Grade 5 Unit 1 test: Decimal place value and powers of ten (answer key)

12 questions, 38 points

ANSWERS AT A GLANCE

1. (a) Sunflower 0.062 g, pea 0.206 g, squash 0.26 g (or 0.260 g), corn 0.602 g. (b) sunflower, pea, squash, corn
2. 500,000, 480,000, 510,000, 50,000. In order: $5{,}000 \times 10^1$, 48×10^4, 5×10^5, 510×10^3.
3. (a) 406.2 grams (b) 40,620 grams
4. (a) 8.65 grams (b) 86.5 grams (c) He divided by 1,000 (moved the digits three places) instead of by 100 (two places).
5. A = 5.04, B = 4.5, C = 5.4, D = 0.504. Order: D, B, A, C.
6. (a) 100 (b) $444_{\text{five}} = 124$ (c) No: $444_{\text{five}} = 124$ is more than the three-digit number 100.
7. (a) 7,090 (b) 70,900; it is 10 times as much, because one more factor of ten moves every digit one more place left. (c) 9 tens, or 90
8. (a) 3.404 (b) three and four hundred four thousandths (c) $3 + \frac{4}{10} + \frac{4}{1000}$
9. 6.45, 6.46, 6.47, 6.48, 6.49
10. (a) 12 and 12.4 (b) 12.40 (c) Any one of 12.395, 12.397, 12.398, 12.399, 12.400, 12.401, 12.402, 12.403, 12.404.
11. (a) $2 \times 10^6 + 8 \times 10^5$ (b) 1,800,000 tickets, which is $1 \times 10^6 + 8 \times 10^5$
12. (a) 45 grams, 101101_{two} (b) the 32, 16, 4 and 2 gram weights; 110110_{two}

WORKED SOLUTIONS

1. A science class weighs four seeds, in grams.

Sunflower: sixty-two thousandths. Pea: 0.2 + 0.006. Squash: two hundred sixty thousandths. Corn: $\frac{6}{10} + \frac{2}{1000}$. (3 points)

(a) Write each weight in standard form.

(b) List the seeds from lightest to heaviest.

ANSWER

(a) Sunflower 0.062 g, pea 0.206 g, squash 0.26 g (or 0.260 g), corn 0.602 g. (b) sunflower, pea, squash, corn

SOLUTION

(a) Sunflower: sixty-two thousandths fills the last two places, so a 0 holds the tenths: 0.062.

Pea: 2 tenths, 0 hundredths, 6 thousandths: 0.206.

Squash: two hundred sixty thousandths fills all three places: 0.260, which is 0.26.

Corn: 6 tenths, 0 hundredths, 2 thousandths: 0.602.

(b) As thousandths the weights are 62, 206, 260 and 602. So 0.062 < 0.206 < 0.260 < 0.602: sunflower, pea, squash, corn.

SCORING

2 points for all four standard forms (1 point for three of them). 1 point for the order sunflower, pea, squash, corn.

2. Write the value of each number. Then put the four numbers in order from smallest to largest.

5×10^5 48×10^4 510×10^3 $5{,}000 \times 10^1$ (3 points)

ANSWER

500,000, 480,000, 510,000, 50,000. In order: $5{,}000 \times 10^1$, 48×10^4, 5×10^5, 510×10^3.

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SOLUTION

Write the zeros for each:

$$5 \times 10^5 = 500{,}000$$
$$48 \times 10^4 = 480{,}000$$
$$510 \times 10^3 = 510{,}000$$
$$5{,}000 \times 10^1 = 50{,}000$$

The smallest is 50,000, the only one with five digits. The other three have six digits; compare from the hundred thousands place: 480,000 < 500,000 < 510,000.

In order: $5{,}000 \times 10^1$, 48×10^4, 5×10^5, 510×10^3.

The biggest power, 10^5, does not make the biggest number, and the biggest front number, 5,000, does not either. Only the values decide.

SCORING

2 points for the four values (1 point if two or three are right); 1 point for the correct order.

3. One sheet of stickers weighs 4.062 grams. (3 points)

(a) A pack holds 100 sheets. How much do the sheets in a pack weigh?

(b) A carton holds 10^4 sheets. How much do the sheets in a carton weigh?

ANSWER

(a) 406.2 grams (b) 40,620 grams

SOLUTION

(a) The pack weighs 4.062 × 100 grams. Every digit moves two places left: 4 ones become 4 hundreds, 0 tenths become 0 tens, 6 hundredths become 6 ones and 2 thousandths become 2 tenths. The sheets weigh 406.2 grams.

(b) $10^4 = 10{,}000$, so every digit moves four places left: 4 ones become 4 ten thousands, 0 tenths become 0 thousands, 6 hundredths become 6 hundreds and 2 thousandths become 2 tens. The ones place is empty and gets a 0. The sheets weigh $4.062 \times 10^4 = 40{,}620$ grams.

SCORING

1 point for 406.2 grams; 2 points for 40,620 grams (1 point if the work moves every digit four places but leaves the empty ones place unfilled, giving 4,062).

4. A box of 100 crayons weighs 865 grams. Every crayon weighs the same. (3 points)

(a) How much does one crayon weigh?

(b) The crayons in the box are split into 10 equal packs. How much does one pack weigh?

(c) Ethan says one crayon weighs 0.865 grams. What mistake did he make?

ANSWER

(a) 8.65 grams (b) 86.5 grams (c) He divided by 1,000 (moved the digits three places) instead of by 100 (two places).

SOLUTION

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(a) Divide by 100: every digit of 865 moves two places right. The 8 hundreds become 8 ones, the 6 tens become 6 tenths, the 5 ones become 5 hundredths. 865 ÷ 100 = 8.65 grams.

(b) Each pack is one of 10 equal parts of the box, so divide by 10: every digit moves one place right. 865 ÷ 10 = 86.5 grams. (Each pack holds 10 crayons, and 10 crayons of 8.65 grams also make 86.5 grams.)

(c) 0.865 is 865 ÷ 1,000: Ethan moved every digit three places right, as if the box held 1,000 crayons. The box holds 100, so the digits move only two places, and one crayon weighs 8.65 grams.

SCORING

1 point for 8.65 grams; 1 point for 86.5 grams; 1 point for saying Ethan divided by 1,000 (moved three places) when the box holds 100 crayons.

5. Find the value of each expression. Then list the letters in order from least to greatest value.

A: $5{,}040 \div 10^3$ B: $4{,}500 \div 10^3$ C: $540 \div 10^2$ D: $50.4 \div 10^2$ (3 points)

ANSWER

A = 5.04, B = 4.5, C = 5.4, D = 0.504. Order: D, B, A, C.

SOLUTION

A: three places right, 5,040 ÷ 1,000 = 5.040 = 5.04.

B: three places right, 4,500 ÷ 1,000 = 4.500 = 4.5.

C: two places right, 540 ÷ 100 = 5.40 = 5.4.

D: two places right, 50.4 ÷ 100 = 0.504.

Compare the ones first: D has 0 ones, B has 4, and A and C have 5. For A and C, compare the tenths: 0 tenths is less than 4 tenths, so 5.04 < 5.4. The order is 0.504 < 4.5 < 5.04 < 5.4, which is D, B, A, C.

SCORING

2 points for the four values (1 point if three are right); 1 point for the order D, B, A, C.

6. Diego says that every three-digit base five numeral is less than every three-digit base ten number. (3 points)

(a) What is the smallest three-digit number in base ten?

(b) What is the largest three-digit numeral in base five? Write it in base ten.

(c) Is Diego right? Explain.

ANSWER

(a) 100 (b) $444_{\text{five}} = 124$ (c) No: $444_{\text{five}} = 124$ is more than the three-digit number 100.

SOLUTION

(a) The smallest three-digit number in base ten is 100.

(b) The largest base five digit is 4, so the largest three-digit base five numeral is 444_{five}:

$$444_{\text{five}} = 4 \times 25 + 4 \times 5 + 4 = 100 + 20 + 4 = 124.$$

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It is one less than the next place, 125.

(c) Diego is wrong. 444_{five} is 124, which is more than 100, so this three-digit base five numeral is greater than a three-digit base ten number. Base five numerals with three digits run from $100_{\text{five}} = 25$ up to 124, and base ten three-digit numbers start at 100, so the two ranges overlap.

SCORING

1 point for 100; 1 point for $444_{\text{five}} = 124$; 1 point for saying Diego is wrong, with 124 > 100 as the reason.

7. (4 points)

(a) Find 0.709×10^4.

(b) Find 0.709×10^5. How many times as much as your answer to (a) is it? Explain.

(c) In 0.709 the 9 is worth 9 thousandths. What is the 9 worth in your answer to (a)?

ANSWER

(a) 7,090 (b) 70,900; it is 10 times as much, because one more factor of ten moves every digit one more place left. (c) 9 tens, or 90

SOLUTION

(a) 10^4 moves every digit four places left. 7 tenths become 7 thousands, 0 hundredths become 0 hundreds and 9 thousandths become 9 tens. The ones place is empty and gets a 0: $0.709 \times 10^4 = 7{,}090$.

(b) 10^5 moves every digit five places left. 7 tenths become 7 ten thousands, 0 hundredths become 0 thousands and 9 thousandths become 9 hundreds. The tens and ones are empty and get zeros: $0.709 \times 10^5 = 70{,}900$. Since $10^5 = 10^4 \times 10$, this is 10 times the answer to (a): 7,090 × 10 = 70,900.

(c) The 9 is in the tens place of 7,090, so it is worth 9 tens, which is 90.

SCORING

1 point for 7,090; 1 point for 70,900; 1 point for "10 times" with a reason (one more factor of ten, or every digit one more place left); 1 point for 90.

8. A number has a 3 in the ones place. It has a 4 worth 0.4, and another 4 worth one hundredth as much as the first 4. Every other digit is 0. (3 points)

(a) Write the number in standard form.

(b) Write it in word form.

(c) Write it in expanded form with fractions.

ANSWER

(a) 3.404 (b) three and four hundred four thousandths (c) $3 + \frac{4}{10} + \frac{4}{1000}$

SOLUTION

(a) A 4 worth 0.4 is in the tenths place. One hundredth as much is two places to the right, since each place is one tenth of the place to its left: the thousandths place, worth 0.004. The hundredths place gets a 0. The number is 3.404.

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(b) Whole part three, then "and", then 404 ending in the thousandths place: three and four hundred four thousandths.

(c) $3 + \frac{4}{10} + \frac{4}{1000}$. Check: 3 + 0.4 + 0.004 = 3.404.

SCORING

1 point for 3.404 with the second 4 in the thousandths place. 1 point for the word form. 1 point for the expanded form.

9. Zoe thinks of a number with two decimal places. Rounded to the nearest tenth, it is 6.5. Rounded to the nearest whole number, it is 6. List every number Zoe could be thinking of. (3 points)

ANSWER

6.45, 6.46, 6.47, 6.48, 6.49

SOLUTION

Numbers that round to 6.5 to the nearest tenth run from the halfway mark 6.45 (halfway rounds up) up to 6.54. The number 6.55 is halfway to 6.6 and rounds up to 6.6, so it is left out.

Numbers that round to 6 to the nearest whole number have a tenths digit from 0 to 4, so they are less than 6.5.

Both must be true, so Zoe's number is from 6.45 to 6.49: 6.45, 6.46, 6.47, 6.48 or 6.49.

SCORING

1 point for the numbers from 6.45 to 6.54 that round to 6.5; 1 point for using that the number is less than 6.5; 1 point for the complete list of five numbers.

10. Maya weighs her school backpack. The scale shows 12.396 pounds. (3 points)

(a) Round the weight to the nearest whole number and to the nearest tenth.

(b) Round the weight to the nearest hundredth.

(c) Ben's backpack weighs a different amount. His scale also shows three decimal places. His weight rounds to the same three answers as Maya's. Give one weight Ben's backpack could have.

ANSWER

(a) 12 and 12.4 (b) 12.40 (c) Any one of 12.395, 12.397, 12.398, 12.399, 12.400, 12.401, 12.402, 12.403, 12.404.

SOLUTION

(a) Whole number: the tenths digit is 3, so 12.396 ≈ 12. Tenth: the neighbors are 12.3 and 12.4. The hundredths digit is 9, so 12.396 ≈ 12.4.

(b) The neighbors are 12.39 and 12.40, because ten hundredths make a tenth. The thousandths digit is 6, so 12.396 ≈ 12.40. The zero stays to show the hundredths place.

(c) Ben's weight must round to 12.40 to the nearest hundredth. The halfway mark below 12.40 is 12.395, and halfway rounds up, so 12.395 works. The halfway mark above is 12.405, which rounds up to 12.41, so the largest weight is 12.404. Every weight from 12.395 to 12.404 also rounds to 12.4 and to 12. Ben's weight is different from Maya's, so it is one of 12.395, 12.397, 12.398, 12.399, 12.400, 12.401, 12.402, 12.403 or 12.404.

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SCORING
1 point for 12 and 12.4; 1 point for 12.40 with the zero shown; 1 point for any one weight from 12.395 to 12.404 other than 12.396.

11. A baseball team sold 2,800,000 tickets this season. (3 points)

(a) Write the number of tickets in expanded form using powers of ten. Leave out the zero terms.

(b) Last season the team sold 10^6 fewer tickets. How many tickets did it sell last season? Write the answer as a number and in expanded form using powers of ten.

ANSWER
(a) $2 \times 10^6 + 8 \times 10^5$ (b) 1,800,000 tickets, which is $1 \times 10^6 + 8 \times 10^5$

SOLUTION
(a) The 2 is in the millions place, six places left of the ones, so it is 2×10^6. The 8 is in the hundred thousands place, five places left, so it is 8×10^5. Every other digit is 0, so those terms are left out:

$$2{,}800{,}000 = 2 \times 10^6 + 8 \times 10^5$$

(b) $10^6 = 1{,}000{,}000$, one million. Taking one million away takes one from the millions digit and leaves every other place alone:

$$2{,}800{,}000 - 1{,}000{,}000 = 1{,}800{,}000$$

In expanded form that is $1 \times 10^6 + 8 \times 10^5$. Only the term for 10^6 changed, from 2×10^6 to 1×10^6.

SCORING
1 point for $2 \times 10^6 + 8 \times 10^5$ with the zero terms left out; 1 point for 1,800,000; 1 point for $1 \times 10^6 + 8 \times 10^5$ (also accept $10^6 + 8 \times 10^5$).

12. In science class, Elena has a balance scale and six weights. They weigh 1, 2, 4, 8, 16 and 32 grams, one of each. (4 points)

(a) Elena balances a pear with the 32, 8, 4 and 1 gram weights. How many grams is the pear? Write its weight in base two.

(b) An apple weighs 54 grams. Which weights balance it? Write 54 in base two.

ANSWER
(a) 45 grams, 101101_{two} (b) the 32, 16, 4 and 2 gram weights; 110110_{two}

SOLUTION
(a) 32 + 8 + 4 + 1 = 45 grams. In base two, write a 1 for each weight used and a 0 for each weight left off, from 32 down to 1: 32 yes, 16 no, 8 yes, 4 yes, 2 no, 1 yes. So $45 = 101101_{\text{two}}$.

(b) Take 32, leaving 22. Take 16, leaving 6. Skip 8, since it is more than 6. Take 4, leaving 2. Take 2, leaving 0. Skip 1. So the 32, 16, 4 and 2 gram weights balance the apple, and $54 = 110110_{\text{two}}$.

SCORING

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> 1 point for 45 grams; 1 point for 101101_{two}, with the zeros for 16 and 2; 1 point for the weights 32, 16, 4 and 2; 1 point for 110110_{two}.

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