

## ARCH 631: Sample Exam

**Note: This is a sample exam with the types of questions that will be on mid-term exams. The subject is Physics 101.**

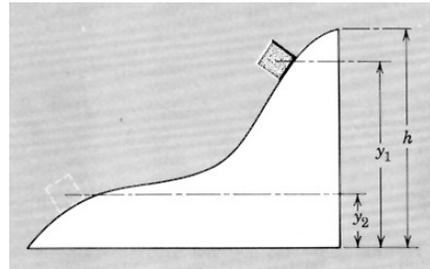
*No aids are allowed for parts 1 and 2. One side of a letter sized paper with notes is allowed during part 3, along with a silent, **non-programmable** calculator. Any reference charts for part 3 will be provided.*

Part 1) Worth ~50% (~2.5 points each)

**Circle** the answer which *best* satisfies the statement or question.

---

- Center of mass can be best described as which of the following?
  - The average mass location when two bodies, each with a mass, are separated by a distance  $x$ .
  - The single point on a body that moves the way a single particle subjected to a force would move.
  - The total mass of the system of particles.
- The rate of change of momentum of a body is proportional to the resultant force acting on the body and is in the direction of that force* is the definition of
  - Linear momentum
  - Angular momentum
  - Conservation of energy
- The figure shown to the right illustrates which principle?
  - Harmonic oscillation
  - Kinetic friction
  - Potential energy
- In order to determine the final velocity of a body under constant acceleration, which of the following must be known?
  - Initial velocity, acceleration, and time expired
  - Initial velocity, final distance, and time expired
  - Rate of change of the acceleration, final distance, and mass
- What other oscillating systems are analogous to mechanical oscillating bodies?
  - Violin strings, and watch pendulums
  - Radio waves, microwaves and visible light
  - Deformation of elastic bodies obeying Hook's law
- etc....



*Part 2) Worth ~20% (~20 points)*

**Compose** a response to the following series of questions with no more than 2/3 of a page of text. The content will be graded in terms of the accuracy, completeness, and relevance of the ideas expressed. The form will be evaluated for clarity, organization, correct spelling and grammar, and legibility. Content will have higher worth than form. *Poor format will likely result in unrecognizable content.*

---

21. Three resistors  $R_1 = 25$  ohms,  $R_2 = 50$  ohms, and  $R_3 = 75$  ohms each obey Ohm's law. These three resistors are connected in series to a battery that has negligible internal resistance. How do the currents, voltages and electrical power dissipated compare for the three resistors? How do the currents and voltages for the individual resistors compare to the battery voltage and to the current through the battery.

If the same resistors are connected in parallel to the battery, how do the currents, voltages and electrical power dissipated compare for the three resistors? How do the currents and voltages for the individual resistors compare to the battery voltage and to the current through the battery.

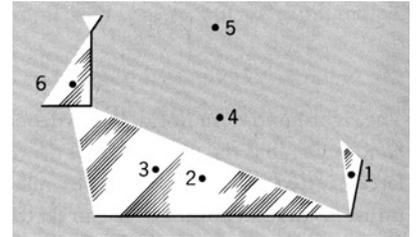
In which case, series or parallel, does the battery deliver the greater electrical power to the circuit? Give the reasoning behind your answer.

Part 3) Worth ~30% (~6 points each)

**Provide** a short, concise and legible answer to the following questions. Show work using any equations, decisions, and/or conclusions in the space provided.

---

22. A sculptor decides to portray a bird shown in the figure. Luckily the final model is actually able to stand upright. The model is formed of a single sheet of metal of uniform thickness. Of the points shown, which is most likely to be the center of mass and why?



23. How fast must a 1800-lb Volkswagen travel in mi/hr to have the same momentum as a 5.8 k-Cadillac going 1 mi/min?
24. How fast must the Volkswagen of problem 23 go to have the same kinetic energy?
25. When two children play catch on a train, does the kinetic energy of the ball depend upon the speed of the train?
26. Does the reference frame chosen affect your answer to problem 25? If so, would you call kinetic energy a scalar quantity?

27. etc....