Prince Sultan University

Department of Mathematics & Physics

SCI 101- General Sciences

Final Exam

First Semester, Term 151

Thursday 24/12/2015

Examination Time : 120 minutes

Name (Please Print). . . . . .

Student I.D. . . . . .

Section No. . . . . .

Instructor. . . . . .

Important Instructions:

1. You can use a scientific calculator that does not have programming or graphing capabilities.

*2. You may **NOT** borrow a **calculator** from anyone.*

*3. Do not use **RED pen**.*

*4. This is a closed books and notes exam. Do **NOT** use notes or textbooks.*

*5. There should be **NO** talking during the examination.*

*6. Your will be **expelled** immediately from the exam if your mobile phone is seen or heard.*

*7. Any signs of **cheating** may cause you being expelled from the exam.*

*8. This examination has **2 parts**. **Part 1** has **20 multiple choice questions**, each question worth **1 point**. **Part 2** has **five workout problems** each problem worth **4 points**.*

Make sure your paper has all the questions and problems.

Part 1: 20 Multiple Choice Questions (1 mark each)

1) Which of the following is considered acceleration?

a) Speeding up. b) Stopping. c) Changing direction. d) all of the these.

2) If a car is decelerating at a rate of 3 m/s^2, how long does it take the car to reduce its speed from 39 m/s to 18 m/s?

a) 7 s b) 19 s c) 24 s d) 18 s

3) If a book is pulled to the right with a force of 8 N and to the left with a force of 3 N, then the net force on the book is

a) 3 N left b) 11 N right c) 5 N right d) 5 N left

4) A ball is dropped from rest from the top of a tall building. If the ball reaches the ground in 13 seconds, what is the height of the building?

a) 100 m b) 404 m c) 845 m d) 950 m

5) When a ball is thrown upwards, it reaches a maximum height and falls back to the ground. At its highest point

a) its acceleration is zero. b) its velocity is zero.

c) the net force on it is zero. d) all of the above.

6) No work is done by gravity on a bowling ball that rolls along a horizontal bowling alley because

a) no force acts on the ball.

b) no distance is covered by the ball.

c) no potential energy is being converted to kinetic energy.

d) the force on the ball is at right angles to the ball's direction of motion .

7) A running dog has a kinetic energy of 450 J. If it doubles its speed its kinetic energy becomes:

a) 1800 J b) 900 J c) 225 J d) 112.5 J

8) The total work required to increase the speed of a 1500 kg car from 2 m/s to 4 m/s is:

a) 3 kJ b) 18 kJ c) 9 kJ d) 15 kJ

9) Which one of the following four sentences is Pascal's principle?
a) As long as the temperature does not change, gas pressure multiplied by its volume is always constant.
b) An immersed body is buoyed by a force that is equal to the weight of the fluid it displaces.
c) A change in pressure at any point in an enclosed fluid at rest is transmitted to all points in the fluid.
d) Where the speed of the fluid increases, internal pressure in the fluid decreases.

10) A rock, which weighs 1400 N in air, has a weight of 900 N when completely submerged in fresh water of density 998 kg/m^3 . The volume of the rock is:

a) 0.14 m^3 b) 0.6 m^3 c) 0.9 m^3 d) 0.05 m^3

11) A piece of metal is heated to a temperature of 288 K. What is that temperature in Fahrenheit ^oF?
a) 1041.8 b) -9.4 c) 59 d) 293.9

12) Cooler fluids sink through warmer fluids. This fact causes

a) heat to be transferred by Conduction. b) heat to be transferred by Convection.

c) heat to be transferred by radiation. d) all of the above.

13) How much water at 100 ^oC can you evaporate using 564 kJ of thermal energy? Given that the latent heat Vaporization of water is 2256000 J/kg.

a) 0.25 kg b) 4 kg c) 4000 kg d) 0.00025 kg

14) Which of the following is **true** concerning specific heat capacity?

a) Materials with large values of specific heat capacity take longer time to change temperature compared to materials with small values of specific heat capacity when given the same thermal energy.

b) The unit with which specific heat capacity is measured is J/kg.

c) Specific heat capacity of an object depends on its mass.

d) Specific heat capacity of an object depends on its temperature.

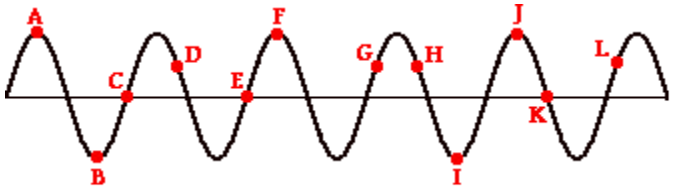
15) How many calories are there in 702 joules?

a) 227 b) 40 c) 168 d) 2934

16) The relationship $v = \lambda f$ between the wave speed, wavelength, and wave frequency is true for

a) water waves only. b) sound waves onl c) light waves only. d) all waves.

17) In the shown figure, which of the following represents a wavelength?



a) The distance from point A to point F. b) The distance from point B to point I.

c) The distance from point H to point L. d) The distance from point C to point E.

18) Which of the following is **NOT** true about standing waves:

a) Standing waves appear to be constantly moving.

b) There are stationary points on a standing wave.

c) Antinodes occur halfway between nodes.

d) Standing waves are the result of interference between incident and reflected waves.

19) A train whistle at rest has a frequency of 4500 Hz. If you are standing still and measure the frequency to be 4491 Hz, then you can conclude that

a) The train is moving toward you. b) The train is moving away from you.

c) The train is at rest. d) You are inside the train.

20) In destructive interference,
a) the crest of one wave overlaps the trough of another wave.

b) the individual effects of the waves are reduced.

c) waves are out of phase.

d) All of the above.

Part 2: Solve the following five problems in the space provided in between showing all your steps (4 marks each)

Problem 1: A person pushes with a horizontal force of 120 N on a 16 kg shopping cart for a distance of 9 m. A 48 N frictional force opposes the motion of the cart. If he started to push the cart from rest, calculate each of the following

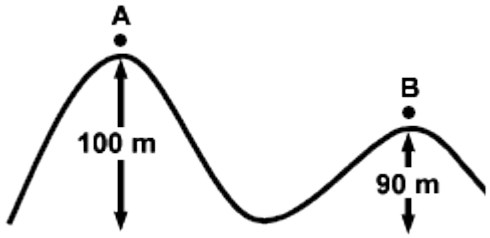
a) The net force on the cart.

b) The acceleration of the cart.

c) The time required to travel the 9 m.

d) The speed of the cart at the end of the 9 m.

Problem 2: A 70 kg skier starts to move from rest from point A down a frictionless hill of height 100 meters. Then he ascends another hill of height 90 meters, as shown in the figure below.



a) Calculate the mechanical energy of the skier anywhere on this path.

b) What is the speed of the skier when he reaches the top of the second hill?

Problem 3: A 1.25 m thick layer of oil floats above the surface of a swimming pool. Given the density of water is 1000 kg/m^3 and the density of oil is 600 kg/m^3.

a) What is the liquid pressure inside water due to oil only?

b) What is the total liquid pressure 4 m deep due to both oil and water?

c) What is the total pressure 4 m deep after including air pressure above oil? Given air atmospheric pressure is 1.01×10^5 Pa.

Problem 4: In an experiment, the temperature of a 50 g metal block is raised to 200 °C then dropped into a glass containing 400 g of water initially at 20 °C. If the final equilibrium temperature reached by the metal and water is 22.4 °C, What is the specific heat capacity of the metal block? (assuming no heat is lost to the environment)

Given that: the specific heat capacity of water is 4180 J/(kg.°C)

Problem 5: A low-frequency radio wave has a period of 4×10^{-6} second. Given that the speed of light is 3×10^{8} m/s, find

a) The frequency of this radio wave

b) The wavelength of this radio wave