



*Department of Mathematics
and General Sciences*

Physical Science (SCI101)
Second Major Exam

Second Semester, Term 132
Date: Sunday 27/4/2014

Name:	
ID number:	
Section number or time:	
Instructor's name:	

Important instructions:

1. Examination time: 60 minutes.
2. Write your name before starting with the questions.
3. **Switch off your mobile phone** and put any books and notes away.
4. You should have 5 pages in total, including this page and a scratch paper.
5. You may use a calculator but you may *not* borrow one.

Good Luck!

Mark

Part 1: 10 multiple choice questions, 1 point each. Circle the letter of the most correct answer using a pen. Use $g = 10 \text{ m/s}^2$ and $G = 6.67 \times 10^{-11} \text{ N.m}^2/\text{kg}^2$.

- Q1. Falling on sand is safer than falling on solid floor because:
a) the time of impact is reduced which increases the force of impact
b) both the time of impact and the force of impact are reduced
c) the time of impact is increased which reduces the force of impact
d) both the time of impact and the force of impact are increased
- Q2. Consider a ball thrown straight up. During its flight (neglecting air resistance):
a) its mechanical energy remains unchanged
b) its kinetic energy is conserved
c) its potential energy remains zero
d) All of the above
- Q3. A mouse has a kinetic energy of 20 J. If it doubles its speed then its kinetic energy becomes:
a) 40 J b) 60 J c) 80 J d) 30 J
- Q4. The gravitational attractive force between two objects is 0.01 N when they are 6 m apart. What is the force between them when the distance between them becomes 2 m?
a) 0.09 N b) 0.02 N c) 0.03 N d) 0.003 N
- Q5. What is the momentum of a 1200 kg car moving at 90 km/h?
a) 108000 N.s b) 13.3 N.s c) 48 N.s d) 30000 N.s
- Q6. A car having a momentum of 20000 N.s hits a wall and stops in 0.2 seconds. How much force is exerted on the car?
a) 100000 N b) 4000 N c) 20000 N d) 8000 N
- Q7. The kinetic energy of a bike is increased from 1500 J to 2000 J. How much total work was done on the bike?
a) 2000 J b) 500 J c) 3500 J d) -500 J
- Q8. A 0.1 kg falling ball hits the ground at 10 m/s and bounces back at 7 m/s. How much impulse is delivered to the ball?
a) 14.5 N.s b) 0.3 N.s c) 1.7 N.s d) 0.45 N.s
- Q9. If a 60% efficient machine is supplied with 200 J of energy, how much is its useful energy output?
a) 140 J b) 60 J c) 80 J d) 120 J
- Q10. What is the gravitational attractive force between two identical school buses, each having a mass of 16000 kg, when the distance between their centers is 3 m?
a) $5.7 \times 10^{-3} \text{ N}$ b) $1.6 \times 10^4 \text{ N}$ c) $1.2 \times 10^{-6} \text{ N}$ d) $1.9 \times 10^{-3} \text{ N}$

End of part 1

Part 2: Solve each of the following three problems. **Show all the steps of your work in the provided space** and include the appropriate units. Use $g = 10 \text{ m/s}^2$.

Q1. (4 points) On a horizontal floor, a man pulls a 20 kg crate for a distance of 5 m from rest. He applies a horizontal pulling force of $F_1 = 60 \text{ N}$, and the force of friction between the crate and the ground is $F_2 = 10 \text{ N}$. Calculate:

a) The work done by the man

b) The work done by friction

c) The work done by gravity

d) The final speed of the crate

Q2. (3 points) While on ice, a 70 kg skater (moving at 3 m/s) crashes with another 50 kg skater (moving at 1.2 m/s in the same direction). He grasps the other skater and they continue moving together. Ignoring frictional forces, calculate their speed after the crash.

- Q3. (3 points) A 0.2 kg stone is dropped from rest from the top of a 20 m high building. Ignoring air resistance, calculate:
- a) The initial mechanical energy of the stone

b) The potential and kinetic energies of the stone after falling 5 m

c) The kinetic energy of the stone just before hitting the ground

End of part 2

*Scratch paper. **DO NOT** remove*