AL AMAL LEARNING CENTER

PHYSICS CHAPTER 1

Class 9 | Unit 1 | Physical Quantities and Measurement

PREFIXES PRACTICE

What is inside

Part	Contents
A	Quick concept: what prefixes are, the prefix table and how to convert
B	60 **practice questions** in three levels (easy, moderate, hard), questions only
C	**Answer key** with every question written again, with answer and short explanation

Student Learning Outcomes covered

Recall the prefixes (exa to atto) and their symbols; state the power of ten for each prefix; convert between units using prefixes; write very large and very small quantities in scientific notation and with prefixes; compare and order quantities with different prefixes; apply prefixes to real-life quantities (distance, time, storage, thickness, mass).

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 prefixes?

A **prefix** is a name given to a power of ten. It is placed before a unit (metre, gram, second) to make very large or very small values easier to write. For example, 0.000040 m is easier to write as 40 µm.

Prefix	Symbol	Power of ten	Prefix	Symbol	Power of ten
exa	E	10^{18}	deci	d	10^{-1}
peta	P	10^{15}	centi	c	10^{-2}
tera	T	10^{12}	milli	m	10^{-3}
giga	G	10^{9}	micro	µ	10^{-6}
mega	M	10^{6}	nano	n	10^{-9}
kilo	k	10^{3}	pico	p	10^{-12}
hecto	h	10^{2}	femto	f	10^{-15}
deca	da	10^{1}	atto	a	10^{-18}

Memory trick: E P T G M k h da ... d c m µ n p f a (big to small). Each step of the big ones is a jump of 10^3 (after kilo, the steps are 10^2 and 10^1).

How to convert

Step 1. Replace the prefix with its power of ten. Example: 3 km = 3×10^3 m.

Step 2. To change from one prefix to another, subtract the powers. Example: 1 mm to µm gives $10^{-3} \div 10^{-6} = 10^3$, so 1 mm = 1000 µm.

Step 3. Moving to a smaller unit makes the number bigger. Moving to a bigger unit makes the number smaller.

Step 4. For areas, square the conversion factor (1 km^2 = $(10^3)^2$ m^2).

Worked example

Convert 4500 ng into µg.
4500 ng = 4500×10^{-9} g = 4.5×10^{-6} g. Since 10^{-6} g is 1 µg, the answer is **4.5 µg**.
Check: nano is 1000 times smaller than micro, so the number must become 1000 times smaller: 4500 ÷ 1000 = 4.5.

PART B PRACTICE QUESTIONS

Solve all 60 questions in your copy. Check your work with the answer key in Part C.

Level 1: Easy (Definition-Based)

1. What is a prefix?

2. Write the symbol and the power of ten of kilo.

3. What power of ten does giga represent?

4. Write the symbol of the prefix micro.

5. Which prefix stands for 10^{-2}?

6. What is the value of the prefix peta, and what is its symbol?

7. Name the prefix with the symbol n and write its value.

8. Which prefix has the symbol da, and what is its value?

9. Which is larger, mega or kilo?

10. Write the power of ten for pico.

11. How many metres are there in 1 kilometre?

12. How many millimetres are there in 1 metre?

13. Write the symbols of tera and hecto.

14. Why do we use prefixes in measurements?

Level 2: Moderate

15. Convert 3.5 km into metres.

16. Convert 450 g into kilograms.

17. Express 5×10^{6} W using a prefix.

18. Convert 0.002 s into milliseconds.

19. Pakistan's power capacity is 40,000 MW. Express it in GW.

20. Convert 2.5 L into mL.

21. There are 86,400 seconds in a day. Express this in kiloseconds.

22. Convert 7.5 cm into metres.

23. Write 12 µm in metres using scientific notation.

24. Express 3×10^{-9} s using a prefix.

25. Arrange in increasing order of size: 1 mm, 1 km, 1 cm, 1 µm.

26. How many milligrams are there in 0.25 g?

27. Convert 2.4 GB into MB.

Level 3: Hard (Concept-Based and Past Paper Pattern)

28. How many micrometres are there in 1 kilometre?

29. How many times is 1 Gm larger than 1 Mm?

30. Express 0.2 mm in µm and in metres (scientific notation).

31. Convert 5 nm into µm.

32. The thickness of a page is 4.0×10^{-5} m. Express it in µm. How many such pages make a stack 1 mm thick?

33. A grain of salt has mass 1.0×10^{-4} g. Express it in µg. How many grains make 1 g?

34. The distance to Alpha Centauri is 4.132×10^{16} m. Express it in Pm and in km.

35. A hard disk stores 30 TB. How many GB is this?

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36. The mass of the Earth is 5.98×10^{24} kg. Write it in grams in scientific notation.

37. The diameter of a hydrogen nucleus is 1.7 fm. Write it in metres. How many times is 1 nm larger than 1 fm?

38. A student says 1 ms = 1000 µs. Is he correct?

39. A student writes 5 Mm = 5×10^{3} m. Find his mistake and correct it.

40. A wire is 0.25 mm thick. Express its thickness in µm, in nm and in metres.

41. Show 5000 nanograms in micrograms.

42. Show 6000 nanograms in milligrams.

43. Express the following in the prefix micro: (a) 0.00005 g (b) 0.0000000072 m (c) 0.0000093 s.

44. Your hair grows at the rate of 1 mm per day. Find the growth rate in nm s^{-1} and µm s^{-1}.

45. A fingernail grows 0.1 mm per day. Find its growth rate in nm s^{-1} and µm s^{-1}.

46. How many kilometres are there in 40 micrometres?

47. Show that the prefix nano is one thousand times smaller than the prefix micro.

48. Show that the prefix giga is one million times larger than the prefix kilo.

49. Express using prefixes: (a) 45.6×10^{-11} m (b) 0.00072×10^{-7} s.

50. Express using prefixes: (a) 62.5×10^{-8} m (b) 0.0043×10^{7} W.

51. A device measures a charge of 5000 nC. Convert it into µC, and then into mC.

52. Convert the following: (a) 0.004 m into mm (b) 8×10^{-6} s into ns (c) 7500 g into kg.

53. A file size is 0.5 GB. Express it in kB and in MB.

54. The mass of a truck load is 3.5 Mg. Express it in g and in kg.

55. A computer chip takes 250 ps to complete one step. Express this in ns and in seconds.

56. A car moves at 72 km h^{-1}. Express its speed in m s^{-1} and in cm s^{-1}.

57. The density of water is 1 g cm^{-3}. Express it in kg m^{-3}.

58. Convert 2 hours into ks and into ms.

59. A boy is 12 years old. Express his age in megaseconds (take 1 year = 365 days).

60. Convert 1 mm^2 into μm^2, and 1 km^2 into m^2.

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PART C ANSWER KEY

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

Level 1: Easy (Definition-Based)

1. What is a prefix?
Answer: A name given to a power of ten.
Explanation: It is written before a unit to show a multiple or sub-multiple of that unit.

2. Write the symbol and the power of ten of kilo.
Answer: k, 10^3.
Explanation: Kilo means one thousand.

3. What power of ten does giga represent?
Answer: 10^9.
Explanation: Giga means one billion.

4. Write the symbol of the prefix micro.
Answer: μ.
Explanation: Micro uses the Greek letter μ (mu) and means 10^{-6}.

5. Which prefix stands for 10^{-2}?
Answer: Centi.
Explanation: Centi means one-hundredth.

6. What is the value of the prefix peta, and what is its symbol?
Answer: 10^{15}, P.
Explanation: Peta is bigger than tera (10^{12}).

7. Name the prefix with the symbol n and write its value.
Answer: Nano, 10^{-9}.
Explanation: Nano means one-billionth.

8. Which prefix has the symbol da, and what is its value?
Answer: Deca, 10^1.
Explanation: Deca means ten.

9. Which is larger, mega or kilo?
Answer: Mega.
Explanation: Mega is 10^6 and kilo is 10^3.

10. Write the power of ten for pico.
Answer: 10^{-12}.
Explanation: Pico is smaller than nano (10^{-9}).

11. How many metres are there in 1 kilometre?
Answer: 1000 m (10^3 m).
Explanation: Kilo means 10^3.

12. How many millimetres are there in 1 metre?
Answer: 1000 mm.
Explanation: 1 mm = 10^{-3} m.

13. Write the symbols of tera and hecto.
Answer: T and h.
Explanation: Tera (T) is 10^{12} and hecto (h) is 10^2.

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14. **Why do we use prefixes in measurements?**
Answer: To write very large or very small values in convenient units.
Explanation: They avoid long strings of zeros and make scientific notation easier.

Level 2: Moderate

15. **Convert 3.5 km into metres.**
Answer: 3500 m.
Explanation: 3.5×10^{3} m = 3500 m.

16. **Convert 450 g into kilograms.**
Answer: 0.45 kg.
Explanation: 1 g = 10^{-3} kg, so $450 \times 10^{-3} = 0.45$ kg.

17. **Express 5×10^{6} W using a prefix.**
Answer: 5 MW.
Explanation: 10^{6} is mega.

18. **Convert 0.002 s into milliseconds.**
Answer: 2 ms.
Explanation: 0.002 s = 2×10^{-3} s.

19. **Pakistan's power capacity is 40,000 MW. Express it in GW.**
Answer: 40 GW.
Explanation: $40{,}000 \times 10^{6}$ W = 4×10^{10} W = 40×10^{9} W.

20. **Convert 2.5 L into mL.**
Answer: 2500 mL.
Explanation: 1 L = 1000 mL.

21. **There are 86,400 seconds in a day. Express this in kiloseconds.**
Answer: 86.4 ks.
Explanation: 86,400 ÷ 1000 = 86.4.

22. **Convert 7.5 cm into metres.**
Answer: 0.075 m.
Explanation: 1 cm = 10^{-2} m, so $7.5 \times 10^{-2} = 0.075$ m.

23. **Write 12 µm in metres using scientific notation.**
Answer: 1.2×10^{-5} m.
Explanation: $12 \times 10^{-6} = 1.2 \times 10^{-5}$.

24. **Express 3×10^{-9} s using a prefix.**
Answer: 3 ns.
Explanation: 10^{-9} is nano.

25. **Arrange in increasing order of size: 1 mm, 1 km, 1 cm, 1 µm.**
Answer: 1 µm < 1 mm < 1 cm < 1 km.
Explanation: Their sizes are 10^{-6} m, 10^{-3} m, 10^{-2} m and 10^{3} m.

26. **How many milligrams are there in 0.25 g?**
Answer: 250 mg.
Explanation: 1 g = 1000 mg, so $0.25 \times 1000 = 250$ mg.

27. **Convert 2.4 GB into MB.**
Answer: 2400 MB.
Explanation: Giga ÷ mega = $10^{9} \div 10^{6} = 10^{3}$, so $2.4 \times 1000 = 2400$.

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Level 3: Hard (Concept-Based and Past Paper Pattern)

28. How many micrometres are there in 1 kilometre?
Answer: 10^9 µm.
Explanation: 10^3 m ÷ 10^{-6} m = 10^9.

29. How many times is 1 Gm larger than 1 Mm?
Answer: 1000 times.
Explanation: $10^9 \div 10^6 = 10^3$.

30. Express 0.2 mm in µm and in metres (scientific notation).
Answer: 200 µm and 2×10^{-4} m.
Explanation: 0.2×10^{-3} m = 2×10^{-4} m, and dividing by 10^{-6} gives 200 µm.

31. Convert 5 nm into µm.
Answer: 5×10^{-3} µm (0.005 µm).
Explanation: $5 \times 10^{-9} \div 10^{-6} = 5 \times 10^{-3}$.

32. The thickness of a page is 4.0×10^{-5} m. Express it in µm. How many such pages make a stack 1 mm thick?
Answer: 40 µm; 25 pages.
Explanation: 4.0×10^{-5} m = 40×10^{-6} m, and 1 mm ÷ 40 µm = 1000 ÷ 40 = 25.

33. A grain of salt has mass 1.0×10^{-4} g. Express it in µg. How many grains make 1 g?
Answer: 100 µg; 10,000 grains.
Explanation: 1.0×10^{-4} g = 100×10^{-6} g, and $1 \div 10^{-4} = 10^4$.

34. The distance to Alpha Centauri is 4.132×10^{16} m. Express it in Pm and in km.
Answer: 41.32 Pm; 4.132×10^{13} km.
Explanation: Dividing by 10^{15} gives Pm, and dividing by 10^3 gives km.

35. A hard disk stores 30 TB. How many GB is this?
Answer: 30,000 GB (3×10^4 GB).
Explanation: Tera ÷ giga = $10^{12} \div 10^9 = 10^3$, so 30 × 1000 = 30,000.

36. The mass of the Earth is 5.98×10^{24} kg. Write it in grams in scientific notation.
Answer: 5.98×10^{27} g.
Explanation: 1 kg = 10^3 g, so add 3 to the exponent.

37. The diameter of a hydrogen nucleus is 1.7 fm. Write it in metres. How many times is 1 nm larger than 1 fm?
Answer: 1.7×10^{-15} m; 10^6 times.
Explanation: $10^{-9} \div 10^{-15} = 10^6$.

38. A student says 1 ms = 1000 µs. Is he correct?
Answer: Yes.
Explanation: 10^{-3} s ÷ 10^{-6} s = 10^3.

39. A student writes 5 Mm = 5×10^3 m. Find his mistake and correct it.
Answer: 5 Mm = 5×10^6 m.
Explanation: He used the power of kilo (10^3) for mega, which is 10^6.

40. A wire is 0.25 mm thick. Express its thickness in µm, in nm and in metres.
Answer: 250 µm, 2.5×10^5 nm, 2.5×10^{-4} m.
Explanation: 0.25×10^{-3} m = 2.5×10^{-4} m, and dividing by 10^{-6} or 10^{-9} gives µm or nm.

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41. Show 5000 nanograms in micrograms.
Answer: 5 µg.
Explanation: 5000×10^{-9} g = 5×10^{-6} g, and 10^{-6} g is 1 µg.

42. Show 6000 nanograms in milligrams.
Answer: 0.006 mg (6×10^{-3} mg).
Explanation: 6000×10^{-9} g = 6×10^{-6} g, and dividing by 10^{-3} gives 6×10^{-3} mg.

43. Express the following in the prefix micro: (a) 0.00005 g (b) 0.0000000072 m (c) 0.0000093 s.
Answer: (a) 50 µg (b) 0.0072 µm (c) 9.3 µs.
Explanation: Write each in powers of ten, (a) 5×10^{-5} g, (b) 7.2×10^{-9} m, (c) 9.3×10^{-6} s, then divide by 10^{-6}.

44. Your hair grows at the rate of 1 mm per day. Find the growth rate in nm s^{-1} and µm s^{-1}.
Answer: About 11.6 nm s^{-1} and 0.0116 µm s^{-1}.
Explanation: 1 mm = 10^6 nm = 10^3 µm and 1 day = 86,400 s, so $10^6 \div 86{,}400 \approx 11.6$ and $10^3 \div 86{,}400 \approx 0.0116$.

45. A fingernail grows 0.1 mm per day. Find its growth rate in nm s^{-1} and µm s^{-1}.
Answer: About 1.16 nm s^{-1} and 1.16×10^{-3} µm s^{-1}.
Explanation: 0.1 mm = 10^5 nm = 100 µm, and dividing each by 86,400 s gives these values.

46. How many kilometres are there in 40 micrometres?
Answer: 4×10^{-8} km.
Explanation: 40×10^{-6} m $\div 10^3 = 40 \times 10^{-9}$ km = 4×10^{-8} km.

47. Show that the prefix nano is one thousand times smaller than the prefix micro.
Answer: Micro ÷ nano = 1000, so nano is 1000 times smaller.
Explanation: Micro = 10^{-6}, nano = 10^{-9}, and $10^{-6} \div 10^{-9} = 10^3$.

48. Show that the prefix giga is one million times larger than the prefix kilo.
Answer: Giga ÷ kilo = 10^6 = 1,000,000.
Explanation: Giga = 10^9, kilo = 10^3, and $10^9 \div 10^3 = 10^6$.

49. Express using prefixes: (a) 45.6×10^{-11} m (b) 0.00072×10^{-7} s.
Answer: (a) 456 pm (b) 72 ps.
Explanation: (a) $45.6 \times 10^{-11} = 456 \times 10^{-12}$ m. (b) $0.00072 \times 10^{-7} = 7.2 \times 10^{-11} = 72 \times 10^{-12}$ s.

50. Express using prefixes: (a) 62.5×10^{-8} m (b) 0.0043×10^7 W.
Answer: (a) 625 nm (or 0.625 µm) (b) 43 kW.
Explanation: (a) $62.5 \times 10^{-8} = 625 \times 10^{-9}$ m. (b) $0.0043 \times 10^7 = 4.3 \times 10^4 = 43 \times 10^3$ W.

51. A device measures a charge of 5000 nC. Convert it into µC, and then into mC.
Answer: 5 µC and 5×10^{-3} mC.
Explanation: 5000×10^{-9} C = 5×10^{-6} C = 5 µC, and dividing by 10^{-3} gives 5×10^{-3} mC.

52. Convert the following: (a) 0.004 m into mm (b) 8×10^{-6} s into ns (c) 7500 g into kg.
Answer: (a) 4 mm (b) 8000 ns (c) 7.5 kg.
Explanation: (a) $0.004 \div 10^{-3} = 4$. (b) $8 \times 10^{-6} \div 10^{-9} = 8 \times 10^3$. (c) $7500 \times 10^{-3} = 7.5$.

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53. A file size is 0.5 GB. Express it in kB and in MB.
Answer: 5×10^5 kB and 500 MB.
Explanation: Giga ÷ kilo = 10^6, so $0.5 \times 10^6 = 5 \times 10^5$. Giga ÷ mega = 10^3, so $0.5 \times 1000 = 500$.

54. The mass of a truck load is 3.5 Mg. Express it in g and in kg.
Answer: 3.5×10^6 g and 3.5×10^3 kg.
Explanation: Mega = 10^6, so 3.5 Mg = 3.5×10^6 g. Dividing by 10^3 gives kg.

55. A computer chip takes 250 ps to complete one step. Express this in ns and in seconds.
Answer: 0.25 ns and 2.5×10^{-10} s.
Explanation: 250×10^{-12} s = 2.5×10^{-10} s, and dividing by 10^{-9} gives 0.25 ns.

56. A car moves at 72 km h^{-1}. Express its speed in m s^{-1} and in cm s^{-1}.
Answer: 20 m s^{-1} and 2000 cm s^{-1}.
Explanation: 72×10^3 m ÷ 3600 s = 20 m s^{-1}, and 1 m = 100 cm.

57. The density of water is 1 g cm^{-3}. Express it in kg m^{-3}.
Answer: 1000 kg m^{-3}.
Explanation: 1 g = 10^{-3} kg and 1 cm^3 = $(10^{-2}$ m$)^3$ = 10^{-6} m^3, so $10^{-3} \div 10^{-6} = 10^3$.

58. Convert 2 hours into ks and into ms.
Answer: 7.2 ks and 7.2×10^6 ms.
Explanation: $2 \times 3600 = 7200$ s = 7.2×10^3 s, and $7200 \times 10^3 = 7.2 \times 10^6$ ms.

59. A boy is 12 years old. Express his age in megaseconds (take 1 year = 365 days).
Answer: About 378 Ms (3.78×10^2 Ms).
Explanation: $12 \times 365 \times 86{,}400 = 378{,}432{,}000$ s = 3.78432×10^8 s, and dividing by 10^6 gives about 378 Ms.

60. Convert 1 mm^2 into μm^2, and 1 km^2 into m^2.
Answer: 10^6 μm^2 and 10^6 m^2.
Explanation: Areas square the conversion factor: 1 mm = 10^3 μm so 1 mm^2 = $(10^3)^2$ μm^2, and 1 km = 10^3 m so 1 km^2 = $(10^3)^2$ m^2.

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