

### Physics 10 midterm exam #1

October 2, 2000

Compare the energy in a kilogram of gasoline to that in a kilogram of a lead-acid (car) battery:

- the gasoline has about 400 times as much energy
- the gasoline has about 10 times as much energy
- the gasoline has about 400 times less energy
- the two cannot be honestly compared, since one stores power and the other stores energy

In a piece of wood, the instantaneous speed of the molecules is approximately

- zero, since they don't move
- whatever speed the wood is moving
- approximately 13.7 meters per second
- approximately 1000 feet per second
- approximately 186,000 miles per second

In the ocean, the pressure and velocity of sound changes with depth. Starting at the ocean bottom and going up, which of the following correctly describes the pressure -- sound velocity behavior with increasing height above the sea floor bottom?

- shallow: high press -- high vel  
middle depth: medium press -- low vel  
deep: low press -- high vel
- shallow: high press -- low vel  
middle depth: medium press -- high vel  
deep: low press -- low vel
- shallow: low press -- low vel  
middle depth: medium press -- high vel  
deep: high press -- low vel
- shallow: low press -- high vel  
middle depth: medium press -- medium vel  
deep: low press -- low vel

What is it that sweeps our solar system clean of comets?

- Jupiter
- asteroids
- The ABM system
- impacts with the Earth
- the Sun
- Nothing. We always get our "fair share" of comets.

Which of the following statements is true?:

- Energy is measured in joules and power in calories
- Power is energy divided by time
- Batteries release energy but TNT releases power
- Power signifies a very large value of energy
- all of the above

The density of water is how much larger than air?

- 1/100
- 100

- 1000
- $1 \times 10^6$

What is a wavelength?

- the length of the crest of a wave
- the distance between crests
- the depth that a wave has zero motion
- the distance between crest and trough

Sound moves slower near the troposphere. This occurs because this region of the atmosphere

- contains ozone, and sound is slow in ozone
- is colder
- is less dense
- is above the clouds

A spherical ball has a diameter of 18 cm, and has a mass of 5 kg. At what speed would you need to throw it to get it into space:

- 186,000 miles per hour
- 11 km/sec
- 186,000 miles per second
- about 140 miles per hour

Hybrid vehicles run on:

- electric and solar power
- solar power and gasoline
- electric power and gasoline
- nuclear power and gasoline

Work is equal to

- force multiplied by distance
- force multiplied by time
- mass multiplied by distance
- weight multiplied by force

A object that has a mass of 10 kg, and is moving at 5 m/sec has what Kinetic energy?

- 250 Joules
- 500 Joules
- 125 Joules
- 50 Joules

To place a kilogram into space, assuming that a completely efficient method is used, would take how much gasoline?

- 1 gram
- 100 grams
- 1 kilogram
- 100 kilograms

The greatest energy for one gram of material comes from

- fusion
- a meteor
- a comet
- TNT
- fission

Temperature is the measure of:

- average momentum
- average Kinetic Energy
- average velocity
- average total energy

What is the main reason that hydrogen-driven automobiles have not replaced gasoline ones?

- Hydrogen is too expensive
- Hydrogen is too difficult to store in an automobile
- Hydrogen is radioactive, and the public fears it
- Hydrogen, when combined with oxygen, is explosive

A nuclear explosion occurs on the ground, and releases the energy equivalent of 1 megaton of gasoline. (Note: I did NOT say of TNT.) The material removed from the crater will weight approximately:

- 100 kilotons (i.e. 0.1 megatons)
- 1 megaton
- 10 megatons
- 100 megatons

A growing thunderstorm rises to about 60,000 feet, and then no longer rises. This is because:

- It reaches the ozone level
- It reaches an altitude where the surrounding air is too cold to support further rise
- It does not have sufficient energy to go further
- It gets tired

The main contribution of the Nemesis theory to what was previously known is the idea that:

- An asteroid impact killed many microscopic creatures as well as the dinosaurs
- It was an asteroid that hit the Earth rather than a comet
- It proved that the Alvarez hypothesis was correct
- It provided a way that could make comets hit the Earth every 26 million years

Approximately how often does the square root rule of statistical analysis hold true?

- nearly 100% of the time
- about 95% of the time
- about 2/3 of the time
- about 50% of the time
- about 1/3 of the time
- about 5% of the time
- much less than 5% of the time

According to the book Nemesis, what was the punishment Muller received for breaking the \$15,000 photomultiplier tube?

- he was immediately dismissed

he was told to pay for the damage in monthly installments

he was not punished, but was told that he must learn to be more careful in the future

he congratulated by Alvarez

he never broke a \$15,000 photomultiplier tube

In spite of the fact that TNT has very little relative energy per gram, it is a highly effective explosive. Explain why, in a few brief words:

\_\_\_\_\_

\_\_\_\_\_

Which has the most energy?:

one gram of uranium that undergoes fission

one gram of TNT

one gram of chocolate chip cookies

one gram of gasoline

A person accidentally walks into a nuclear reactor chamber and receives a sudden dose of 12.5 Sieverts of radiation. The probability that this person will die of cancer is (WARNING: some people might consider this to be a "trick" question):

about 10%

about 50%

close to 100%

much less than 10%

An energetic photon from a radioactive explosion is also known as a:

x-ray or gamma ray

beta ray

alpha ray

cosmic ray

If 100 people are exposed to 100 SV of radiation how many people would you expect to get cancer:

4 people

1 person

25 people

it depends on how much each person received individually

A high index of refraction indicates that light travelling through it travels:

faster than in a low index material

slower than in a low index material

in a curved path

the same speed as in a lower index material, but the speed of sound changes.

In the cloud chamber demonstration, what was the cause of smoky trails?

the particles are burning when it it released from the nucleus, due to the high energy from the explosion.

the air in the chamber is supersaturated with alcohol. Droplets of alcohol adhere to the ions broken up from the atoms of the air, thus leaving a trail.

as particles collide with atoms of the air, the energy transferred from the particles to the atoms makes the

bounced-away atoms vibrate strongly, making a visible path.

Water waves tend to move:

- slower in shallow water
- faster in shallow water as they break
- slower in deep water
- The same speed in shallow water as in deep water

You are swimming in the ocean and you see a wave coming. It is about 1 meter high, and the distance between two crests is about 12 m. Approximately how far down do you need to go in order to miss most (2/3) of the underwater part of the wave?

- 1 m
- 2 m
- 3 m
- 6 m
- 12 m

The number of people we expect to die from cancer, caused by the Chernobyl accident, is approximately

- 2600
- 26 thousand
- 26 million
- none, because the statistical variations are too large

In the "haunted house" of Disneyland, there is a dinner table at which dancing ghosts appear and disappear. The most accurate physics description of these ghosts is:

- they are real images
- they are virtual images
- they are ghostly images
- they appear at the focus of the mirror

A graded index fiber:

- works better than an ordinary fiber because it has no scratches
- works better than an ordinary fiber because scratches won't affect it
- works better than an ordinary fiber because it is a higher quality glass
- works no better than an ordinary fiber

10,000 students from Cal and 10,000 from Stanford are tested on physics 10 concepts. Of these, we learn that 900 Cal students understand physics 10 concepts, but that only 830 Stanford students understand the same concepts. Is this a statistically-significant difference?

- yes, it is much more than 1 standard deviation
- no, it is much less than 1 standard deviation
- It is just barely significant at the 1 standard deviation level

Don't miss the last problem, on the next side!

In the South Pacific, a submarine engine emits a loud sound. The Hawaii Station (North Point of Triangle) reports the sound after a certain period of time  $n$ . The Philippines Station (West Point of Triangle) reports the sound after  $2n$ . The Tahiti Station (South Point of Triangle) reports the sound after  $3n$ . Using the principles of the LOFAR system, what following location best approximates the location of the sub?

- The sub is located near American Samoa, which is closest to Tahiti, then next closest to the Philippines, then next closest to Hawaii.
- The sub is located nearest to the Philippines, then next nearest to Tahiti, then next nearest to Hawaii.
- The sub is located off the coast of Guam, which is closest to the Philippines, then to Hawaii, then to Tahiti.
- The sub is located nearest to Hawaii, then next closest to the Philippines, and furthest from Tahiti.
- The sub is located more west of Hawaii than east of the Philippines, and is more south of the Philippines than north of Tahiti.