

SPH3U Exam Review

Problem

- A car leaves Toronto and drives west at 80.0 km/h for the next 1.5 h. The vehicle then proceeds north at 50.0 km/h for the next 2.0 h.
 - What is the car's average speed for the entire trip?
 - What is the car's average velocity for the entire trip?
- Two children wrestle over a toy of mass 1.5 kg. The boy pulls with a force of 6.0 N [W] while the girl pulls with a force of 8.0 N [E]. The toy slides with an acceleration of 1.0 m/s^2 .
 - Draw a free-body diagram of the situation.
 - Determine the value of the frictional force acting on the toy.
- A hockey puck of mass $3.50 \times 10^2 \text{ g}$ is sliding along the ice at 6.0 m/s [N] when it hits a rough patch that exerts a frictional force of 0.42 N [S].
 - Draw the free-body diagram of the puck while it slides on the rough section.
 - Determine the puck's acceleration.
 - Determine how far the puck will slide before stopping once it hits the rough section.
- A person throws a 2.0-kg object vertically upward and it reaches a position 4.0 m above the point of release 0.90 s later.
 - What speed must the object have had upon release? Include a free-body diagram.
 - If the person throws the object from rest through a vertical distance of 1.2 m, what acceleration must the object have during the throw?
 - What force must the person be exerting during the throw to reach the desired height? Provide another free-body diagram depicting the forces acting during the throw.
- If a 7.2 N force is required to accelerate a 3.4-kg object along a horizontal surface at a rate of 1.6 m/s^2 , what is the frictional resistance that is acting?
- A force of 1.2 N is applied to an object of mass 1.5 kg. It accelerates at 0.50 m/s^2 . Determine the force of friction that is acting and the coefficient of kinetic friction involved.

7. Two children pull a toy truck of mass 2.4 kg along a rough horizontal surface. One child pulls with a force of 8.4 N [N] and the other pulls with a force of 3.6 N [S]. The coefficient of friction involved is 0.18. How does the object move?

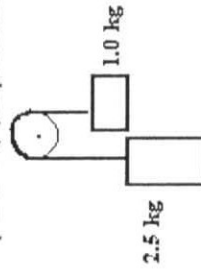
8. How much force would be required to start a 1.0-kg object sliding along a horizontal surface if the coefficient of starting friction is 0.20?

9. A person stands on a set of bathroom scales which have been calibrated in newtons. The scales read 500 N. (Assume three significant digits.)

- What would the reading be if the same person stood on the scales on a planet where the gravitational field strength, g , is 14 N/kg ?
- If this planet had a mass of $7.0 \times 10^{24} \text{ kg}$, what would its radius be?
- What would this person weigh at an altitude of $2.8 \times 10^6 \text{ m}$ above the planet's surface?

10. A soap box derby is about to start and Marisa pushes her 15.0-kg car to the start line 10.0 m up the hill. Calculate the work done by Marisa on the soap box car over the 10.0 m if friction is ignored.

11. A string hangs over a frictionless pulley as shown in the diagram below. A 1.0-kg mass hangs on one side of the pulley and a 2.5-kg mass hangs on the other side. Both masses are initially at rest. Calculate the speed of each mass when the 2.5-kg mass has fallen 1.0 m from the rest position. Let positive (+) represent upward.



12. Determine the heat lost when 140 kg of water cools from 45.0°C to 15.0°C .

$$(c_w = 4.18 \times 10^3 \text{ J/kg}\cdot^\circ\text{C})$$

13. An elevator motor provides 45.0 kW of power while lifting a 2000-kg elevator 35.0 m. If the elevator contains six passengers of the same mass and it takes 20.0 s to accomplish this task, determine the mass of each passenger.

14. A microwave rated at 1000 W heats a 500-g glass of water from 10°C to 55°C in 2.0 min. Determine the efficiency of the energy transformation.
15. The distance between two successive crests in a wave is 1.5 m, and the source generates 25 crests and 25 troughs in 5.0 s. What is the speed of the waves?
16. A standing wave with five loops is generated in a string. If the waves travel at 17.5 m/s with a frequency of $1.40 \times 10^2\text{ Hz}$, how long is the string?
17. The tine of a tuning fork makes 20 vibrations in 0.50 s. If the speed of sound is 350 m/s , what is the wavelength of the sound wave created?
18. A camper stands in a valley between two parallel cliff walls. He claps his hands and notices that the echo from the nearby wall returns 0.75 s later while the echo from the farther wall returns 1.50 s later. If the speed of sound is 345 m/s , how wide is the valley?
19. A tuning fork with a frequency of 512 Hz is struck at the same time as a guitar string. If 24 beats are heard in 6.0 s, find the possible frequency or frequencies of the guitar string.
20. A vocal tract acts as an air column closed at one end. The vocal tract of a singer is 25.0 cm long and is vibrating in the second overtone. If the speed of sound is 352 m/s , what frequency is the singer producing? Include a diagram.
21. Certain pipe organs act like air columns closed at one end. If the speed of sound is 343 m/s , how long does a pipe need to be to produce a fundamental frequency of 75.0 Hz ? Include a diagram.
22. Immersion heaters are placed into liquids to warm them up. If 250 g of water in a cup is heated from 15°C to 97°C in 5.0 m, what current must the heater draw from a 12.0-V battery? ($c_w = 4.184\text{ J/g}\cdot^{\circ}\text{C}$)
23. A 120-V circuit contains a load with a resistance of $15.0\ \Omega$. What resistance must be added in parallel with the load to result in a current of 12.0 A in the circuit?
24. What is the resistance of a 1500-W heater if it uses a current of 10.0 A ?
25. A string of lights has six lamps connected in parallel. If each lamp has a resistance of $120\ \Omega$ and the string is connected to a 120-V supply, calculate
(a) the total resistance in the circuit
(b) the current in the circuit
26. A string of lights has ten lamps connected in series. If each lamp has a resistance of $25\ \Omega$ and the string is connected to a 120-V source, calculate
(a) the total resistance in the string
(b) the current drawn by the string
27. An appliance has a resistance of $15.0\ \Omega$. It uses 30.0 V , supplied by the secondary coil of a transformer. The transformer has 200 turns in its primary coil and is plugged into a 120-V source. Calculate
(a) the current in the secondary coil
(b) the current in the primary coil
(c) the power rating of the transformer
(d) the amount of energy the appliance uses in one minute
28. A welding machine uses a current of 75.0 A with a potential difference of 60.0 V . If it is supplied by a transformer connected to a 240 V source, calculate the power rating of the welding machine.