CLASS VIII – MATHEMATICS

Chapter Test: Power Play – Step-by-Step Solutions & Marking Scheme

(Ganita Prakash, Grade 8, Part I – Chapter 2)

M. M.: 40 | Marks for each step are shown in square brackets.

Section A – Multiple Choice Questions (1 mark each)

Q.	Ans.	Solution
1	**(C)**	$(-3)^4 = (-3)(-3)(-3)(-3)$. An even power of a negative number is positive, so the value is $9 \times 9 =$ **81**.
2	**(D)**	$5^{-2} = 1/5^2 =$ **1/25**, using $n^{-a} = 1/n^a$.
3	**(A)**	Same base, so add the exponents: $2^{7+(-3)} =$ **2^4**.
4	**(C)**	$(n^a)^b = n^{ab}$, so $(7^3)^2 = 7^{3\times2} =$ **7^6**.
5	**(B)**	45,00,000 = 4.5 × 10,00,000 = **4.5×10^6**. (45×10^5 is not standard form as 45 is not less than 10.)
6	**(C)**	0.00032 = 3.2 ÷ 10,000 = 3.2×10^{-4}. The decimal point moves 4 places to the right to get 3.2, so the exponent is **−4**.
7	**(A)**	Any non-zero number raised to the power 0 equals 1, so 1 + 1 + 1 = **3**.
8	**(B)**	$1/81 = 1/3^4 = 3^{-4}$. So $3^x = 3^{-4}$ gives x = **−4**.
9	**(C)**	From Fig. 1, $81 = 3^4$ and $1/27 = 3^{-3}$. So $81 \times (1/27) = 3^{4+(-3)} = 3^1 =$ **3**. (Check: 81 ÷ 27 = 3.)
10	**(D)**	Fig. 2 has 8 rows and 8 columns, so the number of small squares = 8 × 8 = 64. Since $8 = 2^3$, $8 \times 8 = 2^3 \times 2^3 =$ **2^6** (= 64).

Section B – Very Short Answer Questions (2 marks each)

Q11. Message-spreading tree (Fig. 3)

From the figure: Round 1 has $3 = 3^1$ new people and Round 2 has $3 \times 3 = 3^2 = 9$ new people. Each person passes the message to 3 new people, so Round n has 3^n new people.

(i) Round 4: **$3^4 = 81$ people** ($3 \times 3 \times 3 \times 3 = 81$). [1]

(ii) $2187 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^7$ (check: $3^6 = 729$, $3^7 = 729 \times 3 = 2187$). So 2187 people receive it for the first time in **Round 7**. [1]

Q12. Prime factorisation

(A) 1176: 1176 ÷ 2 = 588; 588 ÷ 2 = 294; 294 ÷ 2 = 147; 147 ÷ 3 = 49; 49 ÷ 7 = 7; 7 ÷ 7 = 1. [1]

$1176 = 2 \times 2 \times 2 \times 3 \times 7 \times 7 =$ **$2^3 \times 3 \times 7^2$**. [1]

(B) 2160: 2160 ÷ 2 = 1080; ÷ 2 = 540; ÷ 2 = 270; ÷ 2 = 135; 135 ÷ 3 = 45; ÷ 3 = 15; ÷ 3 = 5; ÷ 5 = 1. [1]

$2160 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 5 =$ **$2^4 \times 3^3 \times 5$**. [1]

Q13. 0.00000012 m in standard form

Step 1: Move the decimal point 7 places to the right to get a number between 1 and 10: 1.2. [1]

Step 2: Since the point moved 7 places to the right, the exponent is −7. So $0.00000012 =$ **1.2×10^{-7} m**. [1]

Section C – Short Answer Questions (3 marks each)

Q14. Paper-folding bar graph (Fig. 4)

(i) From the graph: after 3 folds = 0.008 cm and after 6 folds = 0.064 cm. [½]

Ratio = 0.064 ÷ 0.008 = 8 = $2 \times 2 \times 2 =$ **2^3** times. (Using powers: $2^6 \div 2^3 = 2^3$.) [½]

(ii) The thickness doubles with every fold, so after n folds it is 0.001×2^n cm. [1]
After 12 folds: 0.001×2^{12} cm. [½]
$2^{12} = 4096$, so thickness = $0.001 \times 4096 =$ **4.096 cm**. [½]

Q15.
(A) Step 1: LHS = $2^6 \times 3^6$. Same exponent, so = $(2 \times 3)^6 = 6^6$. [1½]
Step 2: $6^6 \div 6^4 = 6^{6-4} = 6^2 =$ **36** = RHS. Hence shown. [1½]
(B) Step 1: Same exponent: $(-2)^3 \times (-5)^3 = [(-2) \times (-5)]^3 = 10^3$. [1½]
Step 2: $10^3 \times 10^{-1} = 10^{3+(-1)} =$ **$10^2 = 100$**. [1½]
(Check: $(-8) \times (-125) = 1000$; $1000 \times 1/10 = 100$.)

Q16. Ascending order of 2^8, 8^2, 3^5, 5^3
Step 1: $2^8 = 256$; $8^2 = 64$; $3^5 = 243$; $5^3 = 125$. [2]
Step 2: $64 < 125 < 243 < 256$, so the ascending order is **$8^2 < 5^3 < 3^5 < 2^8$**. [1]

Q17.
(A) Step 1: Make the powers of 10 equal: $3.2 \times 10^4 = 0.32 \times 10^5$. [1]
Step 2: Sum = $(4.5 + 0.32) \times 10^5 = 4.82 \times 10^5$. [1]
Step 3: Since $1 \le 4.82 < 10$, this is in standard form: **4.82×10^5**. [1]
(B) Step 1: $8 \times 10^5 = 0.8 \times 10^6$. [1]
Step 2: Difference = $(6.3 - 0.8) \times 10^6 = 5.5 \times 10^6$. [1]
Step 3: Standard form: **5.5×10^6**. [1]

Section D – Long Answer / Word Problem / Case-based Questions (4 marks each)

Q18.
(A) (i) Start = 5. After each hour the number is multiplied by 2, so after 6 hours it is $5 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 =$ **5×2^6**. [1]
$5 \times 64 =$ **320 bacteria**. [1]
(ii) After n hours there are 5×2^n bacteria. We need $5 \times 2^n > 1000$, i.e. $2^n > 200$. [1]
$2^7 = 128$ (< 200) gives $5 \times 128 = 640$, not enough; $2^8 = 256$ (> 200) gives $5 \times 256 = 1280$. So after **8 hours**. [1]
(B) (i) Starting with 1 lotus and tripling each day, Day 5 has $1 \times 3 \times 3 \times 3 \times 3 \times 3 =$ **3^5**. [1]
$3^5 =$ **243 lotuses**. [1]
(ii) Day 6: $3^6 = 729$ (not more than 1000). [1]
Day 7: $3^7 = 2187 > 1000$. So the pond first has more than 1000 lotuses on **Day 7**. [1]

Q19.
(A) (i) Each of the 3 letter places has 26 choices and each of the 4 digit places has 10 choices. Number of codes = $26 \times 26 \times 26 \times 10 \times 10 \times 10 \times 10 =$ **$26^3 \times 10^4$**. [1]
(ii) $26^2 = 676$; $26^3 = 676 \times 26 = 17{,}576$. [1]
Number of codes = $17{,}576 \times 10^4 =$ **17,57,60,000** (175,760,000). [1]
(iii) 17,57,60,000 = **1.7576×10^8**. [1]
(B) (i) Each character has 26 + 10 = 36 choices, so the number of passcodes = $36 \times 36 \times 36 \times 36 =$ **36^4**. [1]
(ii) $36^2 = 1296$; $36^4 = 1296 \times 1296$. [1]
$1296 \times 1296 = 1296 \times 1300 - 1296 \times 4 = 16{,}84{,}800 - 5{,}184 =$ **16,79,616** (1,679,616). [1]
(iii) $1{,}679{,}616 = 1.679616 \times 10^6 \approx$ **1.68×10^6** (3 significant digits). [1]

Q20. Case Study: speed of light
(i) Time = Distance ÷ Speed. [½]
Time = $(1.5 \times 10^{11}) \div (3 \times 10^8) = (1.5 \div 3) \times 10^{11-8} = 0.5 \times 10^3$. [1]
$= 5 \times 10^2$, so the time is **5×10^2 seconds** (500 s, about 8 minutes 20 seconds). [½]
(ii) Distance = Speed × Time. [½]
Distance = $3 \times 10^8 \times 3600 = 3 \times 10^8 \times 3.6 \times 10^3 = (3 \times 3.6) \times 10^{8+3} = 10.8 \times 10^{11}$. [1]
Rewriting 10.8 as 1.08×10: = **1.08×10^{12} metres**. [½]

Note for teachers: Award full marks for any correct alternative method. In Q16 and Q19, a student who writes correct exponential forms but makes a small arithmetic slip may be given the method marks.