From Nano to Life Assessment

1. Where are Rare Earth Elements predominantly found in NATURE for manufacturing purposes? [select one]
    a. the elements wind, water, fire
    b. electronics like hard drives
    c. the minerals bastnasite, monazite, and loparite
    ANSWER: C
    SOURCE

2. What products use Rare Earth Elements to function? [select one]
    a. the elements wind, water, fire
    b. electronics like hard drives
    c. the minerals bastnasite, monazite, and loparite
    ANSWER B
    SOURCE, SOURCE

3. How can Rare Earth Elements be reclaimed from electronic devices? [select many]
    a. high pressure mechanics
    b. harsh chemicals
    c. bioleaching
    ANSWERS: A, B, C
    SOURCE, SOURCE

4. Which method for reclaiming Rare Earth Elements is both a biotechnology and a sustainable practice? [select one]
    a. high pressure mechanics
    b. harsh chemicals
    c. bioleaching
    ANSWERS: C
    SOURCE

5. In order to study individual genes involved in Rare Earth Element recovery, Dr. Schmitz's research team generated gene knockout mutants of the bacteria, *Gluconobacter oxydans*. If you were to research a new bacterial species for bioleaching, how would you determine which genes are present in your species? [select one]
    a. Bacterial growth assay
    b. Nanopore DNA sequencing and genome assembly
    c. chemical reactor processing

    ANSWER B

    SOURCE, SOURCE

6. Choose a testable hypothesis that builds upon the research of Dr. Schmitz and her team of researchers: [select one]
    a. Bacteria isolated from soils rich in rare earth elements can bioleach rare earth elements.
    b. Bioleaching is a function that all bacteria found in rare earth elements possess.
    c. Rare Earth Elements can mutate bacteria for biotechnology applications.

    ANASWER: A

7. Select an experimental approach that would enable researchers like Dr. Schmitz to study the genes from bacteria (AKA "what nature has given us") and use it sustainably recycle electronic waste: [select one]
    a. Isolate and grow new bacteria, extract genomic DNA, QC, rapid barcoding, sequence with Nanopore, assemble genome, explore genes
    b. Grow *E.coli*, extract genomic DNA, QC, rapid barcoding, sequence with Nanopore, assemble genome, explore genes
    c. Isolate new bacteria, extract genomic DNA, QC, rapid barcoding, sequence with Sanger sequencing, assemble genome, explore genes

    ANSWER A

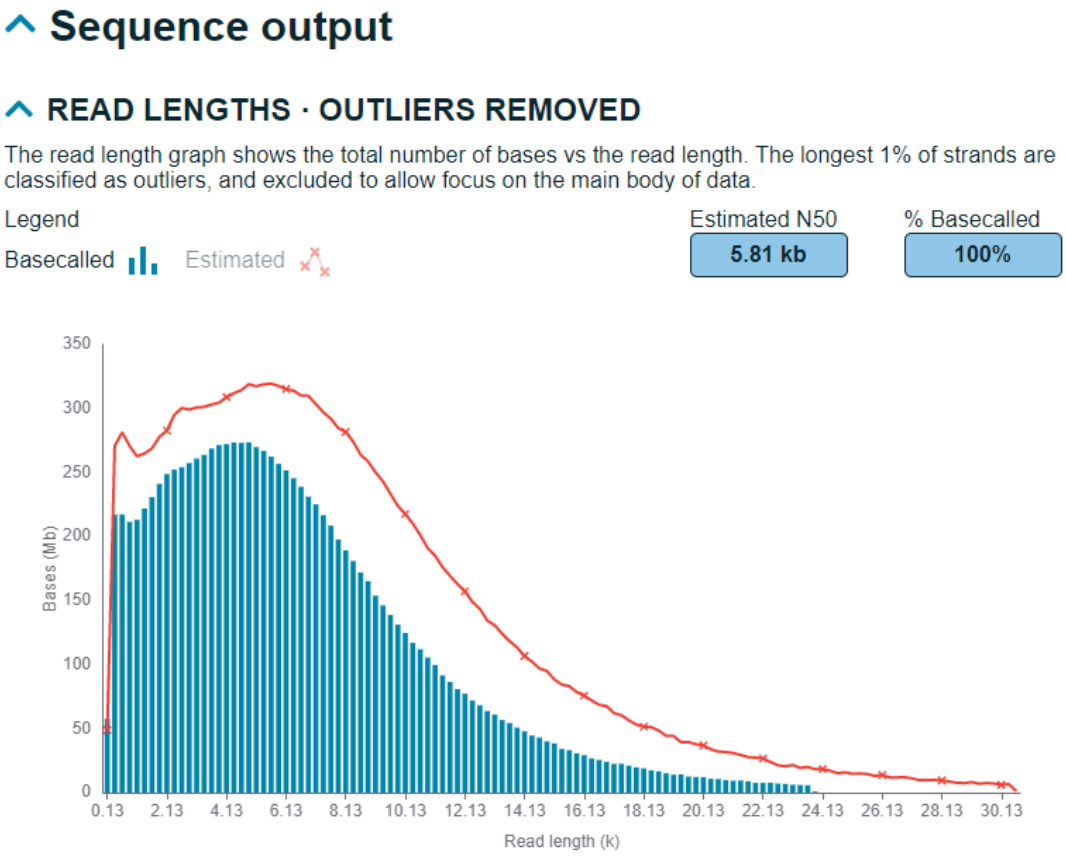
8. Nanopore technology determines the nucleotide base sequences of DNA by... [select one]
    a. Fluorophores
    b. Light detection
    c. Ion currents

    ANSWER C

9. Analyze the Read Lengths data visualization graph of the sequence output that Dr. Goller and Dr. Williams discussed. What does the peak at 5K length indicate? [select one]

a. 250 strands of DNA 5K in length were sequenced
b. One piece of 5K DNA was repeatedly sequenced 250 times
c. Strands of DNA 5K in length account for 250 Mb of our sequence data

ANSWER C



10. Analyze the Quality Score data visualization graph that Dr. Goller and Dr. Williams discussed. Were the Nanopore sequences reliable in the first day (24hrs) of sequencing? [select one]

a. No, the quality scores indicate failed sequences.
b. Some sequences were below the quality.
c. Yes, all the visualized quality scores were above the quality threshold.

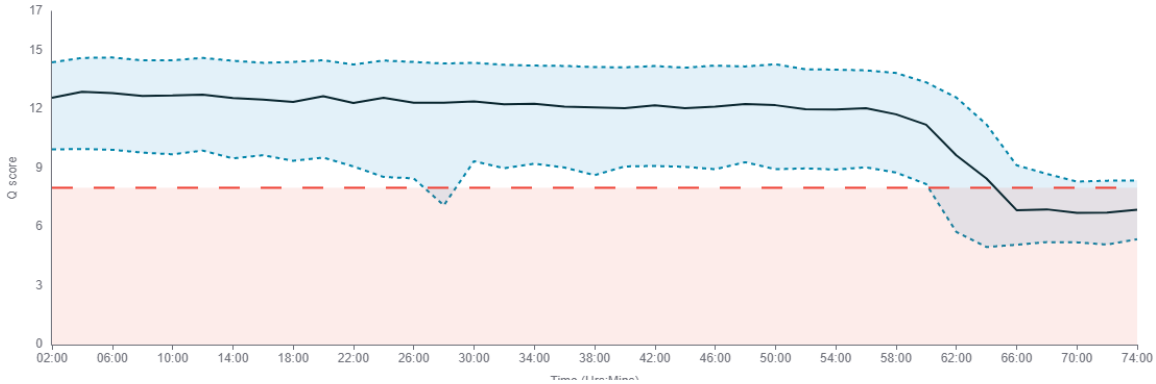
ANSWER: C

QUALITY SCORE

The quality score is calculated as basecalling is performed on your device. Quality score is measured on the logarithmic PHRED scale. Reads that fall below the minimum value of 8 will be classified as failed reads. You can alter the accepted minimum quality score in MinKNOW.

Legend

Mode
The most frequent quality score of reads in the run.

Spread
The spread of quality scores, found by calculating full width half maximum.

Min. quality score
Minimum quality score to be accepted as a passed read.