

# Prince Sultan University

## Deanship of Educational Services

Department of Mathematics  
and General Sciences



### COURSE DETAILS:

| Introduction to Physical Science |                             | SCI101 | FINAL EXAM |
|----------------------------------|-----------------------------|--------|------------|
| Semester:                        | Second Semester -- Term 182 |        |            |
| Date:                            | Saturday, April 27, 2019    |        |            |
| Time Allowed:                    | 180 minutes                 |        |            |

### STUDENT DETAILS:

|                    |                                                                                 |
|--------------------|---------------------------------------------------------------------------------|
| Student Name:      |                                                                                 |
| Student ID Number: |                                                                                 |
| Section:           | Circle the number of your section: 165 166 167 168                              |
| Instructor's Name: | Circle the name of your Instructor:<br>Dr. Muaffaq Nofal, Dr. Hazem Abu-Farsakh |

### INSTRUCTIONS:

- You may use a scientific calculator that does not have programming or graphing capabilities. NO borrowing calculators.
- NO talking or looking around during the examination.
- NO mobile phones. If your mobile is seen or heard, your exam will be taken immediately.
- Show all your work when required and be organized.
- You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.
- Assume  $g = 10 \text{ m/s}^2$  and  $G = 6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$**

### GRADING:

|           | Page 1 | Page 2 | page 3 | Page 4 | page 5 | Page 6 | Page 7 | Total |
|-----------|--------|--------|--------|--------|--------|--------|--------|-------|
| Mark      |        |        |        |        |        |        |        |       |
| Full Mark | 7      | 7      | 7      | 7      | 4      | 4      | 4      | 40    |

**Note: The periodic table of elements is attached at the exam.**

**Part 1: 28 Multiple Choice Questions (1 mark each)**

1) Consider two objects A and B. Object A is a 4 kg iron block and Object B is an 8 kg iron block. Which of the following is true?

- a) Object A has the same inertia as object B.
- b) Object A has twice as much inertia as object B.
- c) Object B has twice as much inertia as object A.
- d) Object A has twice as much weight as object B.

2) “Every object continues in a state of rest or uniform speed in a straight line unless acted upon by a nonzero force”. This statement is called

- a) Action-reaction law.
- b) Newton’s first law.
- c) Newton’s second law.
- d) Newton’s third law.

3) The momentum of an object at a given instant does not depend on its:

- a) mass
- b) direction of motion
- c) speed
- d) acceleration

4) on a windy day waves in the ocean are higher than their average height. This can be explained by which of the following

- a) Newton’s third Law
- b) Bernoulli's principle
- c) Pascal’s Principle
- d) Archimedes’ Principle

5) The unit with which specific heat capacity is measured is

- a) J/kg
- b) J/ (kg. K)
- c) J.K/kg
- d) kg/ (J.K)

6) The maximum displacement of a wave from equilibrium is called

- a) Its amplitude.
- b) Its frequency.
- c) Its period.
- d) Its wavelength.

7) Interference of waves is a characteristic of

- a) Light waves only.
- b) Sound waves only.
- c) Water waves only.
- d) All kinds of waves.



15) Which of the following is **NOT TRUE** about the periodic table of elements?

- a) Elements in the same period have similar properties
- b) The periodic table is a listing of only the elements found in nature.
- c) Elements in the periodic table are arranged according to their mass number.
- d) All of the above.

16) In which type of atomic bonding are atoms held together by their mutual attraction for shared electrons.

- a) Ionic bond
- b) Metallic bond
- c) Covalent bond
- d) Periodic bond

17) Two automobiles are 140 kilometers apart and traveling toward each other along a straight line. One automobile is moving at constant velocity of 50 km/h and the other is moving at constant velocity of 30 km/h. In how many hours will they meet?

- a) 1.5 h
- b) 2 h
- c) 2.5 h
- d) 1.75 h

18) An 800-kg car experiences a braking force of 3200 N which brought it to a stop in 5 seconds. Calculate the speed of the car just before the brakes were applied.

- a) 20 m/s
- b) 0.9 m/s
- c) 4 m/s
- d) 14 m/s

19) What impulse should be delivered to a 900 kg car to speed up from a speed of 54 km/h to a speed of 99 km/h?

- a) 40500 N.s
- b) 11250 N.s
- c) 13500 N.s
- d) 24750 N.s

20) A 3 kg ball is moving to the right at 8 m/s when it collides with a 5 kg ball that is moving initially to the left at 2 m/s. If the larger ball bounces back after the collision at 4 m/s, what is the velocity of the smaller ball after collision?

- a) 6 m/s to the left
- b) 6 m/s to the right
- c) 2 m/s to the left
- d) 2 m/s to the right

21) A ball is dropped from rest from the top of a tall building. If the ball reaches the ground in 7 seconds, what is the height of the building?

- a) 100 m
- b) 35 m
- c) 245 m
- d) 49 m

22) How much work is done in 3 minutes by a 2.5 hp machine? (1 hp = 746 watt)

- a) 335.7 kJ                      b) 10.36 J                      c) 134.3 kJ                      d) 5.6 kJ

23) A running man has a kinetic energy of 650 J. If he doubles his speed, then his kinetic energy becomes:

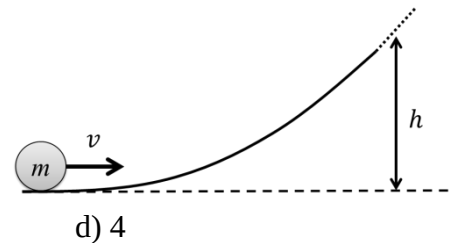
- a) 1300 J                      b) 162.5 J                      c) 325 J                      d) 2600 J

24) What is the kinetic energy of a 4 kg object that possesses  $28 \frac{\text{kg}\cdot\text{m}}{\text{s}}$  of momentum?

- a) 7 J                      b) 98 J                      c) 14 J                      d) 196 J N

25) A ball of mass  $m = 3 \text{ kg}$  rolling horizontally at a speed of  $v = 4 \text{ m/s}$  encounters a hill, as shown in the figure. Ignoring friction, what is the maximum height  $h$  the ball can reach before rolling back?

- a) 16 m                      b) 0.2 m                      c) 0.8 m



d) 4

26) Calculate the acceleration of gravity at the surface of Mercury. Given that the mass of Mercury is  $3.3 \times 10^{23} \text{ kg}$  and its radius is 2440 km.

- a)  $3.7 \text{ m/s}^2$                       b)  $9.02 \text{ m/s}^2$                       c)  $8.3 \text{ m/s}^2$                       d)  $5.4 \text{ m/s}^2$

27) When a liquid other than mercury is used in a barometer, the length of the liquid column in the barometer at sea level was 190 cm. What is the density of the liquid used? (given that the density of mercury is  $13.6 \text{ g/cm}^3$  and the atmospheric pressure at sea level is 76 cm Mercury)

- a)  $1033.6 \text{ g/cm}^3$                       b)  $10.9 \text{ g/cm}^3$                       c)  $252.1 \text{ g/cm}^3$                       d)  $5.44 \text{ g/cm}^3$

28) What is the speed of a wave that vibrates up and down 15 times each second and the distance between successive wave crests is 2.5 m?

- a) 2.5 m/s                      b) 6 m/s                      c) 37.5 m/s                      d) 15 m/s

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

**Problem 1:** A 0.48 kg wooden block of volume  $800 \text{ cm}^3$  is floating at the surface of seawater. The wooden block displaces  $430 \text{ cm}^3$  of seawater.

a) (1 mark) Calculate the density of the block of wood.

b) (1 mark) Calculate the density of sea water.

c) (1 mark) Calculate the buoyant force on the block of wood.

d) (1 mark) calculate the apparent weight of the block of wood.

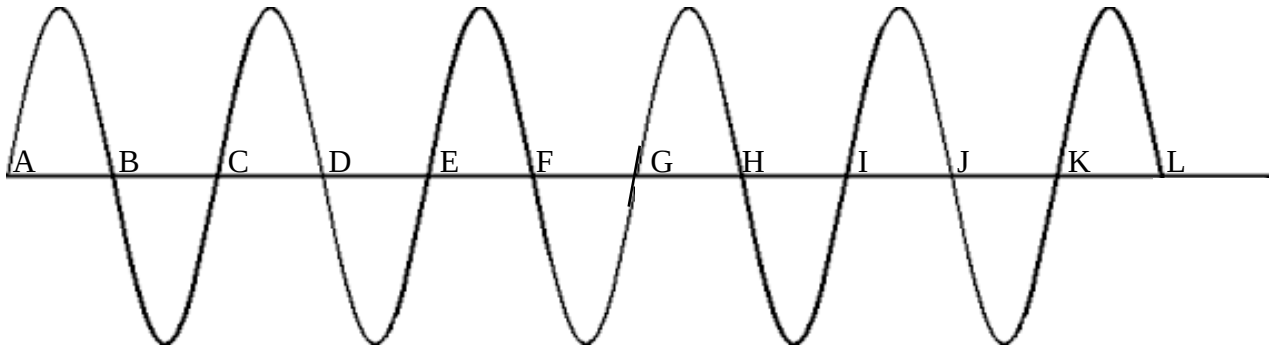
**Problem 2:** Calculate the thermal energy needed to convert a 700 g of ice at a temperature of  $-20\text{ }^{\circ}\text{C}$  to liquid water at  $35\text{ }^{\circ}\text{C}$ .

Given that: the specific heat capacity of ice is  $4350\text{ J}/(\text{kg}\cdot^{\circ}\text{C})$

the specific heat capacity of water is  $4200\text{ J}/(\text{kg}\cdot^{\circ}\text{C})$

the latent heat of fusion of ice is  $335000\text{ J/kg}$

**Problem 3:** The shown figure represents a wave of wavelength 36 cm. If the time needed for the wave to travel from point B to point K is 0.9 seconds, find



a) (1 mark) The period of the wave.

b) (1 mark) The frequency of the wave

b) (1 mark) The speed of the wave

c) (1 mark) The distance from point C to point J



# The Periodic Table

|                     |     | GROUPS   |          |          |           |           |           |           |           |           |           |           |           |            |           |            |           |            |            |         |
|---------------------|-----|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|------------|-----------|------------|------------|---------|
|                     |     | 1        | 2        | 3        | 4         | 5         | 6         | 7         | 8         | 9         | 10        | 11        | 12        | 13         | 14        | 15         | 16        | 17         | 18         |         |
| PERIODS             | 1 → | 1<br>H   |          |          |           |           |           |           |           |           |           |           |           |            |           |            |           |            |            | 2<br>He |
|                     | 2 → | 3<br>Li  | 4<br>Be  |          |           |           |           |           |           |           |           |           |           | 5<br>B     | 6<br>C    | 7<br>N     | 8<br>O    | 9<br>F     | 10<br>Ne   |         |
|                     | 3 → | 11<br>Na | 12<br>Mg |          |           |           |           |           |           |           |           |           |           | 13<br>Al   | 14<br>Si  | 15<br>P    | 16<br>S   | 17<br>Cl   | 18<br>Ar   |         |
|                     | 4 → | 19<br>K  | 20<br>Ca | 21<br>Sc | 22<br>Ti  | 23<br>V   | 24<br>Cr  | 25<br>Mn  | 26<br>Fe  | 27<br>Co  | 28<br>Ni  | 29<br>Cu  | 30<br>Zn  | 31<br>Ga   | 32<br>Ge  | 33<br>As   | 34<br>Se  | 35<br>Br   | 36<br>Kr   |         |
|                     | 5 → | 37<br>Rb | 38<br>Sr | 39<br>Y  | 40<br>Zr  | 41<br>Nb  | 42<br>Mo  | 43<br>Tc  | 44<br>Ru  | 45<br>Rh  | 46<br>Pd  | 47<br>Ag  | 48<br>Cd  | 49<br>In   | 50<br>Sn  | 51<br>Sb   | 52<br>Te  | 53<br>I    | 54<br>Xe   |         |
|                     | 6 → | 55<br>Cs | 56<br>Ba | 57<br>La | 72<br>Hf  | 73<br>Ta  | 74<br>W   | 75<br>Re  | 76<br>Os  | 77<br>Ir  | 78<br>Pt  | 79<br>Au  | 80<br>Hg  | 81<br>Tl   | 82<br>Pb  | 83<br>Bi   | 84<br>Po  | 85<br>At   | 86<br>Rn   |         |
|                     | 7 → | 87<br>Fr | 88<br>Ra | 89<br>Ac | 104<br>Rf | 105<br>Db | 106<br>Sg | 107<br>Bh | 108<br>Hs | 109<br>Mt | 110<br>Ds | 111<br>Rg | 112<br>Cn | 113<br>Uut | 114<br>Fl | 115<br>Uup | 116<br>Lv | 117<br>Uus | 118<br>Uuo |         |
|                     |     |          |          |          |           |           |           |           |           |           |           |           |           |            |           |            |           |            |            |         |
| 6th-period subset → |     | 58<br>Ce | 59<br>Pr | 60<br>Nd | 61<br>Pm  | 62<br>Sm  | 63<br>Eu  | 64<br>Gd  | 65<br>Tb  | 66<br>Dy  | 67<br>Ho  | 68<br>Er  | 69<br>Tm  | 70<br>Yb   | 71<br>Lu  |            |           |            |            |         |
| 7th-period subset → |     | 90<br>Th | 91<br>Pa | 92<br>U  | 93<br>Np  | 94<br>Pu  | 95<br>Am  | 96<br>Cm  | 97<br>Bk  | 98<br>Cf  | 99<br>Es  | 100<br>Fm | 101<br>Md | 102<br>No  | 103<br>Lr |            |           |            |            |         |

Scratch paper

Assume  $g = 10 \text{ m/s}^2$  and  $G = 6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$