Exponents and Power: Exercise 13.1

Q.1 Find the value of: (i) 2⁶ (ii) 9³ (iii) 11^2 (iv) 5^4 Sol: (i) Given: $2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$ = 64(ii) Given: $9^3 = 9 \times 9 \times 9$ = 729 (iii) Given: $11^2 = 11 \times 11$ = 121 (iv) Given: $5^4 = 5 \times 5 \times 5 \times 5$ = 625Q.2 Express the following in exponential form: (i) $6 \times 6 \times 6 \times 6$ (ii) t × t (iii) $\mathbf{b} \times \mathbf{b} \times \mathbf{b} \times \mathbf{b}$ (iv) $5 \times 5 \times 7 \times 7 \times 7$ (v) $2 \times 2 \times a \times a$ (vi) $a \times a \times a \times c \times c \times c \times c \times d$ **Sol:** Exponential form: (i) Given: $6 \times 6 \times 6 \times 6 = 6^4$ (ii) Given: t × t = t² (iii) Given: $b \times b \times b \times b = b^4$ (iv) Given: $5 \times 5 \times 7 \times 7 \times 7 = 5^2 \times 7^3$ (v) Given: $2 \times 2 \times a \times a = 2^2 \times a^2$ (vi) Given: $a \times a \times a \times c \times c \times c \times c \times d = a^3 \times c^4 \times d$ Q.3 Express each of the following numbers using exponential notation: (i) 512 (iii) 729 (iv) 3125 (ii) 343 Sol: (i) Given: 512 $= 2^9$ (ii) Given: 343 Factors of $343 = 7 \times 7 \times 7$ $= 7^{3}$ (iii) Given: 729 Factors of $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3$ $= 3^{6}$ (iv) Given: 3125 Factors of $3125 = 5 \times 5 \times 5 \times 5 \times 5$

 $= 5^5$

Q.4 Identify the greater number, wherever possible, in each of the following.(i) 4^3 or 3^4 (ii) 5^3 or 3^5 (iii) 2^8 or 8^2 (iv) 100^2 or 2^{100} (v) 2^{10} or 10^2

Sol: (i) Given: 4^3 or 3^4 $4^3 = 4 \times 4 \times 4 = 64$ $3^4 = 3 \times 3 \times 3 \times 3 = 81$ Since, 64 < 81So, $4^3 < 3^4$

(ii) Given: 5³ or 3⁵

 $5^3 = 5 \times 5 \times 5 = 125$ $3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$ Since, 125 < 243So, $5^3 < 3^5$

(iii) Given: 2^8 or 8^2 $2^8 = 2 \times 2 = 256$ $8^2 = 8 \times 8 = 64$ Since, 256 > 64So, $2^8 > 8^2$

(iv) Given: 100² or 2¹⁰⁰

 $100^{2} = 100 \times 100 = 10000$ $2^{100} = 2^{10 \times 10} = 1024^{10} = 1024 \times 102$

Q.5 Express each of the following as product of powers of their prime factors:(i) 648(ii) 405(iii) 540(iv) 3,600Sol:(i) Given: 648Prime factors of 648: $2 \times 2 \times 2 \times 3 \times 3 \times 3 = 2^3 \times 3^4$

(ii) Given: 405Prime factors of $405: 3 \times 3 \times 3 \times 3 \times 5 = 3^4 \times 5$

(iii) Given: 540 Prime factors of 540 = $2 \times 2 \times 3 \times 3 \times 3 \times 5 = 2^2 \times 3^3 \times 5$

(iv) Given: 3600 Prime factors of 3600 = $2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 5 = 2^4 \times 3^2 \times 5^2$

| Q.6 Simplify: | | | |
|------------------------------|---|---------------------------|---|
| (i) 2 × 10 ³ | (ii) $7^2 \times 2^2$ | (iii) 2 ³ × 5 | (iv) 3 × 4 ⁴ |
| (v) 0 × 10 ² | (vi) 5 ² × 3 ³ | (vii) 24 × 3 ² | (viii) 3 ² × 10 ⁴ |
| Sol: | | | |
| (i) Given: 2 × 10 | $0^3 = 2 \times 10 \times 10 \times 10$ | | |
| = 2000 | | | |
| (ii) Given: $7^2 \times 2^2$ | $2^2 = 7 \times 7 \times 2 \times 2$ | | |
| = | = 49 × 4 | | |
| : | = 196 | | |

(iii) Given: $2^3 \times 5 = 2 \times 2 \times 2 \times 5$ $= 8 \times 5$ = 40 (iv) Given: $3 \times 4^4 = 3 \times 4 \times 4 \times 4 \times 4$ $= 3 \times 256$ = 768 (v) Given: $0 \times 10^2 = 0 \times 10 \times 10$ = 0 (vi) Given: $5^2 \times 3^3 = 5 \times 5 \times 3 \times 3 \times 3$ $= 25 \times 27$ = 675 (vii) Given: $2^4 \times 3^2 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$ $= 16 \times 9$ = 144 (viii) Given: $3^2 \times 10^4 = 3 \times 3 \times 10 \times 10 \times 10 \times 10$ $= 9 \times 10000$ = 90000 **Q.7 Simplify:** (ii) (-3) × (-2)³ (i) $(-4)^3$ (iii) $(-3)^2 \times (-5)^2$ (iv) (-2)³ × (-10)³ Sol: (i) Given: $(-4)^3 = -4 \times -4 \times -4$ = -64(ii) Given: $(-3) \times (-2)^3 = -3 \times -2 \times -2 \times -2$ $= -3 \times -8$ = 24 (iii) Given: $(-3)^2 \times (-5)^2 = -3 \times -3 \times -5 \times -5$ $= 9 \times 25$ = 225 (iv) Given: $(-2)^3 \times (-10)^3 = -2 \times -2 \times -2 \times -10 \times -10 \times -10$ $= -8 \times -1000$ = 8000 **Q.8 Compare the following numbers:** (i) 2.7×10^{12} ; 1.5×10^{8} (ii) 4 × 10¹⁴; 3 × 10¹⁷ Sol: (i) Given: 2.7×10^{12} ; 1.5×10^{8} By comparing the exponents of base 10, Since, $10^{12} > 10^8$ So, $2.7 \times 10^{12} > 1.5 \times 10^{8}$ (ii) Given: 4×10^{14} ; 3×10^{17}

By comparing the exponents of base 10, Since, $10^{14} < 10^{17}$ So, $4 \times 10^{14} < 3 \times 10^{17}$