole number.**
Answer: 99.
Explanation: The first decimal digit 4 is less than 5.

73. **Round off 56,789 to the nearest hundred.**
Answer: 56,800.
Explanation: The digit after the hundreds place is 8, so 7 hundreds become 8 hundreds.

74. **Round off 56,789 to the nearest thousand.**
Answer: 57,000.
Explanation: The digit after the thousands place is 7, so 6 thousands become 7 thousands.

75. **Round off 98,765 to 2 significant figures and write it in scientific notation.**
Answer: 9.9×10^4.
Explanation: $98{,}765 = 9.8765 \times 10^4$. The third digit is 7 (more than 5), so 9.8 becomes 9.9.

76. **Round off 4.5678×10^5 to 3 significant figures.**
Answer: 4.57×10^5.
Explanation: Keep 4.56. The next digit is 7, so 4.56 becomes 4.57.

77. **A year has 31,557,600 s. Round it to 3 significant figures.**
Answer: 3.16×10^7 s.
Explanation: $31{,}557{,}600 = 3.15576 \times 10^7$. The fourth digit is 5 followed by 76, so 3.15 becomes 3.16.

78. **The speed of light is 299,792,458 m s^{-1}. Round it to 3 s.f. and to 4 s.f.**
Answer: 3.00×10^8 m s^{-1} and 2.998×10^8 m s^{-1}.
Explanation: $299{,}792{,}458 = 2.99792458 \times 10^8$. For 3 s.f. keep 2.99; the next digit is 7, so it becomes 3.00. For 4 s.f. keep 2.997; the next digit is 9, so it becomes 2.998.

Level 4: Scientific Notation and Significant Figures

79. **Write 45,600 in scientific notation with 3 significant figures.**
Answer: 4.56×10^4.
Explanation: Move the decimal point 4 places to the left: 4.56×10^4.

80. **Write 0.000731 in scientific notation.**
Answer: 7.31×10^{-4}.
Explanation: Move the decimal point 4 places to the right, so the power is -4.

81. **Write 0.0050 in scientific notation, keeping 2 significant figures.**
Answer: 5.0×10^{-3}.
Explanation: The trailing zero is significant, so it must be written: 5.0, not 5.

82. **Write 3,200,000 in scientific notation with 2 significant figures.**
Answer: 3.2×10^6.
Explanation: Move the decimal point 6 places to the left.

83. **Write 7.5×10^{-3} as an ordinary decimal number.**
Answer: 0.0075.
Explanation: Move the decimal point 3 places to the left.

84. **Write 8.20×10^4 as an ordinary number. How many significant figures does 8.20×10^4 have?**
Answer: 82,000; 3 significant figures.
Explanation: The notation shows 3 s.f. (8, 2, 0). The ordinary form 82,000 hides this, which is why scientific notation is preferred.

85. **Write 2500 m with 4 significant figures in scientific notation.**
Answer: 2.500×10^3 m.
Explanation: Four digits are needed, so two zeros must be written after 2.5.

86. **Write 2500 m with 2 significant figures in scientific notation.**
Answer: 2.5×10^3 m.
Explanation: Only 2 and 5 are kept.

Al Amal Learning Center Physics Key Book

87. **The wavelength of yellow light is 589 nm. Write it in metres in scientific notation.**
Answer: 5.89×10^{-7} m.
Explanation: 1 nm = 10^{-9} m, so $589 \times 10^{-9} = 5.89 \times 10^{-7}$ m. It still has 3 s.f.

88. **The mass of an electron is 9.11×10^{-31} kg. Write it in grams.**
Answer: 9.11×10^{-28} g.
Explanation: 1 kg = 10^{3} g, so add 3 to the power. It still has 3 s.f.

89. **The Earth–Moon distance is 384,400 km. Write it in metres with 3 significant figures.**
Answer: 3.84×10^{8} m.
Explanation: 384,400 km = 3.844×10^{8} m. Rounding to 3 s.f. gives 3.84×10^{8} m.

90. **The radius of the Earth is 6378 km. Write it in metres with 2 significant figures.**
Answer: 6.4×10^{6} m.
Explanation: 6378 km = 6.378×10^{6} m. Keep 6.3; the next digit is 7, so it becomes 6.4.

91. **The size of an atom is 0.00000000015 m. Write it in scientific notation.**
Answer: 1.5×10^{-10} m.
Explanation: Move the decimal point 10 places to the right. There are 2 s.f. (1 and 5).

92. **Write 0.0000560 in scientific notation.**
Answer: 5.60×10^{-5}.
Explanation: The digits 5, 6, 0 are significant (the last zero is after the decimal point), so the mantissa is 5.60.

93. **Convert 3.60×10^{3} s into hours. Give the answer with correct significant figures.**
Answer: 1.00 h.
Explanation: $3.60 \times 10^{3} \div 3600 = 1.00$. The number 3600 s in 1 h is exact, so the answer keeps 3 s.f.

94. **Convert 4.50×10^{-3} kg into grams.**
Answer: 4.50 g.
Explanation: $4.50 \times 10^{-3} \times 10^{3} = 4.50$ g. It keeps 3 s.f.

95. **Which is more precise, 5.0×10^{3} m or 5.00×10^{3} m? Give a reason.**
Answer: 5.00×10^{3} m.
Explanation: It has 3 s.f. while 5.0×10^{3} has 2 s.f. More s.f. means the length was measured more precisely.

96. **Planck's constant is 6.626×10^{-34} J s. Round it to 2 significant figures.**
Answer: 6.6×10^{-34} J s.
Explanation: Keep 6.6. The next digit is 2, which is less than 5.

Level 5: Calculations with Significant Figures

97. **Find 12.5 + 3.42 + 0.127 and write the answer with the correct number of decimal places.**
Answer: 16.0.
Explanation: Exact result = 16.047. The fewest decimal places is 1 (from 12.5), so round to 1 decimal place: 16.0.

98. **Find 45.6 + 2.345 and write the answer with the correct number of decimal places.**
Answer: 47.9.
Explanation: Exact result = 47.945. The fewest decimal places is 1 (from 45.6), so round to 1 decimal place: 47.9.

99. **Find 120.5 − 3.27 and write the answer with the correct number of decimal places.**
Answer: 117.2.
Explanation: Exact result = 117.23. The fewest decimal places is 1 (from 120.5), so round to 1 decimal place: 117.2.

100. **Find 0.0456 + 1.2 and write the answer with the correct number of decimal places.**
Answer: 1.2.
Explanation: Exact result = 1.2456. The fewest decimal places is 1 (from 1.2), so round to 1 decimal place: 1.2.

Al Amal Learning Center Physics Key Book

101. Find 25.00 + 3.1 + 0.06 and write the answer with the correct number of decimal places.
Answer: 28.2.
Explanation: Exact result = 28.16. The fewest decimal places is 1 (from 3.1), so round to 1 decimal place: 28.2.

102. Find 7.89 − 2.3 and write the answer with the correct number of decimal places.
Answer: 5.6.
Explanation: Exact result = 5.59. The fewest decimal places is 1 (from 2.3), so round to 1 decimal place: 5.6.

103. Find 100.0 + 25.56 and write the answer with the correct number of decimal places.
Answer: 125.6.
Explanation: Exact result = 125.56. The fewest decimal places is 1 (from 100.0), so round to 1 decimal place: 125.6.

104. Find 3.456 + 2.1 + 5.78 and write the answer with the correct number of decimal places.
Answer: 11.3.
Explanation: Exact result = 11.336. The fewest decimal places is 1 (from 2.1), so round to 1 decimal place: 11.3.

105. Find 5.26 + 3.1 and write the answer with the correct number of decimal places.
Answer: 8.4.
Explanation: Exact result = 8.36. The fewest decimal places is 1 (from 3.1), so round to 1 decimal place: 8.4.

106. Find 1.250 + 0.30 + 0.0075 and write the answer with the correct number of decimal places.
Answer: 1.56.
Explanation: Exact result = 1.5575. The fewest decimal places is 2 (from 0.30), so round to 2 decimal places: 1.56.

107. Find 0.356 − 0.0072 and write the answer with the correct number of decimal places.
Answer: 0.349.
Explanation: Exact result = 0.3488. The fewest decimal places is 3 (from 0.356), so round to 3 decimal places: 0.349.

108. Find 6.02 + 3.1 − 1.234 and write the answer with the correct number of decimal places.
Answer: 7.9.
Explanation: Exact result = 7.886. The fewest decimal places is 1 (from 3.1), so round to 1 decimal place: 7.9.

109. Calculate 4.5 × 2.34 and give the answer with the correct number of significant figures.
Answer: 11.
Explanation: Exact result 10.53. The fewest significant figures is 2 (from 4.5), so round to 2 s.f.: 11.

110. Calculate 6.02 × 3.1 and give the answer with the correct number of significant figures.
Answer: 19.
Explanation: Exact result 18.662. The fewest significant figures is 2 (from 3.1), so round to 2 s.f.: 19.

111. Calculate 12.0 ÷ 3.0 and give the answer with the correct number of significant figures.
Answer: 4.0.
Explanation: Exact result 4. The fewest significant figures is 2 (from 3.0), so round to 2 s.f.: 4.0.

112. Calculate 25.4 ÷ 2.0 and give the answer with the correct number of significant figures.
Answer: 13.
Explanation: Exact result 12.7. The fewest significant figures is 2 (from 2.0), so round to 2 s.f.: 13.

Al Amal Learning Center Physics Key Book

113. Calculate 0.0521 × 4.8 and give the answer with the correct number of significant figures.
Answer: 0.25.
Explanation: Exact result 0.25008. The fewest significant figures is 2 (from 4.8), so round to 2 s.f.: 0.25.

114. Calculate 8.314 × 2.0 and give the answer with the correct number of significant figures.
Answer: 17.
Explanation: Exact result 16.628. The fewest significant figures is 2 (from 2.0), so round to 2 s.f.: 17.

115. Calculate 3.142 × 2.5 × 2.5 and give the answer with the correct number of significant figures.
Answer: 2.0×10^{1}.
Explanation: Exact result 19.6375. The fewest significant figures is 2 (from 2.5), so round to 2 s.f.: 2.0×10^{1}.

116. Calculate 9.8 × 0.76 and give the answer with the correct number of significant figures.
Answer: 7.4.
Explanation: Exact result 7.448. The fewest significant figures is 2 (from 9.8), so round to 2 s.f.: 7.4.

117. Calculate $1.00 \times 10^{2} \div 3.0$ and give the answer with the correct number of significant figures.
Answer: 33.
Explanation: Exact result ≈ 33.333333. The fewest significant figures is 2 (from 3.0), so round to 2 s.f.: 33.

118. Calculate 4.56 × 1.2 × 2.00 and give the answer with the correct number of significant figures.
Answer: 11.
Explanation: Exact result 10.944. The fewest significant figures is 2 (from 1.2), so round to 2 s.f.: 11.

119. Calculate 0.250 × 0.40 and give the answer with the correct number of significant figures.
Answer: 0.10.
Explanation: Exact result 0.1. The fewest significant figures is 2 (from 0.40), so round to 2 s.f.: 0.10.

120. Calculate 56.78 ÷ 4.5 and give the answer with the correct number of significant figures.
Answer: 13.
Explanation: Exact result ≈ 12.617778. The fewest significant figures is 2 (from 4.5), so round to 2 s.f.: 13.

121. Calculate 2.50 × 4.00 and give the answer with the correct number of significant figures.
Answer: 10.0.
Explanation: Exact result 10. The fewest significant figures is 3 (from 2.50), so round to 3 s.f.: 10.0.

122. Calculate 15.0 ÷ 4.00 and give the answer with the correct number of significant figures.
Answer: 3.75.
Explanation: Exact result 3.75. The fewest significant figures is 3 (from 15.0), so round to 3 s.f.: 3.75.

123. Calculate 6.4 × 0.025 and give the answer with the correct number of significant figures.
Answer: 0.16.
Explanation: Exact result 0.16. The fewest significant figures is 2 (from 6.4), so round to 2 s.f.: 0.16.

Al Amal Learning Center Physics Key Book

Level 6: Applications and Past Paper Pattern (Short Questions)

124. A chocolate wrapper is 7.6 cm long and 4.5 cm wide. Calculate its area up to a reasonable number of significant figures. [3]
Answer: 34 cm^2.
Explanation: Area = 7.6 × 4.5 = 34.2 cm^2. Both measurements have 2 s.f., so the answer has 2 s.f.: 34 cm^2.

125. A tile is 12.7 cm long and 8.2 cm wide. Find its area with the correct number of significant figures. [3]
Answer: 1.0×10^2 cm^2.
Explanation: Area = 12.7 × 8.2 = 104.14 cm^2. The factor 8.2 has 2 s.f., so round to 2 s.f. and write 1.0×10^2 cm^2.

126. A book is 21.5 cm long and 14.2 cm wide. Find its area with the correct number of significant figures. [3]
Answer: 305 cm^2.
Explanation: Area = 21.5 × 14.2 = 305.3 cm^2. Both have 3 s.f., so the answer is 305 cm^2.

127. The radius of a circular coin is 1.25 cm. Find its area using π = 3.14. [3]
Answer: 4.91 cm^2.
Explanation: Area = $\pi r^2 = 3.14 \times (1.25)^2 = 3.14 \times 1.5625 = 4.90625$ cm^2. All factors have 3 s.f., so the answer is 4.91 cm^2.

128. A circular disc has a radius of 3.5 cm. Find its area using π = 3.142. [3]
Answer: 38 cm^2.
Explanation: Area = $3.142 \times (3.5)^2 = 3.142 \times 12.25 = 38.4895$ cm^2. The radius has 2 s.f., so the answer is 38 cm^2.

129. Find the circumference of a circle of radius 2.50 cm using π = 3.14. [3]
Answer: 15.7 cm.
Explanation: C = 2πr = 2 × 3.14 × 2.50 = 15.70 cm. The number 2 is exact; 3.14 and 2.50 have 3 s.f., so the answer is 15.7 cm.

130. The side of a cube is 2.5 cm. Find its volume with the correct significant figures. [3]
Answer: 16 cm^3.
Explanation: V = 2.5 × 2.5 × 2.5 = 15.625 cm^3. The side has 2 s.f., so the volume is 16 cm^3.

131. A box measures 5.2 cm × 3.1 cm × 2.0 cm. Find its volume with the correct significant figures. [3]
Answer: 32 cm^3.
Explanation: V = 5.2 × 3.1 × 2.0 = 32.24 cm^3. All three numbers have 2 s.f., so the volume is 32 cm^3.

132. A metal block has a mass of 25.0 g and a volume of 5.2 cm^3. Find its density with the correct significant figures. [3]
Answer: 4.8 g cm^{-3}.
Explanation: Density = mass ÷ volume = 25.0 ÷ 5.2 = 4.8077 g cm^{-3}. The volume has 2 s.f., so the answer is 4.8 g cm^{-3}.

133. A cube of side 4.0 cm has a mass of 125 g. Find its density with the correct significant figures. [3]
Answer: 2.0 g cm^{-3}.
Explanation: Volume = $4.0^3 = 64$ cm^3 (2 s.f.). Density = 125 ÷ 64 = 1.953 g cm^{-3}. Round to 2 s.f.: 2.0 g cm^{-3}.

134. A car covers 45.6 m in 3.2 s. Find its speed with the correct significant figures. [3]
Answer: 14 m s^{-1}.
Explanation: Speed = 45.6 ÷ 3.2 = 14.25 m s^{-1}. The time has 2 s.f., so the speed is 14 m s^{-1}.

135. A runner covers 1.20×10^2 m in 8.0 s. Find the average speed with the correct significant figures. [3]
Answer: 15 m s^{-1}.
Explanation: Speed = 120 ÷ 8.0 = 15.0 m s^{-1}. The time has 2 s.f., so the answer is 15 m s^{-1}.

Al Amal Learning Center Physics Key Book

136. A beaker with liquid has a mass of 125.4 g. The empty beaker has a mass of 48.76 g. Find the mass of the liquid. [3]
Answer: 76.6 g.
Explanation: 125.4 − 48.76 = 76.64 g. The fewest decimal places is 1 (from 125.4), so the answer is 76.6 g.

137. Two rods of lengths 15.2 cm and 3.76 cm are joined end to end. Find the total length with the correct number of decimal places. [3]
Answer: 19.0 cm.
Explanation: 15.2 + 3.76 = 18.96 cm. The fewest decimal places is 1, so round 18.96 to 1 decimal place: 19.0 cm.

138. A vernier calliper has a least count of 0.01 cm. The main scale reading is 2.4 cm and the 7th vernier division coincides with a main scale division. Find the reading. How many significant figures does it have? [3]
Answer: 2.47 cm; 3 significant figures.
Explanation: Reading = 2.4 + 7 × 0.01 = 2.47 cm. The digits 2, 4 and 7 are all significant, so it has 3 s.f.

139. A screw gauge has a least count of 0.01 mm. The main scale reading is 5 mm and the circular scale reading is 37 divisions. Find the diameter of the wire. [3]
Answer: 5.37 mm.
Explanation: Diameter = 5 + 37 × 0.01 = 5 + 0.37 = 5.37 mm. It has 3 s.f.

140. The thickness of 20 sheets of paper (a counted number) is 9.0 mm. Find the thickness of one sheet. [3]
Answer: 0.45 mm.
Explanation: 9.0 ÷ 20 = 0.45 mm. The number 20 is exact, so the answer keeps the 2 s.f. of 9.0.

141. A pendulum takes 15.4 s for 10 oscillations. Find its time period with the correct significant figures. [3]
Answer: 1.54 s.
Explanation: T = 15.4 ÷ 10 = 1.54 s. The number 10 is a count (exact), so the answer keeps 3 s.f.

142. The side of a square is 3.46 cm. Find its perimeter and its area with the correct significant figures. [3]
Answer: Perimeter = 13.8 cm; area = 12.0 cm^2.
Explanation: Perimeter = 4 × 3.46 = 13.84 cm. The 4 is exact, so keep 3 s.f.: 13.8 cm. Area = 3.46^2 = 11.9716 cm^2, which rounds to 12.0 cm^2 (3 s.f.).

143. A train moves at 72.0 km h^{-1} for 2.5 h. Find the distance travelled with the correct significant figures. [3]
Answer: 1.8 × 10^2 km.
Explanation: Distance = 72.0 × 2.5 = 180 km. The time has 2 s.f., so the answer is written as 1.8 × 10^2 km.

144. Three readings of the length of a pencil are 2.54 cm, 2.56 cm and 2.55 cm. Find the mean length. [3]
Answer: 2.55 cm.
Explanation: Sum = 7.65 cm. Mean = 7.65 ÷ 3 = 2.55 cm. The number 3 is a count (exact), so the mean keeps 3 s.f.

145. The mass of 100 identical nails (a counted number) is 345.6 g. Find the mass of one nail. [3]
Answer: 3.456 g.
Explanation: 345.6 ÷ 100 = 3.456 g. The 100 is exact, so the answer keeps 4 s.f.

146. The total distance of a race is 150.0 m and the time taken is 12.5 s. Find the average speed with the correct significant figures. [3]
Answer: 12.0 m s^{-1}.
Explanation: 150.0 ÷ 12.5 = 12.0 m s^{-1}. The time has 3 s.f. (the fewest), so the answer has 3 s.f.

147. A person is 1.75 m tall. Express the height in centimetres and state its significant figures. [3]
Answer: 1.75×10^2 cm; 3 significant figures.
Explanation: 1.75 m = 175 cm. Writing it as 1.75×10^2 cm clearly shows 3 s.f.

148. A file has a size of 2.5 GB. Express it in kB with the correct significant figures. [3]
Answer: 2.5×10^6 kB.
Explanation: Giga ÷ kilo = $10^9 \div 10^3 = 10^6$, so 2.5 GB = 2.5×10^6 kB. It keeps 2 s.f.

149. Convert 5.6 cm into metres. Keep the correct significant figures. [3]
Answer: 5.6×10^{-2} m (0.056 m).
Explanation: 1 cm = 10^{-2} m. The value 5.6 has 2 s.f., and so does 0.056.

150. Explain why the product 5.2 × 3.14 is written as 16 and not as 16.328. [3]
Answer: The result cannot be more precise than the least precise number, 5.2, which has 2 s.f.
Explanation: In multiplication the answer has as many s.f. as the factor with the fewest s.f. 16.328 rounded to 2 s.f. is 16.

151. Differentiate between a length of 14.5 cm and a length of 14.50 cm in terms of significant figures and instrument used. [3]
Answer: 14.5 cm has 3 s.f.; 14.50 cm has 4 s.f.
Explanation: 14.50 cm shows a measurement to the nearest 0.01 cm (for example with a vernier calliper), while 14.5 cm shows a measurement to the nearest 0.1 cm (for example with a metre rule).

Level 7: Past Paper Pattern MCQs

152. The number of significant figures in 0.00450 is:
A) 2 B) 3 C) 4 D) 5
Answer: B) 3
Explanation: Leading zeros do not count. 4, 5 and the final 0 count, so 3.

153. Which number has 4 significant figures?
A) 0.0450 B) 4.050 C) 4.5 D) 0.45
Answer: B) 4.050
Explanation: 4.050 has the digits 4, 0, 5, 0, which gives 4 s.f. The others have 3, 2 and 2.

154. Round off 3.4567 to 2 significant figures:
A) 3.5 B) 3.46 C) 3.4 D) 3.45
Answer: A) 3.5
Explanation: Keep 3.4. The next digit is 5 followed by 67, which is more than half, so 3.4 becomes 3.5.

155. The sum 12.5 + 3.26 should be written as:
A) 15.76 B) 15.8 C) 16 D) 15.7
Answer: B) 15.8
Explanation: The sum is 15.76. The fewest decimal places is 1, so the answer is 15.8.

156. The product 2.5 × 3.2 should be written as:
A) 8 B) 8.0 C) 8.00 D) 8.000
Answer: B) 8.0
Explanation: 2.5 × 3.2 = 8.00. Both numbers have 2 s.f., so the answer is 8.0.

157. 0.000450 written in scientific notation with the correct significant figures is:
A) 4.5×10^{-4} B) 4.50×10^{-4} C) 45.0×10^{-5} D) 4.5×10^{-3}
Answer: B) 4.50×10^{-4}
Explanation: The significant digits are 4, 5, 0, so the mantissa is 4.50. The decimal point moves 4 places, so the power is −4.

158. The number of significant figures in 100.05 is:
A) 2 B) 3 C) 4 D) 5
Answer: D) 5
Explanation: The zeros lie between non-zero digits, so all five digits count.

159. The last digit in a measured value is called:
A) an exact digit B) a doubtful digit C) a zero digit D) a prefix
Answer: B) a doubtful digit
Explanation: The last digit is an estimate, so it is doubtful.

Al Amal Learning Center Physics Key Book

160. Which of the following zeros is NOT significant?
A) The zeros in 2005 B) The last zero in 2.50 C) The zeros in 0.025 D) The zero in 3.0
Answer: C) The zeros in 0.025
Explanation: Leading zeros, such as those in 0.025, are not significant.

161. Round off 0.005049 to 2 significant figures:
A) 0.0050 B) 0.0051 C) 0.005 D) 0.00505
Answer: A) 0.0050
Explanation: Keep 0.0050. The next digit is 4, so the number does not change. The zero after 5 must be kept to show 2 s.f.

162. The number of significant figures in 6.0×10^{-3} is:
A) 1 B) 2 C) 3 D) 4
Answer: B) 2
Explanation: Only the mantissa 6.0 is counted, which has 2 s.f.

163. A rectangle is 5.0 cm long and 2.6 cm wide. Its area is:
A) 13 cm^2 B) 13.0 cm^2 C) 13.00 cm^2 D) 1.3 cm^2
Answer: A) 13 cm^2
Explanation: $5.0 \times 2.6 = 13.0$. Both numbers have 2 s.f., so the area is 13 cm^2.

164. The speed of light 3.00×10^8 m s^{-1} has how many significant figures?
A) 1 B) 2 C) 3 D) 4
Answer: C) 3
Explanation: The mantissa 3.00 has 3 digits that count.

165. 456.78 rounded to 4 significant figures is:
A) 456.7 B) 456.8 C) 457 D) 456.78
Answer: B) 456.8
Explanation: Keep 456.7. The next digit is 8, so it becomes 456.8.

166. Which measurement is the most precise?
A) 5 cm B) 5.0 cm C) 5.00 cm D) 5.000 cm
Answer: D) 5.000 cm
Explanation: 5.000 cm has 4 s.f., the most.

167. How many significant figures are in the counted number 25 students?
A) 1 B) 2 C) 3 D) Unlimited (exact)
Answer: D) Unlimited (exact)
Explanation: A counted number is exact, so it has unlimited s.f.

168. The difference 8.76 − 3.1 should be written as:
A) 5.66 B) 5.7 C) 5.6 D) 6
Answer: B) 5.7
Explanation: 8.76 − 3.1 = 5.66. The fewest decimal places is 1, so the answer is 5.7.

169. The area of a circle of radius 2.0 cm ($\pi = 3.14$) with correct significant figures is:
A) 12.56 cm^2 B) 12.6 cm^2 C) 13 cm^2 D) 12 cm^2
Answer: C) 13 cm^2
Explanation: $3.14 \times 2.0^2 = 12.56$. The radius has 2 s.f., so the area is 13 cm^2.

170. The number of significant figures in 0.04050 is:
A) 2 B) 3 C) 4 D) 5
Answer: C) 4
Explanation: The digits 4, 0, 5, 0 count, so 4.

171. 7.46 rounded to the nearest tenth is:
A) 7.4 B) 7.5 C) 7.6 D) 7.0
Answer: B) 7.5
Explanation: The digit after the tenths place is 6, so 7.4 becomes 7.5.

Al Amal Learning Center Physics Key Book

Part C: Mock Test

Section A: MCQs

Q1. The number of significant figures in 0.003060 is:
A) 3 B) 4 C) 5 D) 6
Answer: B) 4
Explanation: Leading zeros do not count. The digits 3, 0, 6, 0 count, so 4.

Q2. Round off 8.7654 to 3 significant figures:
A) 8.76 B) 8.77 C) 8.8 D) 8.765
Answer: B) 8.77
Explanation: Keep 8.76. The next digit is 5 followed by 4, which is more than half, so 8.76 becomes 8.77.

Q3. 15.2 + 3.456 should be written as:
A) 18.656 B) 18.66 C) 18.7 D) 19
Answer: C) 18.7
Explanation: The sum is 18.656. The fewest decimal places is 1, so the answer is 18.7.

Q4. 4.0 × 1.25 should be written as:
A) 5 B) 5.0 C) 5.00 D) 5.000
Answer: B) 5.0
Explanation: 4.0 × 1.25 = 5.00. The factor 4.0 has 2 s.f., so the answer is 5.0.

Q5. The number of significant figures in 6.02×10^{23} is:
A) 2 B) 3 C) 4 D) 23
Answer: B) 3
Explanation: Only the mantissa 6.02 is counted, so 3.

Q6. Which zero is NOT significant?
A) The zero in 2005 B) The last zero in 2.50 C) The zeros in 0.025 D) The zero in 3.0
Answer: C) The zeros in 0.025
Explanation: Leading zeros are not significant.

Q7. Which is the most precise reading?
A) 0.5 g B) 0.50 g C) 0.500 g D) 0.5000 g
Answer: D) 0.5000 g
Explanation: 0.5000 g has 4 s.f., the most.

Q8. Round off 0.0074951 to 2 significant figures:
A) 0.0074 B) 0.0075 C) 0.007 D) 0.0070
Answer: B) 0.0075
Explanation: Keep 0.0074. The next digit is 9, so 0.0074 becomes 0.0075.

Q9. The area of a circle of radius 1.5 cm (π = 3.14) with correct significant figures is:
A) 7.0 cm^2 B) 7.1 cm^2 C) 7.07 cm^2 D) 7.065 cm^2
Answer: B) 7.1 cm^2
Explanation: $3.14 \times 1.5^2 = 7.065$. The radius has 2 s.f. Keep 7.0; the next digit is 6, so it becomes 7.1.

Q10. The number of significant figures in 4.50×10^{-5} is:
A) 2 B) 3 C) 4 D) 5
Answer: B) 3
Explanation: The mantissa 4.50 has 3 digits that count.

Section B: Short Questions

Q11. State the rules for counting zeros as significant figures. Give one example of each rule. [3]
Answer: (1) Zeros between non-zero digits are significant (5.007 has 4 s.f.). (2) Leading zeros are not significant (0.0045 has 2 s.f.). (3) Trailing zeros after a decimal point are significant (2.500 has 4 s.f.).
Explanation: Each rule with its example earns 1 mark.

Al Amal Learning Center Physics Key Book

Q12. (a) How many significant figures are there in 0.0504, 7.200 and 3.0×10^5? (b) Write 0.0000870 in scientific notation. [1.5+1.5]
Answer: (a) 3, 4 and 2. (b) 8.70×10^{-5}.
Explanation: (a) 0.0504: leading zeros do not count, 5, 0, 4 count. 7.200: all four digits count. 3.0×10^5: the mantissa has 2 digits. (b) The digits 8, 7, 0 are significant, and the decimal point moves 5 places.

Q13. (OR) A tile is 12.7 cm long and 8.2 cm wide. Find its area up to the correct number of significant figures. [3]
Answer: 1.0×10^2 cm^2.
Explanation: $12.7 \times 8.2 = 104.14$ cm^2. The width has 2 s.f., so round to 2 s.f.: 1.0×10^2 cm^2.

Q14. (OR) Add 25.4 g, 3.75 g and 0.082 g with the correct number of decimal places. [3]
Answer: 29.2 g.
Explanation: 25.4 + 3.75 + 0.082 = 29.232 g. The fewest decimal places is 1 (from 25.4), so the answer is 29.2 g.

Q15. The diameter of a wire measured with a screw gauge is 1.25 mm. Find the area of its cross-section using area = $\pi d^2/4$ and $\pi = 3.14$. [3]
Answer: 1.23 mm^2.
Explanation: Area = $3.14 \times (1.25)^2 \div 4 = 3.14 \times 1.5625 \div 4 = 1.2266$ mm^2. The number 4 is exact, so the answer keeps 3 s.f.: 1.23 mm^2.

Q16. Round off the following to 3 significant figures: (a) 0.0065478 (b) 29.96 (c) 1,234,567. [1+1+1]
Answer: (a) 0.00655 (b) 30.0 (c) 1.23×10^6.
Explanation: (a) Keep 0.00654; the next digit is 7, so 0.00655. (b) Keep 29.9; the next digit is 6, so it becomes 30.0. (c) 1.234567×10^6: keep 1.23; the next digit is 4, so the answer is 1.23×10^6.

Amal Learning Center
Physics Key Book