PRINCE SULTAN UNIVERSITY
جامعة الأمير سلطان

Department of Mathematics and General Sciences

Physical Science (SCI101) Final Exam

Second Semester, Term 132
Date: Wednesday 28/5/2014

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

Important instructions:

1. Examination time: 120 minutes.
2. **Write your name** before starting with the questions.
3. **Switch off** your mobile **phone** and keep any books and notes away.
4. You should have 7 pages in total, including this page and a scratch paper.
5. You may not borrow a calculator.

Good Luck!

Mark

Part 1: 16 multiple choice questions, 1.5 points each. Circle the letter of the best answer using a pen. Assume $\boldsymbol{g = 10\ m/s^2}$.

Q1. The unit of power, watt, is the same as:
a) J.s b) J/s c) J.m d) J/m

Q2. A 7 kg bowling ball experiences a net force of 14 N. What will be its acceleration?
a) 7 m/s^2 b) 98 m/s^2 c) 0.5 m/s^2 d) 2 m/s^2

Q3. The statement by Newton that "for every action there is an equal but opposite reaction" is regarded as which of his laws of motion?
a) first b) second c) third d) forth

Q4. What is the momentum of a 0.1 kg baseball thrown at 40 m/s?
a) 80 N.s b) 4 N.s c) 40 N.s d) 2 N.s

Q5. If the velocity of a ball is tripled, its kinetic energy is increased by a factor of:
a) 3 b) 6 c) 9 d) 27

Q6. When an object is dropped from a tower, what is the effect of the air resistance as the object falls?
a) It does a positive work
b) It increases the object's kinetic energy
c) It increases the object's potential energy
d) None of the above choices is valid

Q7. The impulse experienced by a body is equivalent to the change in:
a) its velocity
b) its kinetic energy
c) its momentum
d) None of the above

Q8. A ball is rolled on sand. It starts at 5 m/s, moves in a straight line for 4 seconds, and then stops. What is the magnitude of the ball's deceleration?
a) 10 m/s^2 b) 20 m/s^2 c) 1.25 m/s^2 d) zero

Q9. A hydraulic jack is used to lift a 1400 kg car. The area of the small piston in the jack is 50 cm^2 and the area of the large piston is 1250 cm^2. What is the minimum force that must be applied on the small piston to keep the car on the large piston at the desired height?
a) 560 N b) 35000 N c) 14000 N d) 250 N

Q10. A 7 kg bowling ball falls from rest from a 2 m shelf. Just before hitting the floor, what will be its kinetic energy? (neglect air resistance)

a) 70 J b) 140 J c) 45 J d) 28 J

Q11. An automobile of mass 2000 kg moving at 30 m/s is braked suddenly with a constant braking force of 10000 N. How far does the car travel before stopping?

a) 30 m b) 60 m c) 90 m d) 20 m

Q12. A player kicks a ball at rest and it gains a speed of 30 m/s. If the ball has a mass of 0.5 kg and time of contact with the football is 0.025 s, what is the force exerted on the foot?

a) 190 N b) 380 N c) 900 N d) 600 N

Q13. If the gravitational attractive force between a 3×10^6 kg and a 2×10^6 kg objects at a certain distance is 2 N, what will be the gravitational attractive force between a 6×10^6 kg and a 1×10^6 kg objects at the same distance?

a) 1 N b) 8 N c) 4 N d) 2 N

Q14. A gas has a volume of 60 m^3 when its pressure is 20 Pa. What will be its pressure if its volume is decreased to 20 m^3 under constant temperature?

a) 60 Pa b) 30 Pa c) 10 Pa d) 120 Pa

Q15. A barometer is used to measure the pressure at a certain location. The height of the mercury (Hg) reads 72 cm. Given the density of mercury $\rho_{\mathrm{Hg}} = 13.5$ g/cm^3, what is the pressure at that location in kPa? (Assume g = 10 m/s^2)

a) 101.2 kPa b) 97.2 kPa c) 90.3 kPa d) 101.3 kPa

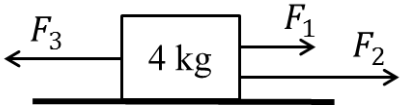
Q16. Concerning the upward lift force produced by airplane wings, which of the following sentences is correct:

a) The pressure above the wing is reduced because air flows faster than below the wing
b) The pressure above the wing is reduced because air flows slower than below the wing
c) The pressure above the wing is increased because air flows faster than below the wing
d) The pressure above the wing is increased because air flows slower than below the wing

End of Part 1

Part 2: Solve the following 5 problems. **Show your work** in the provided space and include the appropriate **units**. Assume $\boldsymbol{g = 10\ m/s^2}$.

Q1. (5 points) A 4 kg box initially at rest on a horizontal surface is pulled by two horizontal forces $F_1 = 6$ N and $F_2 = 11$ N to the right. A friction force of $F_3 = 9$ N also acts on the box, as shown. Calculate:



a) The net force acting on the box (magnitude and direction)

b) The acceleration of the box (magnitude and direction)

c) The total work done on the box after travelling a distance of 4 m.

d) Use the work-energy theorem to calculate the speed of the box after travelling a distance of 4 m.

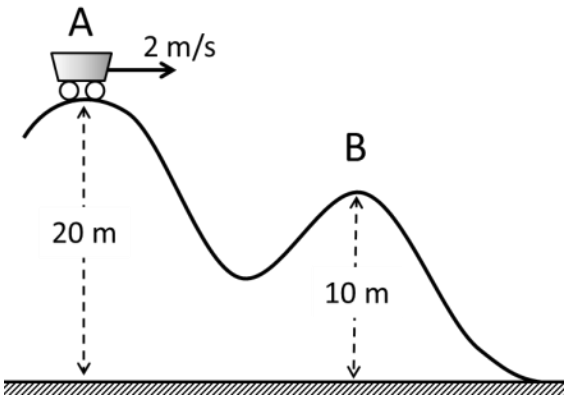
Q2. (2 points) A stone is dropped (from rest) from a 30 m high cliff. Ignoring air resistance, calculate:

a) Its speed after 2 seconds.

b) Its height after 2 seconds.

Q3. (3 points) A 1500 kg car travelling east at 90 km/h collides in a head-on collision with a 1200 kg car travelling west at 108 km/h. The two cars stick and move together after the collision. Calculate their speed just after the collision

Q4. (4 points) A 400 kg roller coaster reaches point A at 2 m/s and continues to move under its own weight, as shown. Neglecting frictional forces, what will be its speed at point B?



Q5. (4 points) A 70 kg person floats in the Dead Sea where the density of water is 1.24 g/cm^3. The average density of his body is 0.95 g/cm^3. Answer the following:

a) How much buoyant force acts on the man?

b) Calculate the volume of the man's body

c) Calculate the volume of the man's body under water

End of Part 2

Scratch paper. KEEP ATTACHED