

Constructed-Response Item 21

21. Describe how DNA and RNA produce the physical characteristics found in organisms. Your answer should describe
- the role of DNA,
 - the sequence of processes involved (including the role of RNA), and
 - how the processes produce the observed physical characteristics.

Scoring Guide for Constructed-Response Item 21

| Score | Description |
|-------|--|
| 4 | Student demonstrates thorough understanding of how cells transmit information through DNA and RNA. Response completely describes the roles of DNA and RNA in producing the physical characteristics observed in organisms. Response contains no errors. |
| 3 | Student demonstrates broad understanding of how cells transmit information through DNA and RNA. Response generally describes the roles of DNA and RNA in producing the physical characteristics observed in organisms. Response contains an error or an omission. |
| 2 | Student demonstrates limited understanding of how cells transmit information through DNA and RNA. Response partially describes the roles of DNA and/or RNA in producing the physical characteristics observed in organisms. Response contains errors and/or omissions. |
| 1 | Student demonstrates little understanding of how cells transmit information through DNA and RNA. Response minimally describes the role of DNA OR RNA. |
| 0 | Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured. |
| Blank | No response. |

Training Notes for Constructed-Response Item 21

Although this item will likely be scored holistically, there are four major links in the sequence:

1. DNA in the nucleus contains genes, the codes for the physical traits.
2. The coding in the DNA is transferred to RNA.
3. The RNA molecules move from the nucleus to the cytoplasm to construct protein molecules.
4. Proteins make up the structure of the observed physical characteristics or catalyze the chemical reactions (enzymes) that result in the observed physical characteristics.

Note:

A 4-point answer does not need to include specific details such as:

- codes occur in triplets
- A (adenine) combines with T (thymine) and C (cytosine) combines with G (guanine)
- there are three kinds of RNA

21. DNA's main function is to give sequences that create proteins (protein synthesis). Different sequences yield different proteins. The absence ~~and~~ or presence of proteins determines characteristics. Protein A present protein B not \Rightarrow characteristic A, Protein B present A not \Rightarrow characteristic B, both A and B present \Rightarrow characteristic AB, neither A nor B present \Rightarrow that characteristic not present. As said above, DNA has sequences, these are made of three bases (A, T, C, G) which work together to code a protein. but, a order for the protein to affect the proper parts of the organism. RNA must replicate, transfer, and deliver the protein by first cutting a double helix of DNA, interposing itself into one side of the split helix, matching up with proper base pairs and basically taking the protein information out of cell's nuclei into the cytoplasm and onto the endoplasmic reticulum which "reads" this protein sends it to the Golgi bodies which package and transport this protein so it can be utilized to ~~the~~ produce a characteristic.

Summary annotation statement:

This response provides a clear explanation of how traits are encoded by DNA and produced by protein. The response also explains the creation and function of RNA as a means of transferring the encoded information to the site of protein synthesis. The response is thorough and receives a score of 4.

21.

DNA is the blueprint of all organisms. Its sequences of nucleotides decide which proteins and enzymes an organism will produce. RNA is the "translator" of these sequences. It attaches itself to a strand of DNA and copies a segment of coding then transfers that to another special RNA which translates these codes into proteins. These proteins create enzymes which are the base of all the chemical processes in an organism.

Summary annotation statement:

This response explains that DNA is a "blueprint" and that its sequences encode the protein. The response also explains that RNA copies DNA, and then that code is used to produce protein. The response does not provide any detail of how RNA molecules move from the nucleus to the site of protein synthesis. The response is general and receives a score of 3.

21. We all have unique and different structures of DNA (deoxyribonucleic acid). It contains the entire works of our personal genetic codes. It is made of the four proteins adenine, guanine, cytosine, and thymine. Our DNA is there sort of like a blueprint. It has all of the information that the RNA (ribonucleic acid) needs to construct the same genetic code in a different yet replica cell. Transfer-RNA (t-RNA) and Messenger RNA (m-RNA) help in this process as they perform the replication of your DNA and transfer the information (through translation) to the new cell. The genetic codes determine all of your physical features of you from the color of your eyes to the size of your knee cap.

Summary annotation statement:

This response provides some valid information, including the description of DNA as a “blueprint,” the link between genetic codes and physical features, RNA’s involvement in transferring genetic codes, and the four components of DNA. The response incorrectly identifies the components of DNA as proteins. The response also incorrectly indicates that the role of RNA is to pass on genetic information to the new cell. The response does not present any correct information about the role of protein. The response is limited and earns a score of 2.

21. DNA and RNA produce physical characteristics found in organisms. DNA is a genetic code that has been passed to you from mom & dad. DNA & RNA work together to create physical characteristics.
ex: if your mother is tall and has dark hair there is a 50% chance the child will to.

Summary annotation statement:

This response identifies DNA as a genetic code that is inherited and determines physical characteristics. The response is minimal and earns a score of 1.

21. Dna runs your body it is your body if one Dna dies & more are made.

Summary annotation statement:

This response contains no information that correctly responds to the question. No credit is earned.

Constructed-Response Item 22

22. Use the information below to answer this question.

Formulas

voltage = current \times resistance

power = voltage \times current

Units of Measure

current: ampere

resistance: ohm

power: watt

voltage: volt

Wires connect a lightbulb to the terminals of a 12-volt battery. The total resistance of the circuit is 4 ohms.

- Calculate the amount of current flowing through the circuit. Show your work.
- Calculate the circuit's power. Show your work.
- If the total resistance of the circuit were greater than 4 ohms, what would happen to the power? Explain your reasoning.

Scoring Guide for Constructed-Response Item 22

| Score | Description |
|-------|--|
| 4 | Student demonstrates thorough ability to use mathematics to describe and predict electrical activity. Response correctly answers all four parts of the item (a, b, and both parts of c)—how much current flows in the circuit, the power of the circuit, how the power would be affected by a greater resistance, and why the power would be affected in that way. |
| 3 | Student demonstrates general ability to use mathematics to describe and predict electrical activity. Response correctly answers at least three parts of the item. Response contains an error or omission. |
| 2 | Student demonstrates limited ability to use mathematics to describe and predict electrical activity. Response correctly answers at least two parts of the item. Response contains errors or omissions. |
| 1 | Student demonstrates little ability to use mathematics to describe and predict electrical activity. Response minimally answers one part of the item. |
| 0 | Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured. |
| Blank | No response. |

Training Notes for Constructed-Response Item 22

a. Worth up to 1 point: current = voltage/resistance = 12 volts/4 ohms = 3 amperes

Note: No units or incorrect units receive only $\frac{1}{2}$ point.

b. Worth up to 1 point: power = voltage \times current = 12 volts \times 3 amperes = 36 watts

Note 1: Students should receive full credit for part b if they use the correct formula but an erroneous current based on an incorrect calculation in part a.

Note 2: No units or incorrect units receive only $\frac{1}{2}$ point.

c. Worth up to 2 points: The power would decrease. It would decrease because the greater resistance means less current flows through the circuit.

Note: The unit is part of the answer, $-\frac{1}{2}$ point for parts a and b if the unit is missing. Convert half points back to the original whole number rubric as shown below.

4 = 4 points

3 = 3 or $3\frac{1}{2}$ points

2 = 2 or $2\frac{1}{2}$ points

1 = $\frac{1}{2}$, 1, or $1\frac{1}{2}$ points

22.

a. voltage = current \times resistance, so current = $\frac{\text{voltage}}{\text{resistance}}$
 current = $\frac{12 \text{ volts}}{4 \text{ ohms}} = \boxed{3 \text{ amperes}}$

b. power = voltage \times current
 power = (12 volts)(3 amperes)
 power = $\boxed{36 \text{ watts}}$

c. If the total resistance was greater than 4 ohms, the amount of power would decrease because there would be less current, and thus less power.

ex. current = $\frac{12 \text{ volts}}{6 \text{ ohms}}$ current = 2 amperes
 power = (12 volts)(2 amperes) = 24 watts

Summary annotation statement:

This response earns credit in Parts A and B for correct answers, 3 amperes and 36 watts, with relevant work for the appropriate formulas. Part C correctly explains that with an increase in resistance the power would be less. It goes on to say that with an increase in resistance "there would be less current, and thus less power." The response is thorough, provides the correct units and supportive work, and earns a score of 4.

- 22.
- A. Current is = $12 \div 4 =$ current current = 3
- b. $3 \times 12 = 36$ power = 36
- c. The power would decrease because the more ohms to divide into voltage the less the current current is, resulting in less power.

Summary annotation statement:

This response provides the correct answers for all sections and shows supporting work with appropriate formulas. However, the response does not provide units for the calculated values. This is a more general response and earns a score of 3.

22. (a) voltage = current \times resistance
 $12 = c \cdot 4 \rightarrow 12 = 4c \rightarrow 3 = c$

3 amperes

(b) power = voltage \times current

$P = 12 \cdot 3 \rightarrow \text{Power} = \mathbf{36 \text{ watts}}$

(c) It would increase. If you increased the resistance in the equation: voltage = current \times resistance, then you would get a higher voltage. Because of the voltage increase, the power would increase:
 power = voltage \times current.

Summary annotation statement:

This response correctly answers Parts A and B, including units and supporting work with appropriate formulas. For Part C, the response indicates that with an increase in resistance “you would get a higher voltage,” resulting in increased power. This is incorrect, so Part C does not receive credit. Overall, the response is limited and earns a score of 2.

22. A) there would be 3 ampere $12 = C \times 4$
 B) the circuits power is 12
 C) It would overheat and shut down because the rest of the circuit wouldn't be able to handle it.

Summary annotation statement:

This response has a correct answer for Part A, 3 amperes, with supportive work and units. Part B has an incorrect value, 12, with no supportive work. Part C does not directly address the issue of power and makes an incorrect prediction about the circuit in general. The response earns credit for Part A only. The response is minimal in scope and earns a score of 1.

22. A.
 $\text{power} = \text{voltage} \times \text{current}$
 $\text{power} = 12 \times 4 \text{ ohm} =$
power = 48 amperes

B.
 $\text{voltage} = \text{current} \times \text{resistance}$
 $\text{voltage} = 48 \text{ amperes} \times 4 \text{ ohms} =$
192 watts

C, the power would increase because it would double.

Summary annotation statement:

Parts A, B, and C all have incorrect answers. Calculations are based on incorrect use of the formulas that were provided. No credit is earned.