GRADE: 7

SUBJECT: Mathematics

LESSON: Exponents and Powers

DURATION: 2½ hrs

MAX MARKS: 80

DETAILED ANSWERS

SECTION A (4 × 10 = 40 marks)

1. Choose the correct option:

a) The value of $(-2)^4$:

- Calculation: $(-2) \times (-2) \times (-2) \times (-2) = 16$
- **Correct Answer:** (ii) 16

b) Scientific notation of 3,430,000:

- 3.43×10^6
- **Correct Answer:** (i) 3.43×10^6

c) Prime factorization of 512:

- $512 = 2^9$
- **Correct Answer:** (iv) 2^9
  d) The value of 10^0 :
- By exponent rule, any number raised to power zero is 1.
- **Correct Answer:** (ii) 1

2. Solve the following:

a) Base and exponent:

- 5^3 - Base = 5, Exponent = 3
- $(-3)^4$ - Base = -3, Exponent = 4
- 7^5 - Base = 7, Exponent = 5

b) Scientific notation:

- 573,000 = 5.73 × 10^5
- 9,812,700,000 = 9.8127 × 10^9

c) Express as powers of 2:

- 32 = 2^5
- 128 = 2^7
- 1024 = 2^{10}

3. Solve the following equations:

a) Find x:

- $3^x = 243 \longrightarrow 243 = 3^5 \longrightarrow x = 5$
- $(-5)^x = -125 \longrightarrow (-5)^3 = -125 \longrightarrow x = 3$

b) Simplify:

- $2^4 \times 2^3 = 2^{4+3} = 2^7$
- $10^7 \div 10^3 = 10^{7-3} = 10^4$

c) Expanded exponential form:

- $753015 = 7 \times 10^5 + 5 \times 10^4 + 3 \times 10^3 + 0 \times 10^2 + 1 \times 10^1 + 5 \times 10^0$
- $900230 = 9 \times 10^5 + 0 \times 10^4 + 0 \times 10^3 + 2 \times 10^2 + 3 \times 10^1 + 0 \times 10^0$

4. TRUE or FALSE:

a) $(-2)^3$ is equal to 8 ⟶ **False** (It is -8)

b) Standard form of 7,000,000 is 7.0 × 10^6 ⟶ **True**

c) 10^{-2} = 0.01 ⟶ **True**

d) The exponent in 5^6 is 5 ⟶ **False** (It is 6)

5. Solve the following problems:

a) Prime factorization:

- 48 = $2^4 \times 3^1$
- 360 = $2^3 \times 3^2 \times 5^1$

b) Compare numbers:

- 4.3×10^{14} vs. 3.01×10^{17} ⟶ 3.01×10^{17} is larger
- 2.3×10^9 vs. 2.5×10^9 ⟶ 2.5×10^9 is larger

c) Find missing number:

- $(-6)^{-3} \times x = 10^1$
- $x = 10^1 \div (-6)^{-3} = 10^1 \times (-6)^3$

SECTION B (4 × 10 = 40 marks)

6. Graph-Based Question:

Graph drawn separately

- **Smallest population:** Venus

7. Exponential Form Calculations:

a) Simplify:

- $\$(-3)^5 \times (-3)^3 = (-3)^{5+3} = (-3)^8$
- $10^9 \div 10^4 = 10^{9-4} = 10^5$

b) Find x:

- $7^x = 49 \longrightarrow 49 = 7^2 \longrightarrow x = 2$
- $2^x = 64 \longrightarrow 64 = 2^6 \longrightarrow x = 6$

c) Powers of 3:

- $81 = 3^4$
- $729 = 3^6$

8. Laws of Exponents Applications:

a) Using exponent rules:

- $(2^3)^4 = 2^{3\times4} = 2^{12}$
- $5^6 \div 5^2 = 5^{6-2} = 5^4$

b) Standard form:

- $6000000 = 6.0 \times 10^6$
- $0.00042 = 4.2 \times 10^{-4}$

c) Compare:

- 1.2×10^8 vs. $9.8 \times 10^7 \longrightarrow 1.2 \times 10^8$ is larger

9. Application-Based Questions:

a) Spaceship travel time:

- Time = Distance / Speed = $(4.5 \times 10^{12})/(1.5 \times 10^7)$
- Time = 3×10^5 seconds

b) Jupiter's mass compared to Earth:

- Ratio = $(1.9 \times 10^{27})/(5.97 \times 10^{24})$
- ≈ 318.75 t× heavier

c) Atom fitting:

- 1 cm = 10^{-2} m
- $10^{-2} \div 2.5 \times 10^{-10} = 4 \times 10^7$ atoms

10. HOTS:

a) Bacteria growth:

- After 6 hours: $2^5 \times 2^6 = 2^{11}$

b) Solve $6^x = 36$:

- $36 = 6^2 \longrightarrow x = 2$

c) Distance in meters:

- 2.4×10^6 km = 2.4×10^9 meters

END OF SOLUTIONS