Matter Review

Science vs. Technology:

1. Read the following passage. Identify whether you think it is more science or technology. Defend your opinion with what we learned about the 2 in class.

Listen, Humpty Dumpty, I hate to break it to you, but while there are certain medical situations where a bandage is good enough to stick you back together again, this is not one of them. Sometimes, even the best intentions (and combined efforts of the reigning monarch's horses and men) aren't enough. Please, go consult with the slug mucus experts immediately.

That's right: slug mucus. When the Dusky Arion slug is threatened, it secretes a mucus that makes it next to impossible for anything to peel the gastropod from its perch. That's bad news for hungry predators, but for biomedical researchers it presented an irresistible opportunity.

In a study published Thursday in Science, *researchers showed how a new tough adhesive inspired by slug slime could work even in the most slippery, blood-soaked situations.*

The slug mucus works because it has positively charged particles that help bind it to whatever surface the slug happens to be crawling on. So researchers created a gel made primarily of water—a hydrogel—with similar properties. The resulting adhesive sticks to a surface in three ways. First, through the positively charged particles that stick to a surface like a sock sticks to your shirt fresh out of the dryer. It also forms weak bonds with the atoms on the desired surface, and slimes its way into every nook and cranny, becoming physically entwined with the stuff it's stuck to.

Combined with a super stretchy matrix, the result is a flexible, strong adhesive that sticks even to wet surfaces—like a heart undergoing surgery. The authors tested the gel on a pig's heart and on rats. Not only did the adhesive hold as well or better than anything already on the market, but it also turned out to be non-toxic, an advantage that some alternatives couldn't match.

"It's a long standing challenge in the materials and biomedical fields," says Jianyu Li, a co-author of the paper. "How we can form a strong and effective adhesion on biological surfaces? Especially considering that in the human body you have blood and other bodily fluids, and forming adhesions on those surfaces turns out to be very challenging."

They're not the first researchers to turn to animals for sticky inspiration. Mussels have helped make similar glues, including some that work underwater. Another team combined the abilities of geckos and mussels to make a better bandage. There's even a bone-setting glue inspired by an underwater worm in the works.

In its current stretchy form, Li says that the adhesive is well suited for working on dynamic organs like the heart and lungs, which are constantly in motion throughout the day. Because the adhesive can stretch without losing strength, it could be used to patch holes in the organs, keeping blood or air safely in its place. Or it could be used to attach a device like a pacemaker while still accommodating the movement of the heart.

This has only been demonstrated on animals so far, and it's not likely to be used in humans for quite some time. But Li and colleagues are already working on developing other uses for the incredibly sticky adhesion. With more research, Li believes the adhesive could be used as a drug delivery method, releasing drugs at a controlled rate in a particular place within the body.

It's a sticky situation, but an exciting one. And we have only the slugs to thank.

- Science - the researchers are curious about the slug slime
  - they are asking "how does the slime work?)
  - it's not about making money from slug slime.

Technology: - the study is not done simply out of curiosity.
- the people doing the study are trying to determine if slug slime can be used to treat the wounds of humans, making their lives better
- They are asking "how can we use slug slime?"
- If the discover rings true, they will be able to sell the product & make money.

2. Read the following passage. Identify whether you think it is more science or technology. Defend your opinion with what we learned about the 2 in class.

Yes, the bird that calls loudly at your window an hour before your alarm goes off is annoying, but how does it learn to sing like that? More specifically, how does it learn to sing that particular song when surrounded by a chorus of other birdy voices? For years, scientists have wondered if birds are born knowing their distinctive calls or if they learn the behavior over time (practicing, practicing, practicing, until they get to an avian Carnegie Hall).

It looks like it may be the former. In a study published Monday in Nature Ecology and Evolution, *ecologists found that even if other species of birds raised young nestlings, the nestlings would still respond more strongly to the songs of their own species. Each songbird's vocal taste was determined—at least in part—by genetics.*
Some animal behaviors can be learned, as the internet will gladly remind us, with cats acting like bunnies ducklings acting like kittens and ducks acting like dogs. But in some cases, nature beats nurture.

For this study, the researchers examined the pied flycatcher and collared flycatcher, two birds that live on the same island in the Baltic sea. They knew that nestlings in each species would start to visibly respond to their species' songs as early as 10 days after they hatched. The ecologists wanted to see if swapping out eggs in the nest (and having the other flycatcher species raise them) would affect the birds' responses to song. In other words, could the baby birds be tricked into learning a totally new birdsong if that's all they heard after hatching?

But the birds weren't fooled by the old switcheroo. Collared flycatcher nestlings responded more strongly to recordings of collared flycatcher adults, opening their little beaks and looking around *intently for the source of the noise—and basically ignoring the pied flycatcher songs. The pied flycatcher nestlings raised by collared flycatchers behaved in a similar way.*

Then, the ecologists took the study a step further. They created hybrids of the two species and found that the resulting hybrid nestlings responded much better to pied flycatcher songs. That suggests to them that there was a genetic component to the song preference.

"Song differences across species are vital for birds to choose appropriate mates and negotiate complex social interactions. A genetic basis for song discrimination in early life may help explain how song differences are maintained in a noisy, diverse world," study co-author David Wheatcroft said in a statement.
And the world is getting noisier. In addition to rival birdsongs, birds also have to contend with—and adapt their songs to—human noises like traffic.

Science:
- the researchers are doing the study because they are curious
- it is difficult to see how studying how birds learn songs can help make humans' lives better.
- it is difficult to see how they could make money off of this study.

Technology:

McGregor does not see how this could be technology. (no human impact)

Properties of Matter:

1. Identify each of the properties below as physical intensive (PI), physical extensive (PE), or chemical (C).

Colour: PI
Colour Intensity: PE
Odor: PI
Taste: C / PI
Volume: PE
Elasticity: PI
Reaction with Acid: C
Phase or State (solid, liquid, or gas) : PI
Luster (shinyness) : PI
Flammability: C
Melting Point: PI
Explosive: C
Toxic: C
Mass: PE
Temperature: PI
Hardness: PI
Tarnishes in air: C
Flexibility: PI
Electrical Conductivity: PI
Solubility (ability to dissolve in water): PI
Shape: PI
Viscosity: PI
Ductility: PI
Malleability: PI

Changes of Matter:

1. Identify each of the changes below as physical (P) or chemical (C).

Aluminum foil is cut in half: P
Rust forms on a car: C
Food scraps turn into compost: C
Hydrogen peroxide bubbles in a cut: C
A match is lit: C
The production of yoghurt from milk: C
Grinding chalk into dust: P
Dissolving sugar in coffee: P
A puddle of water evaporates: P
Burning your toast: C

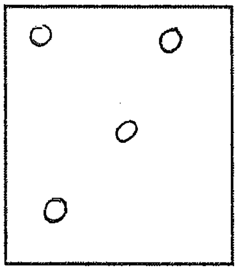
Fruit Ripening: C
Chopping a log in half: P
Tearing Paper: P
Bleaching a stain: C
Sanding a piece of wood: P
Breaking glass: P

Classification of Matter:

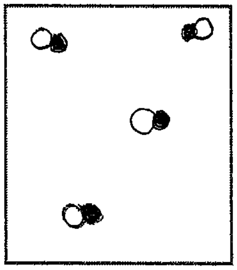
Identify each example of matter as Pure Substance Element (E), Pure Substance Compound/Molecule (C), Mixture Homogenous (Ho), or Mixture Heterogeneous (He).

Sand: He
Pure Air: Ho
Salad Dressing: He
Kool Aid: Ho
Raison Bran: He
Carbon Dioxide: C
Gold: E
Chocolate Milk: Ho
Sushi: He
Titanium: E
Carbon: E
Glucose: C
Concrete: He
Limestone ($CaCO_3$) : C
Brass (copper mixed with zinc) : Ho
Taco Chips: He
Orange Juice with Pulp: He
Benzene (C_6H_6) : C

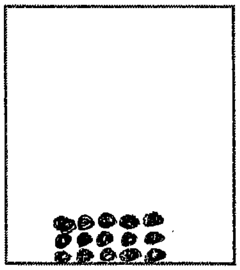
A.



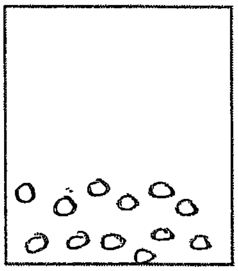
B.



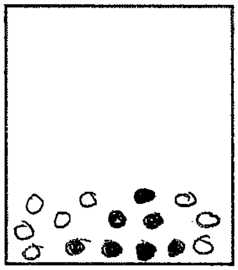
C.



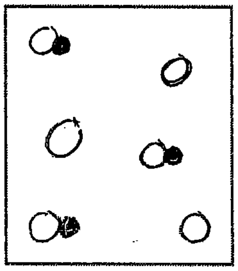
D.



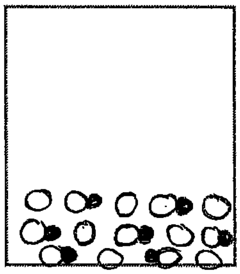
E.



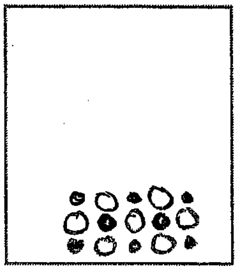
F.



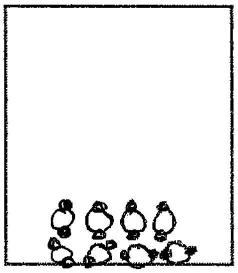
G.



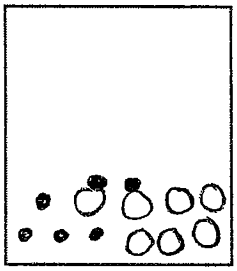
H.



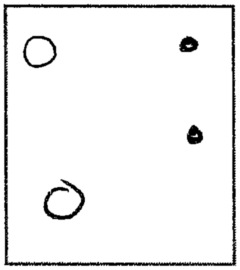
I.



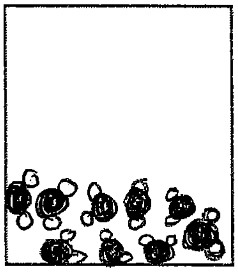
J.



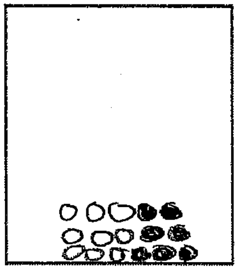
K.



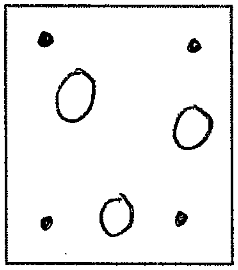
L.



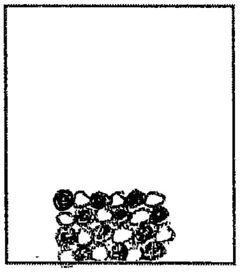
M.



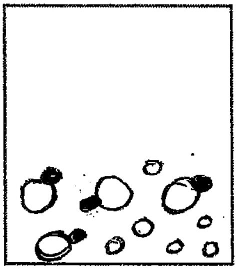
N.



O.



P.



Identify whether each is a solid (s), liquid (l), or gas (g) AND whether it represents an element (e), compound/molecule (c), homogenous mixture (Ho), or heterogenous mixture (He).

Ex: A. g, e B. g, c C. s, e D. l, e

E. l, He F. g, Ho G. l, Ho H. s, He

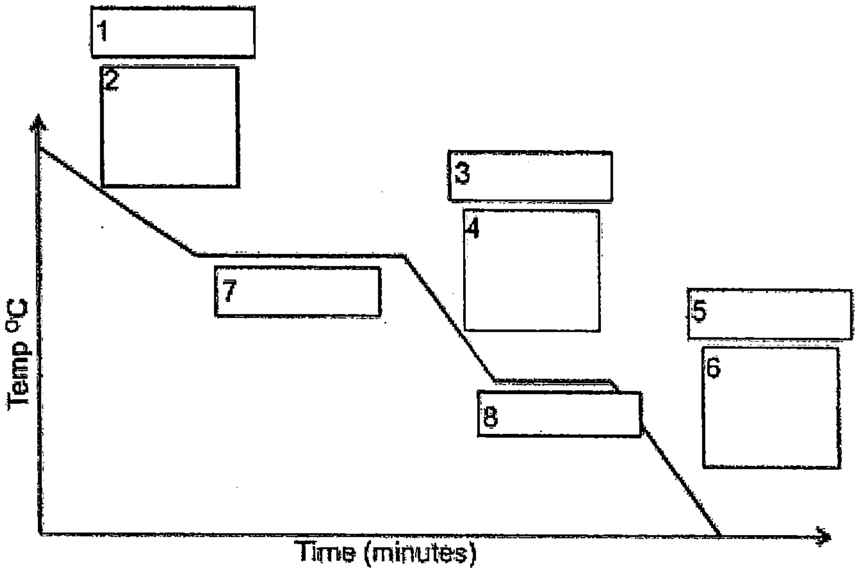
I. s, c J. l, He K. g, He L. l, c

M. s, He N. g, Ho O. s, Ho P. l, He

Heading and Cooling Curves:

Cooling curve

Annotate to show what is happening.



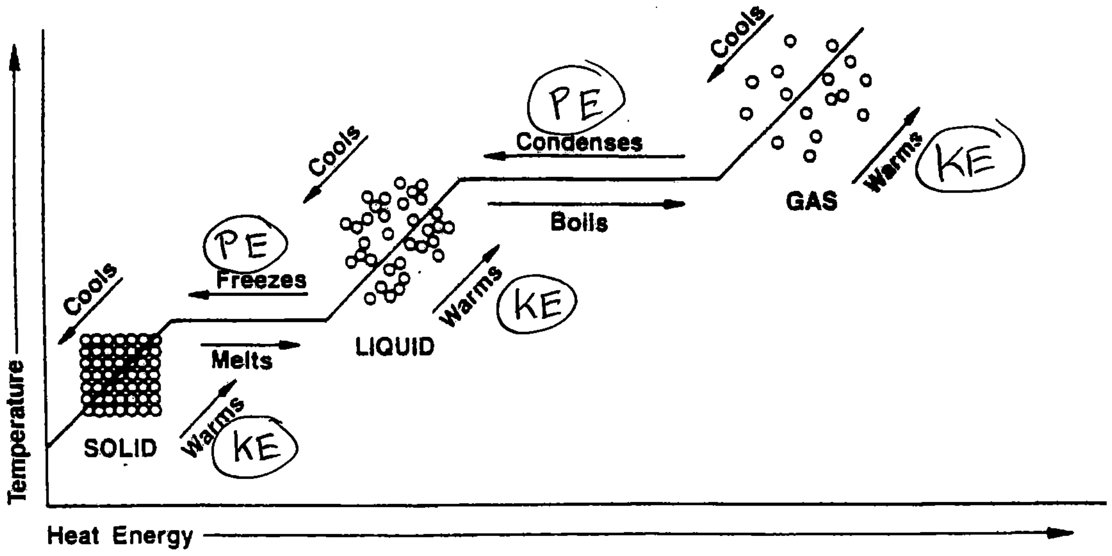
1/ Refer to the curve above

1. gas being cooled
2. gas particles slowing down and moving closer together

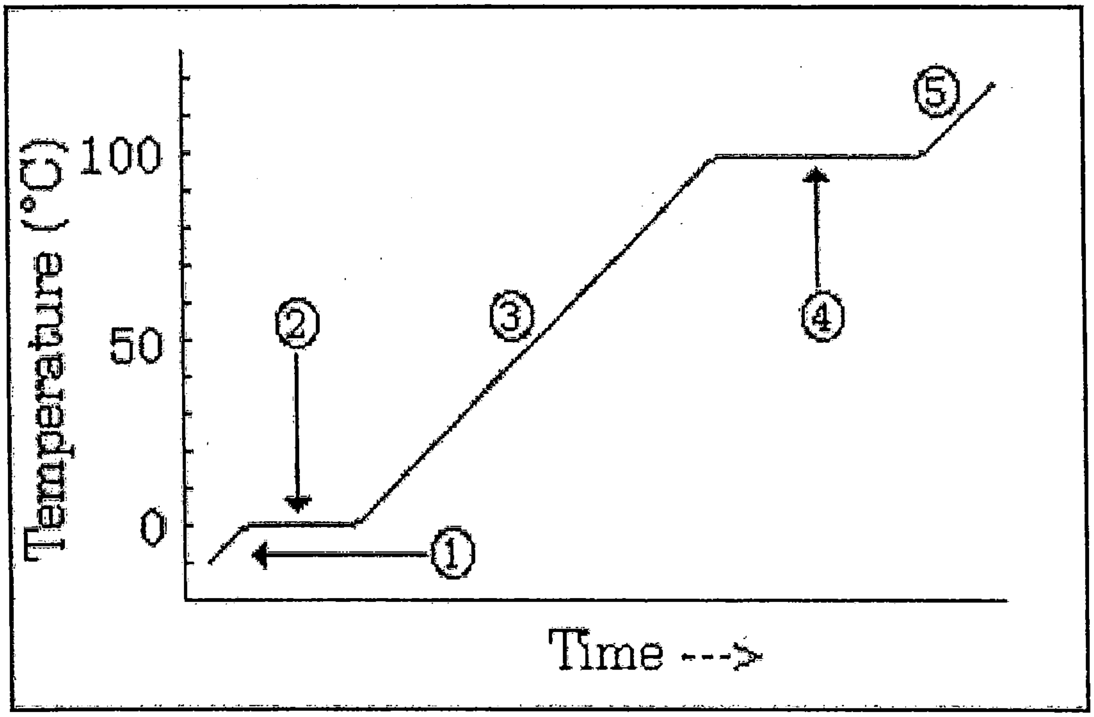
3. liquid being cooled
4. liquid particles move slower and move closer together

5. solid being cooled
6. particles are vibrating slower & slower

7. condensation (gas to liquid)
8. freezing/solidification (liquid to solid)



2/ Label the diagram above with KE and PE to show where Kinetic Energy and Potential Energy are changing.



3/

What is the melting point of the substance? 0 °C

What is the vaporization point of the substance? 100 °C

What is the solidification point of the substance? 0 °C

What is the condensation point of the substance? 100 °C

What regions of the curve show where Kinetic Energy is changing? 1, 3 & 5

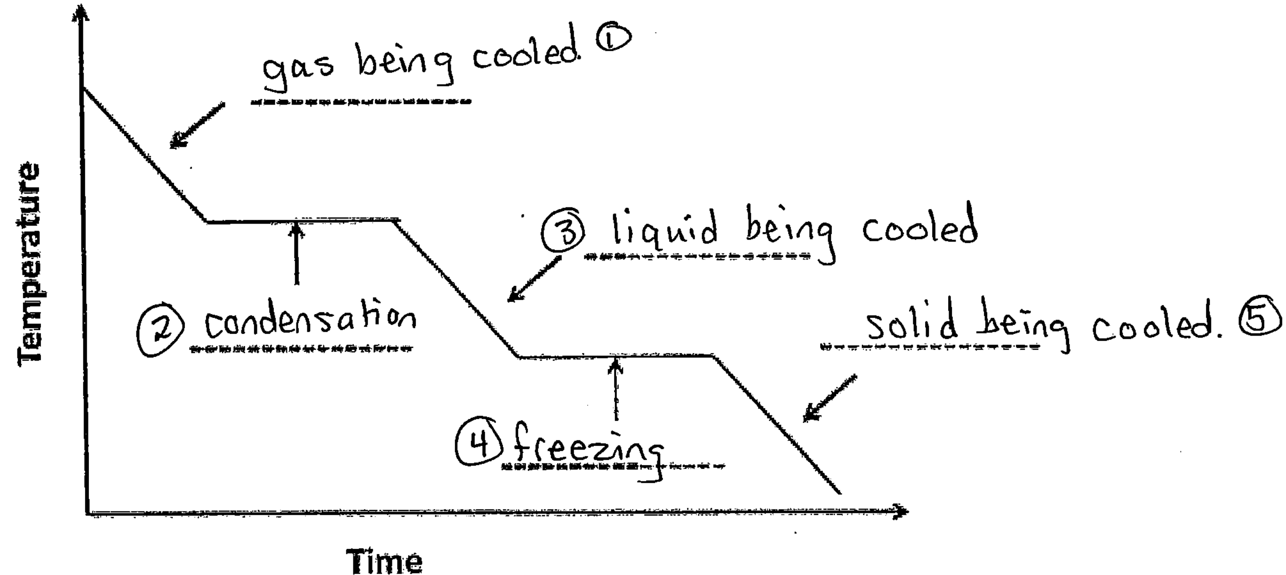
What regions of the curve show where Potential Energy is changing? 2 & 4

What region shows where the gas is being warmed? 5

What region shows where the solid is being heated? 1

4/

Cooling Curve

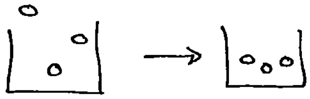


A container of gas has been placed in a freezer, and a scientist measures the temperature every 10 minutes.

1. Label the graph with the correct scientific processes.
2. Describe what is happening at each stage.

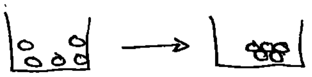
① gas particles are slowing down [redacted]

② substance changing from gas to liquid



③ liquid particles slowing down & [redacted]

④ substance changing from liquid to solid.



⑤ solid particles vibrating slower [redacted]

5/ Explain why temperature does not change during a phase change.

* before the phase change, all added energy is going into making particles move faster. This is kinetic energy changing

(cooling? all energy being removed goes into making particles move slower. (KE change)

* during the phase change, all added energy goes into separating particles from each other & changing forces between particles. This is a potential energy change.

(cooling? all energy being removed goes into moving particles together & forming forces between particles)

* temperature is a measure of only kinetic energy.

* Since K.E. does not change at the phase change, neither does temperature.

Terms: Define each word/phrase and give an example where appropriate

Science: a unique way of gaining understanding about the world around us.

Biology: study of life & living things

Chemistry: study of matter, its changes and properties

Physics: study of motion and energy

Scientific Method: the unique method science uses to explain the world around us

Law: after repeated testing, it describes something but does not explain Ex: Law of Conservation of Matter

Theory: after repeated testing, it describes and explains a phenomenon Ex: Theory of Evolution

Model: after repeated testing, it describes something visually something too large or small to observe. Ex: Model of Solar System

Physical Property: a property that can be observed without a chemical reaction. Generally describes matter interacting with energy Ex: Melting Point

Chemical Property: a property that needs a chemical reaction to test if the substance has the property. Generally involves matter interacting with other substances Ex: reaction with acid

Intensive Physical Property:
a property that does not change with the amount of matter Ex: melting point

Extensive Physical Property:
a property that changes when the amount of matter changes Ex: volume

Physical Change:
a reversible change that does not change the substance Ex: breaking glass

Chemical Change:
a change in substance. Results in new properties & is difficult to change back. Ex: decaying

Pure Substance:
– matter with a unique and identifiable set of properties Ex: pure water (H_2O)

Element: a pure substance composed of one type of atom
Ex: Palladium

Compound/Molecule: a pure substance with 2 or more types of atoms ~~bede~~ bonded together. Ex: CH_3OH (methanol)

Mixture:
2 or more pure substances physically/mechanically combined Ex: salt water

Homogenous Mixture:
a mixture that looks the same throughout Ex: milk

Heterogenous Mixture:
a mixture that is not uniformly mixed Ex: really sour milk

Kinetic Energy:
the energy associated with the motion of particles

Potential Energy:
the energy associated with bonds & forces between particles

Phase Change:
a change in state of matter
Ex: boiling

Solidification:
the change from liquid to solid

Liquification:
the change from solid to liquid

Condensation:
the change from gas to liquid

Vaporization:
the change from liquid to gas

Boiling Point:
the temperature at which a substance changes from a liquid to ~~a~~ gas

Melting Point:
the temperature at which a substance changes from a solid to a liquid

Freezing Point:
the temperature where a substance changes from a liquid to a solid

Condensation Point:
the temperature ~~at~~ which a substance changes from a gas to a liquid.