Today:

- **Finish Chapter 23**
- **Review Session**
- **Midterm 2: Fri Apr 20**

Chs 11, 13, 14, 15, 19, 20, 22, 23

Review for Midterm 2

- **Midterm 2: Fri Apr 20**

Chs 11, 13, 14, 15, 19, 20, 22, 23

40 multiple-choice questions

- Bring a No. 2 pencil and an eraser

Resources for studying:

- go through all questions, exercises, and examples we did during lectures
- revise lectures carefully, reading book and "check yourself" qns for support
- additional questions in today's lecture
- email me if you have any questions or want to meet

Recall:

· Chapter 11: Atomic Structure: nucleus (protons + neutrons) & electrons, atomic number, atomic mass, periodic table, isotopes, element, molecule, compound, antimatter. *You'll be given a periodic table.*

·Chapter 13: Liquids: Pressure = force/area, liquid pressure = weight density x depth, buoyant force, Archimedes principle: buoyant force = weight of fluid displaced, principle of flotation, Pascal's principle, surface tension, capillarity, adhesion, cohesion

· Chapter 14: Gases and Plasmas: atmospheric pressure, Archimedes' principle for air, barometer, Boyle's law, Bernoulli's principle for pressure of moving fluid, plasma

· Chapter 15: Heat: temperature, thermometer, absolute zero, internal energy, heat flow, specific heat capacity, thermal expansion, anomalous expansion of water

· Chapter 19: Vibrations and waves: simple harmonic motion, amplitude, frequency, period, wavelength, wave speed = frequency x wavelength, transverse vs longitudinal, interference, Doppler effect, bow waves, sonic boom

· Chapter 20: Sound: speed of sound, wave of compressions and rarefactions, reflection, refraction, natural frequency, forced vibration, resonance, interference, beats, beat freq =f1 –f2

· Ch 22: Electrostatics: charge conservation, charge quantization, Coulomb's law F= kq1q2/d2, conductors vs insulators, charging by induction, polarization, electric field, electric potential, electric potential energy

· Ch 23: Electric Circuits: flow of charge = current, potential difference, voltage sources, resistance, Ohm's law: current = voltage/resistance, DC and AC, speed and source of electrons in circuit, electric power = current x voltage, series and parallel circuits, overloading

Atoms heavier than hydrogen were made by

A) photosynthesis
B) nuclear fusion
C) radiant energy conversion
D) Radioactivity
E) None of these

Atoms heavier than hydrogen were made by

A) photosynthesis
B) nuclear fusion
C) radiant energy conversion
D) Radioactivity
E) None of these

Answer: B

All nuclei larger than H were made by nuclear fusion in the stars long ago…

Which of the following statements is true?

A) An atom is the smallest particle known to exist.
B) There are only about 120 different kinds of atoms that combine to form many substances.
C) There are thousands of different kinds of atoms that account for a wide variety of substances.
D) A large atom can be photographed.
E) None of these statements are true.

Which of the following statements is true?

A) An atom is the smallest particle known to exist.
B) There are only about 120 different kinds of atoms that combine to form many substances.
C) There are thousands of different kinds of atoms that account for a wide variety of substances.
D) A large atom can be photographed.
E) None of these statements are true.

Answer: B

A force that determines the chemical properties of an atom is a

A) friction force.

B) nuclear force.

C) electrical force.

D) gravitational force.

E) none of these

A force that determines the chemical properties of an atom is a

A) friction force.

B) nuclear force.

C) electrical force.

D) gravitational force.

E) none of these

Answer: C)…from lecture…

If one neutron is added to a helium nucleus, the result is

A) beryllium.

B) boron.

C) hydrogen.

D) lithium.

E) helium

If one neutron is added to a helium nucleus, the result is

A) beryllium.

B) boron.

C) hydrogen.

D) lithium.

E) helium

Answer: E, helium – an isotope.

But if instead, a proton was added, then what would the answer be?

Then D, lithium.

To change platinum into gold, a proton must be

A) removed from the platinum nucleus
B) added to the platinum nucleus
C) removed from the gold nucleus
D) added to the gold nucleus
E) none of the above

To change platinum into gold, a proton must be

A) removed from the platinum nucleus
B) added to the platinum nucleus
C) removed from the gold nucleus
D) added to the gold nucleus
E) none of the above

Answer: B
From periodic table, gold (Au) has atomic # 79 while platinum (Pt) has atomic # 78. So gold has one more proton in its nucleus than Pt does.

Which of these atoms has the greatest number of protons?

A) helium

B) oxygen

C) lead

D) uranium

E) gold

Which of these atoms has the greatest number of protons?

A) helium
B) oxygen
C) lead
D) uranium
E) gold

Answer: D, from periodic table – U has the largest atomic number and atomic number = # protons (= # electrons in neutral atom)

Which has the greatest mass?

Also D.

If a gram of antimatter meets a kilogram of matter, the amount of mass to survive is

A) 1 gram

B) 999 grams

C) 1 kilogram

D) 1.1 kilogram

If a gram of antimatter meets a kilogram of matter, the amount of mass to survive is

A) 1 gram

B) 999 grams

C) 1 kilogram

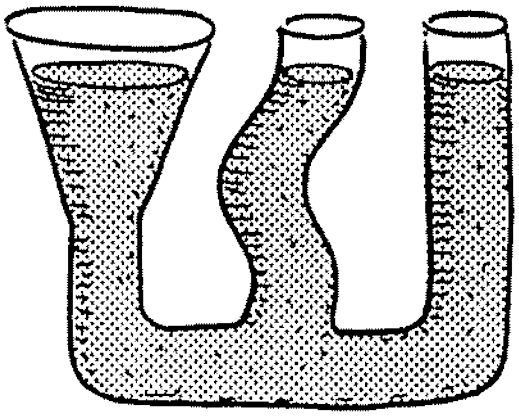
D) 1.1 kilogram

Answer: B

Antimatter and matter annihilate each other, so the 1gram of antimatter annihiliates 1gram of matter, leaving 999 grams of matter.

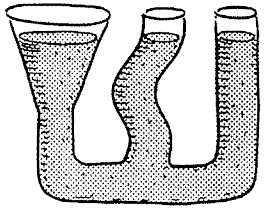
This is why antimatter is so short-lived in our part of the universe.

Everybody knows that “water seeks its own level,” but very few people know why water seeks its own level. The reason has most to do with



1. atmospheric pressure.
2. water pressure depending on depth.
3. water’s density.

Everybody knows that "water seeks its own level," but very few people know why water seeks its own level. The reason has most to do with



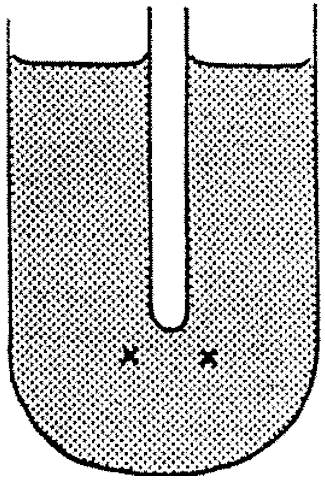
1. atmospheric pressure
2. **water pressure depending on depth.** ✔
3. water's density

Answer: 2

Water pressure depends on depth, so only at equal depths of water will the pressure be equal.

Consider the U-tube. If water is at rest where each X is, the pressures must be equal—otherwise a flow would occur from the region of higher to the region of lower pressure until the pressures equalize. For this to happen, the depths below the surfaces must be equal.

This is true whatever the density of water or whether or not there is atmospheric pressure.



Water pressure is greatest against the

A) top of a submerged object.

B) bottom of a submerged object.

C) sides of a submerged object.

D) is the same against all surfaces

E) none of these

Water pressure is greatest against the

A) top of a submerged object.

B) bottom of a submerged object.

C) sides of a submerged object.

D) is the same against all surfaces

E) none of these

Answer: B

From liquid pressure = density x depth.

This is *why* the buoyant force acts *upward* on a submerged object.

A completely submerged object always displaces its own

A) volume of fluid.

B) weight of fluid.

C) density of fluid.

D) all of these

E) none of these

A completely submerged object always displaces its own

A) volume of fluid.

B) weight of fluid.

C) density of fluid.

D) all of these

E) none of these

Answer: A

Because it is replacing this amount of water with its own volume…

The buoyant force on a rock is least when the rock is completely submerged

A) near the surface

B) halfway to the bottom

C) near the bottom

D) All of the above

The buoyant force on a rock is least when the rock is completely submerged

A) near the surface

B) halfway to the bottom

C) near the bottom

D) All of the above

Answer: D

since buoyant force = weight of the fluid displaced, so only depends on the size of a completely submerged object

If an object is instead only *partly* submerged, then the buoyant force would be less, as less fluid is displaced

When a boat sails from fresh water to salt water, the boat will float

A) lower in the water

B) higher in the water

C) at the same level

When a boat sails from fresh water to salt water, the boat will float

A) lower in the water

B) higher in the water

C) at the same level

Answer: B

Salt water is more dense, so a smaller volume of it will weigh the same as a larger volume of fresh water, hence supplying the same buoyant force but with less displacement.

Is the buoyant force on the sailing boat greater, less or the same in the salt water compared to that in the fresh water?

Answer: the same. For floating objects, the buoyant force always equals the weight of the object (i.e the weight of the boat). (In salt water less water is displaced since a smaller volume of salt water has the same weight as a larger volume of fresh water).

The weight of water displaced by a floating 20-ton boat

A) is less than 20 tons.

B) is 20 tons.

C) is more than 20 tons.

D) depends on the shape of the ship's hull.

E) none of these

The weight of water displaced by a floating 20-ton boat

A) is less than 20 tons.

B) is 20 tons.

C) is more than 20 tons.

D) depends on the shape of the ship's hull.

E) none of these

Answer: B

A floating object displaces amount of water equal to its own weight -- since then the buoyant force balances the weight.

Recall buoyant force = weight of fluid displaced, so this question could be rephrased “The buoyant force on a floating 20-ton boat is…”

If floating, then no net force, so buoyant force must equal weight of object.

The density of ice is about 0.9 that of water, while the density of alcohol is about 0.8 that of water. Will an ice-cube float higher or lower or the same in a mixed drink as more alcohol is added?

A) Higher

B) Lower

C) The same

D) Need more information

The density of ice is about 0.9 that of water, while the density of alcohol is about 0.8 that of water. Will an ice-cube float higher or lower or the same in a mixed drink as more alcohol is added?

A) Higher

B) Lower

C) The same

D) Need more information

Answer: B, Lower

In water, an ice-cube floats on the surface since its density is less than that of water. It displaces less water than its volume, since its weight is less than its volume of water, and weight of the water displaced is equal to the buoyant force.

Now adding alcohol means that the mixed drink density becomes less; therefore, to balance the same weight of the icecube requires more of it. i.e. the icecube will float lower in the drink with more alcohol.

In fact, in pure alcohol, ice-cubes will sink to the bottom!

The ratio of output force to input force of a hydraulic press will be equal to the ratio of the output and input piston

A) areas.

B) diameters.

C) radii.

D) all of these

E) none of these

The ratio of output force to input force of a hydraulic press will be equal to the ratio of the output and input piston

A) areas.

B) diameters.

C) radii.

D) all of these

E) none of these

Answer: A

Pascal's principle says that pressure is transmitted undiminished. Since pressure = force per unit area, then ratio of forces scales as ratio of the areas.

When you put a stick in water and remove it, the stick is wet. When you put a stick in mercury and remove it, the stick is dry. The reason for this is that adhesive forces are greater

A) between the stick and mercury.
B) between the mercury and the water.
C) between stick and water.

When you put a stick in water and remove it, the stick is wet. When you put a stick in mercury and remove it, the stick is dry. The reason for this is that adhesive forces are greater

A) between the stick and mercury.
B) between the mercury and the water.
C) between stick and water.

Answer: C

Adhesive forces are attractive forces between different types of molecules (eg fluid and stick)

Note: cohesive forces are attractive forces between like molecules – and give rise to surface tension…

As a balloon rises higher and higher into the atmosphere, its

A) volume decreases.

B) mass decreases.

C) weight increases.

D) density increases.

E) none of these

As a balloon rises higher and higher into the atmosphere, its

A) volume decreases.

B) mass decreases.

C) weight increases.

D) density increases.

E) none of these

Answer E

As it rises, it experiences less atmospheric pressure, so it tends to expand (volume increases), if not rigid. Mass doesn't change, and weight doesn't change much (if anything, it decreases as g decreases a little bit). Since same mass, but increased volume, then density = mass/volume, is decreased.

Which of the following is true?

A)The density of a large body of liquid (e.g. ocean) remains about constant throughout its volume
B) The density of a large body of gas (e.g. our atmosphere) remains about constant throughout.
C) The pressure in the ocean remains about constant throughout its volume
D) The pressure in the atmosphere remains about constant throughout.
E) None of the above is true

Which of the following is true?

A)The density of a large body of liquid (e.g. ocean) remains about constant throughout its volume
B) The density of a large body of gas (e.g. our atmosphere) remains about constant throughout.
C) The pressure in the ocean remains about constant throughout its volume
D) The pressure in the atmosphere remains about constant throughout.
E) None of the above is true

Answer: A
Liquids are mostly incompressible, so their density remains about the same throughout. The pressure in a liquid increases with depth. Gases can be compressed and both the atmospheric density and pressure varies greatly throughout the atmosphere.

In drinking through a straw, we make use of

A) atmospheric pressure.
B) capillary action.
C) surface tension.
D) Bernoulli's principle.
E) none of these

In drinking through a straw, we make use of

A) atmospheric pressure.
B) capillary action.
C) surface tension.
D) Bernoulli's principle.
E) none of these

Answer: A)

Recall, the drink is pushed up the straw by the pressure difference between the atmospheric pressure pushing down on the liquid, and the very small pressure caused by your sucking the air out of your mouth…

Eg, can’t drink using a straw on the moon, since almost zero atmospheric pressure there

A suction cup sticks to a wall. It is

A) pulled to the wall by the vacuum.

B) pushed to the wall by the atmosphere.

C) both of these

D) neither of these

A suction cup sticks to a wall. It is

A) pulled to the wall by the vacuum.

B) pushed to the wall by the atmosphere.

C) both of these

D) neither of these

Answer: B)

In a vacuum a marshmallow becomes

A) larger.

B) flat.

C) smaller.

D) a hollow shell.

E) none of the above choices

In a vacuum a marshmallow becomes

A) larger.

B) flat.

C) smaller.

D) a hollow shell.

E) none of the above choices

Answer: A

Still have inside pressure of marshmallow cohesive forces and air inside marshmallow, but no outside pressure, so it will expand.

We discussed in class that a barometer made of water would have to be 10.3m tall. Alcohol is less dense than water. If alcohol is used to make a barometer on a day when atmospheric pressure is normal, the height of the alcohol column would be

A) 10.3 m.
B) less than 10.3 m.
C) more than 10.3 m.

We discussed in class that a barometer made of water would have to be 10.3m tall. Alcohol is less dense than water. If alcohol is used to make a barometer on a day when atmospheric pressure is normal, the height of the alcohol column would be

A) 10.3 m.
B) less than 10.3 m.
C) more than 10.3 m.

Answer: C

Recall that 10.3m is the height of a water column whose pressure balances the atmospheric pressure (ie weight of a 10.3m column of water = weight of same column of atmosphere).

Since alcohol is less dense, need more of it to balance the atmospheric pressure.

Suppose you are standing on a weighing scale and suddenly all the atmosphere vanished. Accounting for the buoyancy of air, the reading on the scale would

A) Increase

B) Decrease

C) Remain the same

D) Quickly reduce to zero

Suppose you are standing on a weighing scale and suddenly all the atmosphere vanished. Accounting for the buoyancy of air, the reading on the scale would

A) Increase
B) Decrease
C) Remain the same
D) Quickly reduce to zero

Answer: A

In the presence of the atmosphere, there is an upward buoyancy force on you, that makes the apparent weight as measured by the scales less than your mg.

If this buoyant force is removed, the scales then measure mg, i.e. reading goes up.

Most of the matter in the universe is in the

A) Solid state
B) Liquid state
C) Gaseous state
D) Plasma state
E) None of these

Most of the matter in the universe is in the

A) Solid state
B) Liquid state
C) Gaseous state
D) Plasma state
E) None of these

Answer: D

Recall plasma = ions and electrons in a gaseous phase (eg in a fluorescent lamp). Least common in everyday life but most common form of matter in universe, eg stars

A substance that heats up relatively quickly has a

A) high conductivity.

B) low conductivity.

C) low specific heat.

D) high specific heat.

A substance that heats up relatively quickly has a

A) high conductivity.

B) low conductivity.

C) low specific heat.

D) high specific heat.

Answer: C

Specific heat is like thermal inertia – objects with low specific heat don't require as much heat to raise their temp by the same amount as objects with higher specific heat.

Then, for objects with high specific heat, what is happening to the heat they are absorbing?

Answer: Materials with high specific heat (eg water)can absorb large amounts of energy in the form of internal vibrations and rotations.

The moderate temperatures of islands throughout the world has much to do with water's

A) poor conductivity
B) vast supply of internal energy
C) high specific heat
D) high evaporation rate
E) absorption of solar energy

The moderate temperatures of islands throughout the world has much to do with water's

A) poor conductivity
B) vast supply of internal energy
C) high specific heat
D) high evaporation rate
E) absorption of solar energy

Answer C:
Specific heat capacity reflects the amount of energy needed to raise the temperature of the substance, as discussed in class, and water's specific heat is higher than most substances ✳ doesn't change temperature as much..

If you stake out (measure) a plot of land with a steel tape on a very hot day, the actual amount of land you will have will be

A) smaller than measured.

B) larger than measured.

C) correct.

If you stake out (measure) a plot of land with a steel tape on a very hot day, the actual amount of land you will have will be

A) smaller than measured.

B) larger than measured.

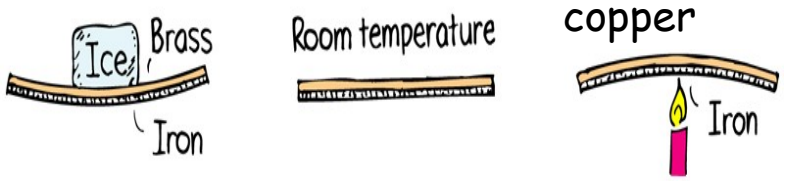
C) correct.

Answer: B

Due to the thermal expansion of the steel, the tic marks on it would be more widely spaced than usual. So a measurement of say 10cm on the expanded tape would represent a larger distance than 10cm.

When a bimetallic bar made of copper and iron strips is heated, the bar bends toward the iron strip. The reason for this is

A) iron expands more than copper.
B) copper expands more than iron.
C) copper gets hotter before iron.
D) iron gets hotter before copper.
E) none of these

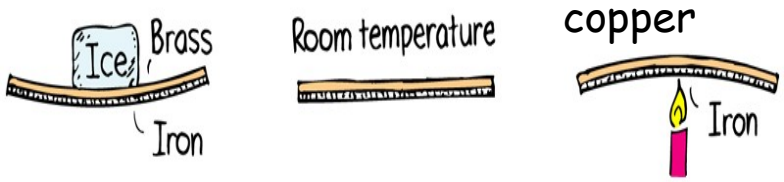


When a bimetallic bar made of copper and iron strips is heated, the bar bends toward the iron strip. The reason for this is

A) iron expands more than copper.
B) copper expands more than iron.
C) copper gets hotter before iron.
D) iron gets hotter before copper.
E) none of these

Answer: B

The copper becomes longer than the iron, but they are stuck together, so the bar bends, with the copper on the outside:



Compared to a giant iceberg, a hot cup of coffee has

A) More internal energy and higher temperature

B) Higher temperature but less internal energy

C) A greater specific heat and more internal energy

D) None of these

Compared to a giant iceberg, a hot cup of coffee has

A) More internal energy and higher temperature

B) Higher temperature but less internal energy

C) A greater specific heat and more internal energy

D) None of these

Answer: B

Internal energy = sum of translational kinetic, vibrational, rotational energies of molecules, whereas temperature = average transl. kinetic per molecule.

So a very large object, even if cooler, will have more internal energy than a smaller one.

Now, if the coffee touches the iceberg, which way will heat flow?

Answer: from cup of coffee to iceberg, as heat always goes from object with higher temp to lower temp, regardless of the relative internal energies

Consider a sample of water at 0 degrees C. If the temperature is slightly increased, the volume of the water

A) increases.

C) decreases.

C) remains the same

Consider a sample of water at 0 degrees C. If the temperature is slightly increased, the volume of the water

A) increases.

C) decreases.

C) remains the same

Answer B)

Ice-water is anomalous in that it contracts on heating. This is why ice floats on water – ponds freeze from their surface downwards.

The vibrations of a transverse wave move in a direction

A) at right angles to the direction of wave travel.

B) that changes with speed.

C) along the direction of wave travel

The vibrations of a transverse wave move in a direction

A) at right angles to the direction of wave travel.

B) that changes with speed.

C) along the direction of wave travel

Answer: A

Eg. water waves, waves on a string, light…, the vibrations move at right angles to the direction of wave travel.

(not like, eg sound, which is a longitudinal wave)

The Doppler effect is characteristic of

A) water waves.

B) light waves.

C) sound waves.

D) all of the above choices

E) none of the above choices

The Doppler effect is characteristic of

A) water waves.

B) light waves.

C) sound waves.

D) all of the above choices

E) none of the above choices

Answer: D

A floating object oscillates up and down 2 complete cycles in 1 second as a water wave of wavelength 5 meters passes by. The speed of the wave is

A) 15 m/s.

B) 5 m/s.

C) 2 m/s.

D) 10 m/s.

E) none of these

A floating object oscillates up and down 2 complete cycles in 1 second as a water wave of wavelength 5 meters passes by. The speed of the wave is

A) 15 m/s.

B) 5 m/s.

C) 2 m/s.

D) 10 m/s.

E) none of these

Answer: D

Freq = 2 Hz, and wavelength = 5 m.

So speed = freq x wavelength = 10m/s

An AM radio station broadcasts at 1 kHz. This means they are generated by electrons

A) whose vibrations take 1,000 s per cycle
B) which vibrate at 1,000 cycles per second.
C) whose waves have crests separated by 103 m.
D) which are amplified at the source by a factor of a thousand
E) none of the above

An AM radio station broadcasts at 1 kHz. This means they are generated by electrons

A) whose vibrations take 1,000 s per cycle
B) which vibrate at 1,000 cycles per second.
C) whose waves have crests separated by 103 m.
D) which are amplified at the source by a factor of a thousand
E) none of the above

Answer: B
1kHz means 1000 Hz, i.e. 1000 cycles per second.

At a concert the oboe is playing a long steady note as you walk away from the stage at an accelerating velocity toward the rest room. The pitch of the sound that you hear, is

A) continually increasing.

B) continually decreasing.

C) steady but lower than normal.

D) steady but higher than normal

E) None of the above choices are correct

At a concert the oboe is playing a long steady note as you walk away from the stage at an accelerating velocity toward the rest room. The pitch of the sound that you hear, is

A) continually increasing.

B) continually decreasing.

C) steady but lower than normal.

D) steady but higher than normal

E) None of the above choices are correct

Answer: B

Doppler effect – if moving away, pitch is lower than that emitted depending on the speed v. So if accelerating away, then it gets lower and lower.

Sound travels faster in air if the air temperature is

A) average.

B) cold.

C) warm.

Sound travels faster in air if the air temperature is

A) average.

B) cold.

C) warm.

Answer: C

From lecture – what the speed of sound depends on..

On a hot day, the speed of sound near the ground is greater than it is at higher altitudes. Then the sound tends to be bent

A) downward.

B) upward.

C) to the right.

D) to the left.

E) None of the above choices are correct.

On a hot day, the speed of sound near the ground is greater than it is at higher altitudes. Then the sound tends to be bent

A) downward.

B) upward.

C) to the right.

D) to the left.

E) None of the above choices are correct.

Answer: B

Since sound is traveling faster near the ground, and slower higher up, the bottom of the wavefronts cover more distance in a second than the top of the wavefronts, so the wave bends away from the ground, i.e. upward.

(recall figure from the lecture)

As a wave propagates, some of its energy dissipates as heat. In time, this will reduce the wave's

A) Speed
B) Wavelength
C) Amplitude
D) Frequency
E) Period

As a wave propagates, some of its energy dissipates as heat. In time, this will reduce the wave's

A) Speed
B) Wavelength
C) Amplitude
D) Frequency
E) Period

Answer: C

(And note that higher frequencies dissipate faster than lower ones i.e. lower pitches tend to travel further.)

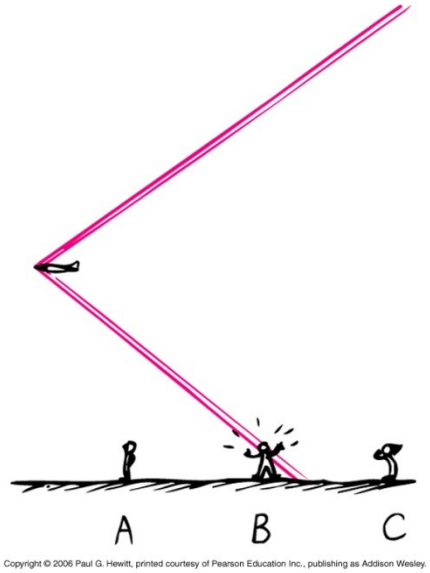
When you tune a radio to a certain station, you match the frequency of the internal electrical circuit to the frequency of the wanted radio station. In so doing you are employing the principle of

A) wave interference.
B) forced vibrations.
C) reverberation.
D) resonance.
E) beats.

When you tune a radio to a certain station, you match the frequency of the internal electrical circuit to the frequency of the wanted radio station. In so doing you are employing the principle of

A) wave interference.
B) forced vibrations.
C) reverberation.
D) resonance.
E) beats.

Answer: D



A supersonic aircraft is passing overhead as shown.

Which of the following statements is true ?

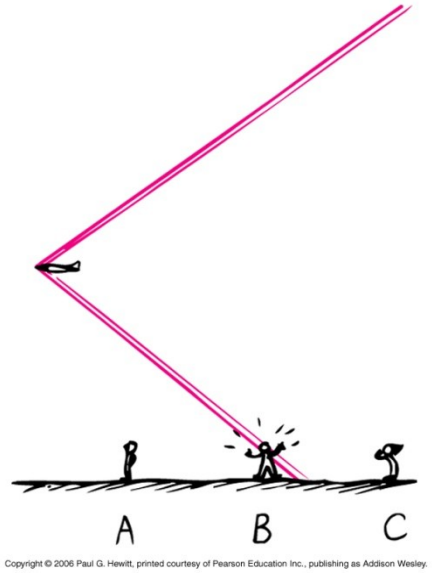
A) No-one hears anything, although B receives a burst of radiation at the instant shown.

B) B hears a sonic boom at the instant shown while A and C hear nothing.

C) B and C hear a sonic boom at the instant shown while A hears nothing

D) If the craft's speed increases further, the "V"-shape becomes less narrow

E) The sonic boom increases in intensity as the craft goes by.



A supersonic aircraft is passing overhead as shown.

Which of the following statements is true ?

A) No-one hears anything, although B receives a burst of radiation at the instant shown.

B) B hears a sonic boom at the instant shown while A and C hear nothing.

C) B and C hear a sonic boom at the instant shown while A hears nothing

D) If the craft's speed increases further, the "V"-shape becomes less narrow

E) The sonic boom increases in intensity as the craft goes by.

Answer: B, supersonic ✳ waves travelling faster than speed of sound, crests all bunch up, and reach observer all at once, yielding the sonic boom

In which one of these media does sound travel the fastest?

A) water vapor
B) water
C) ice
D) Cannot determine without knowing the frequency or wavelength.
E) Sound travels the same speed in each of the above media.

In which one of these media does sound travel the fastest?

A) water vapor
B) water
C) ice
D) Cannot determine without knowing the frequency or wavelength.
E) Sound travels the same speed in each of the above media.

Answer: C

Sound travels fastest in a solid

Suppose you sound a 1056-hertz tuning fork while striking a note on the piano and hear 2 beats/second. You loosen the piano string very slightly, making it a lower pitch, and now hear 3 beats/second. What is *now* the frequency of the piano string?

A) 1053 hertz
B) 1054 hertz
C) 1058 hertz
D) 1059 hertz
E) 1056 hertz

Suppose you sound a 1056-hertz tuning fork while striking a note on the piano and hear 2 beats/second. You loosen the piano string very slightly, making it a lower pitch, and now hear 3 beats/second. What is *now* the frequency of the piano string?

A) 1053 hertz
B) 1054 hertz
C) 1058 hertz
D) 1059 hertz
E) 1056 hertz

Answer: A

Since you hear 3 beats/sec, the frequency of the string must either be 1053-Hz or 1059-Hz. Before it was loosened, the beat frequency was lower, i.e. closer to the tuning fork frequency 1056-Hz. So the new frequency must be 1053-Hz, as tightening it, raising the frequency, decreases the beating and so brings it closer to the tuning fork frequency.

When the distance between two protons is doubled, the electrical repulsion force between the charges

A) Doubles
B) quadruples
C) halves
D) is quartered
E) stays the same

When the distance between two protons is doubled, the electrical repulsion force between the charges

A) Doubles
B) quadruples
C) halves
D) is quartered
E) stays the same

Answer: D, is quartered

Inverse square law – force goes as 1/d2.

The electric field around an isolated electron has a certain strength 1 cm from the electron. The electric field strength 2 cm from the electron is

A) Half as much

B) The same

C) Twice as much

D) Four times as much

E) None of the above is correct

The electric field around an isolated electron has a certain strength 1 cm from the electron. The electric field strength 2 cm from the electron is

A) Half as much

B) The same

C) Twice as much

D) Four times as much

E) None of the above is correct

Answer: E, none of the above

Inverse-square dependence on distance (see previous qn), so if double the distance, then the field (and force on a test charge) goes down by ¼.

To say that an object is electrically polarized is to say

A) It is electrically charged

B) Its charges have been rearranged

C) Its internal electric field is zero

D) It is only partially conducting

E) It is to some degree magnetic

To say that an object is electrically polarized is to say

A) It is electrically charged

B) Its charges have been rearranged

C) Its internal electric field is zero

D) It is only partially conducting

E) It is to some degree magnetic

Answer: B, its charges have been rearranged

From lecture: the electron cloud around the nucleus gets slightly displaced, so that on one side of the object there is more – charge and on the other, more + charge.

An uncharged pith ball is suspended by a nylon fiber. When a negatively charged rubber rod is brought nearby, without touching it, the pith ball

A) is repelled by the rod.
B) Is attracted by the rod
C) becomes charged by induction.
D) is unaffected.
E) None of the above choices are correct.

An uncharged pith ball is suspended by a nylon fiber. When a negatively charged rubber rod is brought nearby, without touching it, the pith ball

A) is repelled by the rod.
B) Is attracted by the rod
C) becomes charged by induction.
D) is unaffected.
E) None of the above choices are correct.

Answer: B

The charges in the pith ball rearrange, with the electrons shifting away from the negative rod. This is polarization. The attraction of the negative rod to the closer positive charges in the pith ball is larger than the repulsion of the rod with the pith ball's electrons (further away), so there is net attraction between the rod and the ball.

Note that if instead the rod was positively charged, there is still a net attraction (see lecture notes)

A child's balloon charged to a large voltage is not dangerous because

A) rubber is not a good conductor of electricity.
B) its outside surface is positively charged.
C) the potential difference between the balloon and the child's hand is very small.
D) it has very little charge and energy
E) None of the above choices are correct.

A child's balloon charged to a large voltage is not dangerous because

A) rubber is not a good conductor of electricity.
B) its outside surface is positively charged.
C) the potential difference between the balloon and the child's hand is very small.
D) it has very little charge and energy
E) None of the above choices are correct.

Answer: D

Recall lecture…

Cool a copper wire and the electrical resistance between its ends

A) increases
B) decreases
C) is unchanged

Cool a copper wire and the electrical resistance between its ends

A) increases
B) decreases
C) is unchanged

Answer: B

Resistance is less for lower temperatures.

Also note that resistance is less if the wire is thicker.

A 20-ohm toaster is connected across a 120-V power supply. What is the current drawn?

A) 20 A

B) 120 A

C) 6 A

D) 240 A

E) none of these

A 20-ohm toaster is connected across a 120-V power supply. What is the current drawn?

A) 20 A

B) 120 A

C) 6 A

D) 240 A

E) none of these

Answer: C, 6A

Current = voltage/resistance = 120/20 = 6 A

(Ohm's law)

When a 60-W light bulb is connected to a 240-V source, the current in the light bulb is

A) 4 A

B) 0.25 A

C) 6 A

D) 1440 A

E) none of these

When a 60-W light bulb is connected to a 240-V source, the current in the light bulb is

A) 4 A

B) 0.25 A

C) 6 A

D) 1440 A

E) none of these

Answer: B, 0.25 A

Power = voltage x current, so current = power/voltage = 60-W/240 = 0.25A

If a current is flowing in a wire, which of the following must be true?

A) The wire must have a high resistance

B) There must be a net charge on the wire

C) There must be a potential difference across the ends of the wire

D) None of the above

If a current is flowing in a wire, which of the following must be true?

A) The wire must have a high resistance

B) There must be a net charge on the wire

C) There must be a potential difference across the ends of the wire

D) None of the above

Answer: C

The charge flows in response to a potential difference. The potential difference must be maintained in order for the current to keep flowing.

When you turn on a light switch, which of the following is true?

A) Light is generated almost instantaneously from electrons travelling extremely fast, released from the switch and going through the lamp filament.
B) Light is generated from electrons travelling extremely fast from the power plant through to the outlet, then on to the lamp.
C) The electrons already present in the lamp filament generate the light, sensing the electric field signal almost instantaneously.
D) The electrons already present in the lamp filament generate the light, leaving the entire circuit positively charged.

When you turn on a light switch, which of the following is true?

A) Light is generated almost instantaneously from electrons travelling extremely fast, released from the switch and going through the lamp filament.
B) Light is generated from electrons travelling extremely fast from the power plant through to the outlet, then on to the lamp.
C) The electrons already present in the lamp filament generate the light, sensing the electric field signal almost instantaneously.
D) The electrons already present in the lamp filament generate the light, leaving the entire circuit positively charged.

Answer: C
From lecture…electrons are present throughout the circuit and all react almost instantaneously when the switch is turned on.

Modern automobile headlights are connected in

A) parallel
B) series
C) resonance
D) none of these

Modern automobile headlights are connected in

A) parallel
B) series
C) resonance
D) none of these

Answer: A

This is why one can still be on while the other is out.

As more lamps are put into a series circuit, the overall current in the power source

A) increases.
B) stays the same.
C) decreases.

As more lamps are put into a series circuit, the overall current in the power source

A) increases.
B) stays the same.
C) decreases.

Answer: C

The total resistance of the circuit increases, while there is the same voltage across it. So the current through it, V/R, decreases.

As more lamps are put into a parallel circuit, the overall current in the power source

A) increases.
B) stays the same.
C) decreases.

As more lamps are put into a parallel circuit, the overall current in the power source

A) increases.
B) stays the same.
C) decreases.

Answer: A

More current is drawn from the power source when more elements are added in parallel, since they each must have the same voltage across them, and so the current in each is V/R; the total current is then the sum of V/R for each R.

When we say that an appliance “uses up electricity” we really mean that

A) current disappears
B) electric charges are dissipated
C) the main power supply voltage is lowered
D) electrons are taken out of the circuit and put somewhere else
E) electron kinetic energy is changed into heat

When we say that an appliance “uses up electricity” we really mean that

A) current disappears
B) electric charges are dissipated
C) the main power supply voltage is lowered
D) electrons are taken out of the circuit and put somewhere else
E) electron kinetic energy is changed into heat

Answer: E

Note that no electrons are created or destroyed or dissipated. Rather, the electrons (always present in the circuit) gain kinetic energy from the power source, almost instantaneously responding to the electric signal when switched on, and this gets transformed to light, heat etc.