Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Class\_\_\_\_\_

QUIZ ANSWER KEY

Introduction to Robotics: Part 3

1. The propulsion system is also called the:
   1. Structural system
   2. Motion system
   3. Control system
   4. Sensor system
2. Which gear always goes in the numerator of a gear ratio calculation?
   1. The driving gear
   2. The driven gear
   3. Either, it doesn’t matter
   4. Neither, this is not the way you calculate gear ratio
3. The gear ratio of 2 gears with the same pitch is the same as:
   1. The ratio of the diameters
   2. The ratio of the number of gear teeth
   3. The ratio of the circumferences
   4. All of the above
4. Which device converts electrical energy into mechanical energy?
   1. Generator
   2. Battery
   3. Light bulb
   4. Motor
5. How do we control the speed of a DC motor?
   1. By changing the wires
   2. By converting from DC to AC
   3. By changing the amount of DC voltage
   4. You cannot control the speed of a DC motor
6. What is the relationship between DC motor speed and DC motor current?
   1. They are inversely related
   2. They are directly related
   3. It depends on the gear ratio
   4. There is no relationship between DC motor speed and DC motor current
7. What symbol do we use for angular velocity?
   1. Ω
   2. ω
   3. ϕ
   4. τ
8. What term is common for angular velocity in America?
   1. RPM
   2. MPH
   3. MPG
   4. Radians per second
9. Which of the following gets electricity into the rotor?
   1. Axle
   2. Stator
   3. Commutator
   4. Brushes
10. Which of the following switches voltage polarity during rotation?
    1. Axle
    2. Stator
    3. Commutator
    4. Brushes
11. Which of the following connects the motor to the external load?
    1. Axle
    2. Stator
    3. Commutator
    4. Brushes
12. What symbol is used for torque?
    1. Ω
    2. ω
    3. ϕ
    4. τ
13. CEMF is directly proportional to:
    1. Current
    2. Torque
    3. Angular velocity
    4. Terminal resistance

Given the following characteristics for a motor: (all values are at 7.2 V)

Free Speed: 43 RPM

Stall Torque: 24 in·lbs

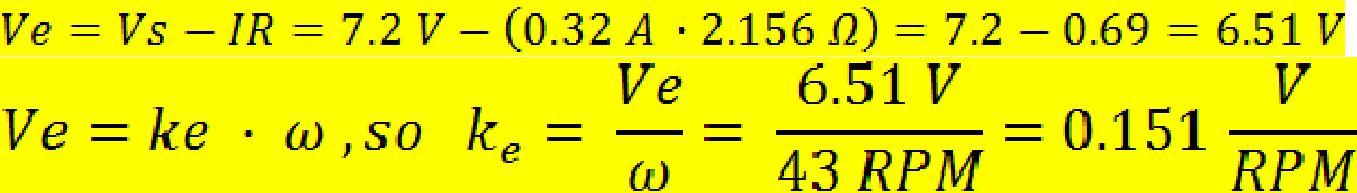
Stall Current: 3.34 amps

Free Current: 0.32 amps

1. What is the terminal resistance for this motor?



1. What is the constant of proportionality (ke) for the motor in question 14?



1. If the load applied to the motor in question 14 is 10 in-lb, what is the speed of this motor?

 **= 25.08 RMP**

1. What current would this motor draw at the speed calculated in question 16?



 **=** 

1. What is the optimal speed of the motor in question 16?

Half of 43 RPM, or 21.5 RPM

1. What makes this speed the optimal speed?

The torque applied to the motor will be exactly one half stall torque

1. What would you have to do to get this motor to its optimal speed?

Add a gear train with a gear ratio of  or 1.2, meaning a gear with 10 teeth driving a gear with 12 teeth

1. Describe 3 things gears are used for.

To change a speed of rotation, to change a torque, to change the direction of motion of the torque

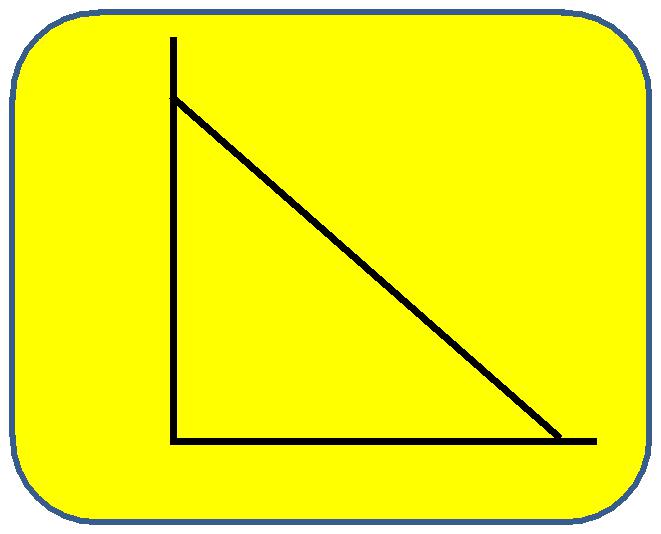
1. Describe 2 things that happen to a DC motor when physical load (like the weight of a robot) increases.

Motor speed decreases, motor current increases

1. Describe why you get generator action in a motor.

Because you have a conductor moving through a magnetic field, which are the conditions necessary for electrical generation.

1. Draw a plot of speed vs. torque for a DC motor.



1. Draw a plot of current vs. torque for a DC motor.

