Montana Comprehensive Assessment System *(MontCAS, Phase 2)*

Criterion-Referenced Test (CRT)

COMMON CONSTRUCTED-RESPONSE ITEM RELEASE
SCIENCE, GRADE 10

2008

OPI

OFFICE OF PUBLIC INSTRUCTION

© 2008 Measured Progress. All rights reserved.

For information, contact Measured Progress, P.O. Box 1217, Dover, NH 03821-1217.
Printed in the United States of America.

Science
Session 1

Write your answer in the space provided for it in your Student Response Booklet.

27. A student has a toy car. When she pulls it backward and then releases it, the toy car moves forward.
    a. Identify **two** forces acting on the toy car besides the force that pushes it forward.
    b. The mass of the toy car is 0.05 kg, and the car accelerates 0.1 m/s^2 when released. Calculate the net force acting on the car. Be sure to provide correct units with your answer.

Scoring Guide

Score	Description
4	Response demonstrates thorough ability to describe and compute the net force that causes the toy car to change its motion. Response contains no errors or omissions.
3	Response demonstrates general ability to describe and compute the net force that causes the toy car to change its motion. Response contains an error or omission.
2	Response demonstrates partial ability to describe and compute the net force that causes the toy car to change its motion. Response contains errors or omissions.
1	Response demonstrates minimal ability to describe and compute the net force that causes the toy car to change its motion. Response is minimal.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Scoring Notes

Part a: Other forces include friction, gravity, air resistance, the initial backwards force exerted by the student, and the upward force exerted by the ground. Note: Inertia is not a force and is not acceptable for credit.

Part b: Net force = mass of toy car × acceleration $0.05\ \text{kg} \times 0.1\ \text{m/s}^2 = 0.005\ \text{N}$

For full credit, student may give:

1. simply .005 N (the correct answer with the correct unit), or
2. the complete calculation along with the answer given in units of kg m/s^2
   [$0.05\ \text{kg} \times 0.1\ \text{m/s}^2 = 0.005\ \text{kg m/s}^2$]

For partial credit, student may give:

1. the correct setup for the calculation, or
2. simply 0.005 kg m/s^2

Part (a) is two points and part (b) is two points.

Score Point 4

a) gravity in the vertical ; air resistence in the horizontal

• gravity keeps the car from floating away

• air resistence stops the forward velocity

mass = .05 kg F = ma F = .1 m/s² • .05 kg =

acceleration = .1 m/s² F = .005 N

Force = ?

Score Point 3

A) Inertia and friction

b) .05 kg · .1 m/s² = .005 kg m/s²

Score Point 2

A. Air resistance, gravity.

B. $.05 \div .1 m/s^2 = 9.6 \times 10^{-6} - 9 = .6^{6}$

Score Point 1

a. Two forces that are acting on the car are gravity and Inertia.

b. 0.1 ÷ 0.05 = 2 2N

Score Point 0

Pressure and strenght.

$0.05 \div 0.1 \, M/s^2 = .5 \, M/s^2$

Science
Session 3

Write your answer in the space provided for it in your Student Response Booklet.

81. Mitosis (nuclear division in nonsex cells) is an important cell process. Describe **four** features or processes of mitosis.

Scoring Guide

Score	Description
4	Student demonstrates thorough understanding of the process of mitosis. Response completely describes four features of mitosis. Response contains no errors or omissions.
3	Student demonstrates general understanding of the process of mitosis. Response describes three features of mitosis. Response contains an error or omission.
2	Student demonstrates partial understanding of the process of mitosis. Response describes two features of mitosis. Response contains errors or omissions.
1	Student demonstrates minimal understanding of the process of mitosis. Response describes one feature of mitosis. Response is minimal.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response.

Scoring Notes

Features of mitosis include:

- requires the replication of DNA
- involves only one division of nuclear material
- has four stages (prophase, metaphase, anaphase, telophase)
- all individual chromosomes line up in the center of the cell
- uses structures called spindle fibers to separate copies of the chromosomes
- results in two daughter cells
- produces identical/clone cells (the cells are genetically identical to each other and the parent cell)
- occurs in animals, plants, fungi, protists (all eukaryotic organisms)
- excludes mature red blood cells, nerve cells, and muscle cells, as well as sex cells
- responsible for growth and repair of the body and asexual reproduction

Note: An acceptable response may include four other facts about mitosis other than the four stages.

Background information on mitosis:

In a dividing cell, the mitotic phase alternates with a growth period called interphase. During interphase, the cell performs its normal functions and duplicates the chromosomes. Other organelles are also manufactured during this time, and during mitosis, these other organelles are partitioned roughly equally between the two new daughter cells. The four basic stages of mitosis are:

Prophase: The nuclear membrane (also called nuclear envelope—a membrane surrounding the nucleus) seems to disappear. The chromatin (the material that forms the chromosomes) condenses into discrete chromosomes. Each duplicated chromosome appears as two identical sister chromatids joined together at the centromere. The mitotic spindle (protein fibers) begins to form. The spindle is composed of two centrosomes (each containing a pair of centrioles) and the microtubules that extend from the centrosomes. The centrosomes

begin to migrate to opposite poles of the cell.

Metaphase: The centrosomes are now at opposite ends of the cell. The chromosomes line up in the middle of the cell along the spindle fibers. They are attached to the spindle at the kinetochore (a specialized protein structure located at the centromere).

Anaphase: The sister chromatids of each chromosome suddenly part and move to opposite sides of the cell, towards the centrosomes. At the end of anaphase, the two poles of the cell have equal and complete numbers of chromosomes.

Telophase: The two daughter cells begin to form. The nuclear membrane reforms. The chromosomes become less condensed. Cytokinesis occurs (the division of the cytoplasm between the two new daughter cells). In animal cells, a cleavage furrow forms which pinches the cell in two. In plant cells, a cell plate forms and becomes a new cell wall as the two new daughter cells separate.

Score Point 4

Mitosis has a very delicate process. The first step in mitosis is Prophase, where chromatin condunses into sister chromatids, a spindle made from microtubules forms, and the nuclear envelope breaks down. In the next step, Metaphase, the sister chromatids are lined up along the center of the cell. Next, in Anaphase, the sister chromatids are split into daughter chromosomes. In the last step, Telephase, the nuclear envelope reforms, the spindle disappears, and the nucleolus reforms. All of these steps, combined with the process of Cytokinesis, finishes out the process known as the cell cycle.

Score Point 3

1) Prophase - In prophase spindles are formed within a cell

2) Metaphase - In Metaphase the chromatids move to the spindles of the cell.

3) Anaphase - In anaphase the two daughter cells split.

4) Telophase - In telophase the two seperated daughter cells begin two grow + start the cycle over.

Score Point 2

Mitosis is the spliting of a cell to create two sister cells. The cell goes through a growth stage before it splits In an animal cell, the cell is pulled apart from opposing sides of the cell In plant cells, a cell plate grows in the middle of the cell causing the split. The product of Mitosis are two identical cells

Score Point 1

The cell divides into two seperate parts after nuclear cell division.

Score Point 0

Chromosomes, meiosis,