Detailed reasoning

Physics 101 PRACTICE 101 FINAL EXAM

Please write and bubble in your student 800 number on the provided scantron. Also print your name and fill in Exam A. There are 20 equally-weighted problems on this test. There is only one correct answer per question. Clearly mark your answer on the provided scantron sheet. The key will be posted online **after** all make-up tests are completed. Your test grade will appear on ecampus or WebAssign. If I decide to curve the test, your test grade online will be curved. In the very unlikely possibility that I have made a mistake and the correct number is not on the exam, the closest number will be counted as correct.

1. What is the reason that adding salt to water makes it boil faster?
   a) This increases the mass of the water ← would make it slower
   b) This increases the specific heat of the water
   c) This decreases the specific heat of the water
   d) This increases the latent heat of the water
   e) This decreases the latent heat of the water

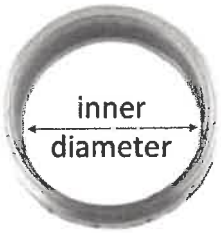
2. Convert 300 K to Fahrenheit. $T_C = T_K - 273.15 = 300 - 273.15 = 26.85\,^\circ C$
   $T_F = \frac{9}{5} T_C + 32$
   a) -2.86°F b) 16.3°F c) 80.3°F d) 300.6°F e) 1064°F

3. The temperature difference between the inside and outside of a house on a specific day is 40°C. What is that temperature difference on the Fahrenheit scale? $\Delta T_F = \frac{9}{5}\Delta T_C$
   a) 4.4°F b) 22°F c) 72°F d) 104°F e) 273.15°F

4. If the average temperature of the ocean were to increase by 5°C, what would be the increase of the average depth of the ocean. The current average depth is about 14,000 **feet**.
   ↑ convert to meters
   a) 0.295 m b) 0.996 m c) 1.47 m d) 4.83 m e) 7.35 m
   $\Delta L = \alpha L_0 \Delta T$

5. Why does hot air rise? It is less dense, but why?
   a) It has a smaller mass than colder air.
   b) It has a larger mass than colder air.
   c) It has a smaller volume than colder air.
   d) It has a larger volume than colder air.
   e) None of these reasons.

6. A wedding ring is heated by running it under hot water. As a result, the inner radius of the ring



Both radii increase

a) slightly increases
b) slightly decreases
c) stays the same
d) may increase or decrease depending on which metal it is made from

7. The heat transfer mechanism mainly responsible for global warming is

a) conduction b) convection c) superposition d) radiation

not a heat transfer mechanism

8. Let's say you are going to use your hand to poke a rod into a fire (such as to roast marshmallows). In order to **minimize** the heat transfer that might burn your hand, you would want to pick a material with a

a) high latent heat
b) low latent heat

refers to change in phase
Hopefully not hot enough to melt.

c) high thermal conductivity
d) low thermal conductivity

$Q = mc\Delta T$

want low

(Sticks are a great choice, except, of course, for the fact that they are highly flammable.)

9. Why does water make a good coolant for your car?

a) high latent heat
b) low latent heat
c) high specific heat
d) low specific heat

$Q = mc\Delta T$

heat transfer Q ↑ want high

10. You get 200 grams of -15°C ice cubes out of the freezer, put it in a glass, and forget about it. You come back to it when all of the ice is now water with a temperature of 20°C. How much energy was absorbed from the environment to cause this result?

a) 6,270 J b) 29,300 J c) 66,600 J d) 89,600 J d) 90,000,000 J

$Q = mC_{ice}\Delta T_{\text{while ice}} + mL_{fusion} + mC_{water}\Delta T_{\text{while water}}$

$= (.2kg)(2090)(15°C) + (.2kg)(333{,}000\ \frac{J}{kg}) + (.2kg)(4186)(20°C)$

convert to miles

$\Delta x = vt = (343 \frac{m}{s})(5\,s) = 1715\,m \sim \left(\frac{3.281\,ft}{1\,m}\right) = 5626.9$

11. If you hear thunder 5 seconds after seeing the lightning bolt it comes from, roughly how far away from you is the lightning bolt? Take the speed of sound to be 343 m/s. (Do not trust the old wives' tell about this). ~1 mile

a) 1 mile b) 2 miles c) 2.5 miles d) 5 miles e) 10 miles

12. A particular grandfather clock has a period of 2 seconds on Earth. If this clock were placed on Mars, what would its period of oscillation be? (Acceleration due to gravity on Mars is 3.7 m/s^2.) $T = 2\pi\sqrt{\frac{L}{g}}$

a) 0.8 seconds b) 2 seconds c) 2.5 seconds d) 3.3 seconds e) 5.3 seconds

13. I hang a 10 kg mass at the end of a spring with spring constant 888 N/m. Due to this mass, it stretches 11 cm. What is the potential energy of this spring at the end of this stretch?

↑convert

a) 5.4 J b) 10.8 J c) 98 J d) 9800 J e) 54,000 J

$PE_{spring} = \frac{1}{2}kx^2$

14. If the linear mass density of a string is 0.006 kg/m and the wavelength and frequency of the string are 1.3 m and 82 Hz respectively, what is the tension in the string?

a) 0.64 N b) 31 N c) 68 N d) 278 N e) 1200 N

$\lambda f = \sqrt{\frac{\text{tension}}{\text{linear mass density}}}$

15. Let's say I push both my son and my daughter on two identical swings. If I push them with the same force, how do the periods of their oscillation compare?

$T = 2\pi\sqrt{\frac{L}{g}}$

↑ no mass

a) The heavier child has a longer period of oscillation.

b) The heavier child has a shorter period of oscillation.

c) They both have the same period of oscillation.

16. By compressing a vertical spring by 1 cm, I launch a ball up in the air 1 meter. If I instead want the ball to go up 4 meters, how much will I need to compress the spring?

Energy conservation

$\frac{1}{2}kx^2 = mgh$

a) 2 cm b) 4 cm c) 8 cm d) 16 cm e) 32 cm

17. I hang a 1.0 kg weight from a spring, which stretches the spring by 1 cm. What answer is closest to the spring constant of the spring?

↑ convert to meters

a) 1 N/m b) 10 N/m c) 100 N/m d) 1000 N/m e) 100,000 N/m

$kx = mg$

$v = \lambda f$ $\lambda = \frac{v}{f}$

18. A radio station broadcasts at 100.1 MHz. Which answer is closest to the wavelength for the radio wave it produces? ↑ Convert to Hz $1\,MHz = 10^6\,Hz$

a) 3 μm b) 3 mm c) 3 m d) 30,000 m e) 3,000,000 m (or 3 Mm)

Several ways to do. Easiest probably to split flight in half

19. On a football field, I launch a cannonball at an angle of 30 degrees from the ground. The speed of the cannonball is 50 m/s. Horizontally how far does it go before it hits the ground? (Ignore the height of the cannon.) Projectile motion

Use y side to get time

x	y
$a_x = 0$	$a_y = -9.8\,m/s^2$
$v_{ox} = 50\cos 30$	$v_{oy} = 50\sin 30$
$\Delta x = ?$	$\Delta y = 0$

a) 110 m b) 128 m c) 221 m d) 255 m e) 442 m

$v_{fy} = v_{oy} + at \rightarrow$ solve for time $(2.555) \rightarrow \Delta x = v_{ox} t$

20. A 100 kg refrigerator slides down a ramp which we can treat like as an inclined plane. The angle of the incline is 35 degrees. Do **not** ignore friction and assume a coefficient of kinetic friction of 0.4. What will be the resulting acceleration of the refrigerator down the incline?

friction $= \mu n$

a) 0 m/s² b) 2.2 m/s² c) 5.6 m/s² d) 6.1 m/s² e) 8.0 m/s²

$\Sigma F_y = 0 \Rightarrow n - mg\cos\theta \Rightarrow n = mg\cos\theta$ $\Sigma F_x = ma = mg\sin\theta - \mu(mg\cos\theta)$

21. A car of mass m is traveling with a speed of 2v. A truck with mass 2m is traveling in the opposite direction at a speed of v. If they collide head on, which driver experiences the greater impulse due to the collision? A few ways to consider

a) The driver of the car. $I = F_{avg}\Delta t$ ← also same

b) The driver of the truck. ↑ same by Newton's 3rd law

c) They experience the same non-zero impulse.

d) Neither one of them experiences an impulse (zero impulse).

22. Determine the angular velocity of the minute hand (smaller hand) of a clock.

$\omega = \frac{\Delta\theta}{t} = \frac{2\pi\ rad}{3600\ seconds}$

a) 0.00175 rad/s b) 0.105 rad/s c) 6.28 rad/s d) 377 rad/s e) 22,600 rad/s

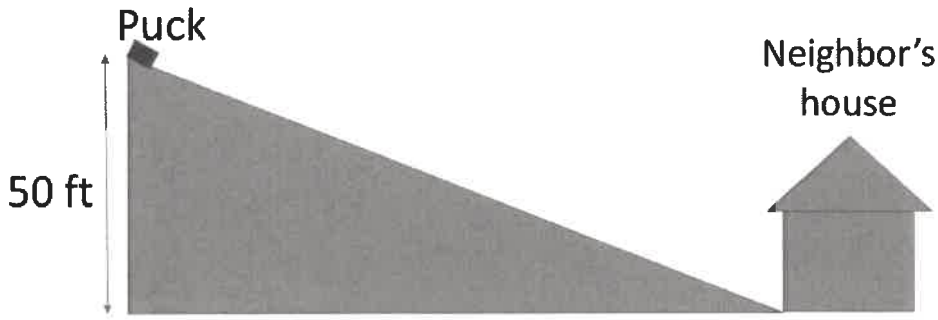
23. My son hits a hockey puck and I fail to stop it. As a result, it slides down our largely sloped yard, until it runs into the house behind/below us. If my son hits the puck at 5 m/s and ignoring friction, what will the speed of the ball be when it hits the neighbor's house 50 **feet** below where he hit it? Conservation of energy ↑ Convert

a) 17.3 m/s b) 18 m/s c) 31.3 m/s d) 31.7 m/s

e) Impossible to determine without knowing the mass of the puck.

$\frac{1}{2}mv_0^2 + mgh = \frac{1}{2}mv_f^2$

$\rightarrow v_f^2 = v_0^2 + 2gh$



24. Let's say you either let a book drop one meter straight down or let it slide down a one meter tall incline (do not ignore friction). In which case (if either) is more work done by gravity. $W_c = -\Delta PE$

a) More work is done by gravity when the book drops straight down.

b) More work is done by gravity when the book slides down the incline.

c) The same amount of work is done by gravity in both cases.

25. I throw a ball straight up in the air. While it is in the air, when is its acceleration zero?

a) On the way up

b) At its maximum height

c) On the way down

d) Never while it is in the air

Never while it is in projectile motion / free fall.