Herbert's Dune and Children of Dune

Worksheet

1. Give examples in the Dune context of the parallel effects of LSD and the Melange:
a. Telltale changes to the eye:
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b. Suspension of time:
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c. Ecstatic (or sometimes frightening) sense of communion with others:
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d. Out-of-body sensations:
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e. Loss of self and merger into a oneness:
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f. Euphoria:
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g. Death-rebirth experience:
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h. Visions/hallucinations:
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2. In 1978, a blind patient from New York name Jerry underwent surgery to receive the first bionic eye, pioneered by private U.S. biophysicist William Dobell (1941-2004). Dobelle's idea was based on studies from the 1950s showing that if you stimulated the visual cortex with electrodes, you could arouse faint light sensations, called phosphenes, evn in blind people. His systems included a tiny camera mounted on a pair of eyeglasses, which captured the scene and sent a signal to a computer that Jerry carried on a waist pack. Then came the bionics: the computer fed the signal to a dozen microelectrodes that a surgeion had previously inserted into Jerry's visual cortex. All Jerry could see were a few faint dots of light. However, with lots of training, he learned to identify some objects. Amazingly, the brain filled the gaps left by his patchy vision. Another, Dobelle patient, Jens Naumann, did even better in 2002. He hit the headlines when he drove a car a few meters. The Tleilaxu eyes in "Dune" are able to work as an artificial eye, and emulate the formidable processing that takes place in the retina. Dobelle tried to achieve this by using a computer algorithm that elaborates signals before they reach the brain. Even today's supercomputers are not able to recognize a human face like any newborn baby doe effortlessly.
In 2006, Kwabena Boahen, built a silicon chip that would copy the structure of a retina. Phototransistors emulated cones and rods, while other types of a transistors performed the functions

of the different retinal neurons. Instead of physically rewiring itself, Boahen and colleages used softwires algorithms that virtually connected different transistors like they were real neurons. Boahen claims that this technique had a resolution of about 5,700 pixels, and process signals almost like a real retina. So, are Tleilaxu eyes a possible reality in our short future? Explain.
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3. Physics limits size structurally, such as the ultimate potential height to which trees can grow. Above a certain height, a tree will bend due to it's own weight. An animal's skeleton resembles, in principle, a beam supported at either end. Beams carrying no additional weight sag downward proportionally to the square of their length and cross-sectional size. Given two similar beams, one 5 cm long and the other 2 meters long, the longer sags 1,300 times as much as the shorter beam. Applying this to terrestrial animals, we find that, as an animal's size increases, it's skeleton gets bulkier and heavier. Dune's sandworms range from medium worms of about 200 meters long, to 3.25 kilometers for the biggest, with an 80 meter diameter mouth with which it can swallow a 120 by 40 meter harvester in one gulp. To build a Sand Worm this size would require structural materials made of Titanium or carbon nanotubes. This would still give the Worms a mass of 24,000 kg. (Note: Earth's largest whales are barely over 33 meters) Is this a realistic size for an animal on a planet with gravity similar to the earth? Explain.
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4. The remarkable speed that "Dune" ascribes to the giant sandworms, wouldn't be possible underground in a terrestrial type of medium. Instead, it is described that Dune's desert sands have properties similar to water. For an animal immersed in water, it's weight is counterpoised with the water around it and there no longer remains as great a physical barrier to indefinite growth. In an aquatic animal, the larger it grows, the faster it goes. It's energy (for locomotion) depends on muscle mass (a function of volume), but it's motion through water is opposed only by friction (a function of surface area), not by gravity, as on land. However, if we assume that Dune's sand acts like water, then can men walk on the sands? Explain.
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5. The surface area of a body, such as a cylinder, increases as the square of the radius increases, whereas the volume of that same body increases as the cube of the radius increases, which means that as an animal's size increases, the volume increases much faster than the surface area. AS animals engage in strenuous activity, they generate heat as a function of the musculature and hence of volume. Normally the surface enables animals to efficiently lose heat, but with a larger volume-to-surface area ratio, larger animals will have a harder time disposing of extra heat. How, then, would the much larger sandworm, with a scaly, water-impermeable integument, rid itself of excess heat generated from chasing prey?

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>6. On Earth, all oxygen production stems from plants, single-celled organisms like algae, and photosynthetic or chemosynthetic bacteria. No animal produces oxygen. Then, where does a planet like "Dune" get it's oxygen for humans to play around on? (Investigate chemoautotrophic bacteria in the guts of tube worms).

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7.Genetic Manipulation is a powerful theme throughout the Dune series. Herbert created a universe where "desired" traits could be enhanced through may carefully controlled generations or created through mechanical manipulation of genetic molecules.

a. The elite sisterhood of the Bene Gesserit had their own, gentler answer to the problem of human evolution: the selective breeding, over ninety generations, of a fully prescient human who would be the Kwisatz Haderach. Who is the Kwisatz Haderach?

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b. In the process of selective breeding, the Bene Gesserit discovered that complex traits can be specified by single genes. Give an example in today's real world, where we find enormous size

variations from a few nucleotides, or a tiny snippet inside a gene.
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c. If human math prodigies only mated with math prodigies, we might arrive at a clan of humans that can calculate complex math problems in their head. Is there a clan, in Dune, that is an example of this? Who?
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d. In the process of selective breeding, the Bene Gesserit discovered that selecting for one desirable trait may bring a host of other unforeseen traits with it. Give an example in today's real world, where we find this happening in breeding programs? Are recessive genes a problem with this?
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e. It is no longer socially acceptable to brain an annoying rival with a club, or to stab a sibling who reaches for the last meat morsel. Do you think humans are headed in a particular direction of selective breeding, or human evolution? Explain.
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f.How do the Bene Gesserit control what sex their baby will be? (Remember, mothers have XX chromosomes and Fathers XY chromosomes) Do you think this is possible?
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g. Brain researchers have determined that memories are generated by the creation of new connections between neurons within an organism through experience and, although the process may involve the actions of nucleic acids or proteins, the memories themselves are stored as a type of neuronal code. This code is based on the proximity and firing patterns of neurons in the brain that represent memories. There is no evidence that memories are inherited by offspring. What are the examples, in "Dune", that make a reality towards this Science Fantasy?
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h. Physical attributes involve the organized distribution of the body into three body layers----the cells and tissues lining our gut and other organs (endoderm), the skin and neuronal layer (ectoderm), and our structural components (mesoderm). The organization of cell types is determined during development in a sequential process that is dictated by our genes. Cellular fates inherited from your parents determine the specific structure of your nose. However, once these determinations have been made, cells progress from a pluripotent state to a differentiated state. Chemical signals that are

received by the cell during the process of differentiation tell it where to go, what cell type to become, and whether to keep dividing or stop dividing. Once a cell has become differentiated, it cannot be returned to become to it's original pluripotent state. How would this be a problem for the Tleilaxu Face-Dancers?
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8. In a America, the Cherokee Natives, were depopulated through disease, warfare, and forced removal throughout the last 200 years. At times they seemed to be on the road of extinction. However, they seem to have a knack of survival. What clan, in "Dune", does this relate to? Explain.
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9. In "Dune" we are told that Arrakis is the third planet orbiting Canupus. Canupus is the brightest star in the constellation of Alpha Carinae. It is approximately 310 light years from Earth and is a yellowish white supergiant star. Canupus is more than 900 times brighter the Sirius and Sirius is 22 times brighter than our the sun. Do you think it is possible that Arrakis could sustain life?
a. Compared to our Earth-Sun relationships, what conditions need to be met sustain life? (Don't forget the need for liquid water)
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b. Since Canupus is so large, would it be more likely to produce stellar flares?
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c. Earth is 4.6 billion years old and life on Earth, corresponding to the oldest known fossils, began 3.8 billion years ago. Stars appreciably larger than that of Earth's sun live only a billion to a few tens of millions of years. Would Canupus have enough time to develop life?
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10. Who is Muad'Dib?
11. The Dune series shows what can happen when belief in a prophet is taken to the extreme. Muad'Dib tried to excape his "terrible purpose" and prevent the religious war, but ultimately his followers grew into the fanatics he had foreseen, and he could not stop them. In the end, he railed against the religion which gave him godhead and then killed people in his name. But he knew that, even after his death, the jihad would follow his ghost. Muad'Dib was, after all, just a man. Can you site examples of this behavior in today's real universe? Explain.
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12. In Dune, Kynes's description that perspiration passes through the inner porous layer of a Stillsuit, after having cooled the skin.
a. Evaporating a liquid such as perspiration requires heat. This heat is
supplied by our bodies. The removal of heat from the skin cools the skin
and body inside. How is this fact, inconsistent with the above statement? (Note that the stillsuit described in "Dune" routes the perspiration away from the skin)
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b. What happens to humans who have exceeded their body's ability to cool by evaporative cooling.
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c. It is mentioned that the stillsuit condenses the evaporated sweat to liquid water for drinking purposes. This creates a closed system. Is this possible without a powered cooling system? Where would this power come from?
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d. It is mentioned that urine and feces are processed in the thigh pads. Do you believe that the body

movements of a human, enable this process to occur? Explain. (Note: Fluid movement requires pressure differentials)
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13. In Dune, two ancient schools survive from the times of the Butlerian Juhad---the Spacing Guild and the Bene Gesserit. Thes schools were designed to develop human talents to eliminate dependence upon “thinking machines”. With one exception, the Guild is male and “emphasizes almost pure mathematics”. The Bene Gesserit is female and emphasizes mental and physical training and their agenda features the breeding of a super being, the Kwisatz Haderach (a male). The split between Guild and the Bene Geserit is along left brain/right brain lines. In general, are men inherently better suited to be navigators than women? Explain
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14. In Dune, the Guild Steersmen navigate Heighliners through folded space with passengers, cargo, troops, and shipments of the spice mélange from Arrakis. Guild Navigators empowered with the limited prescient abilities gained from ingesting spice, had the ability to navigate vast distances safely. (With spice awareness, the ship’s future could be predicted and disaster avoided).
a. Light travels 6 trillion miles in one year. That is 1 Light Year. The most distant object ever built by humankind is the Voyager 1 spacecraft. In early 2007, Voyager 1 was slightly more than 102 A. U. from the sun, (93 million miles). This is just slightly more than 1/1000 of one light year. If Voyager 1 continues it’s current rate, 3.6 A.U. /year, how long would it take to get to Alpha Centauri 4.37 light years away? (Note: Alpha Centauri is the home of the Imperium)
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b. From the above information, why is it necessary to have folded space?
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c. What does mass have to do with folded space?
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d. From E = m c squared, we find that an object's relativistic mass increases as a function of speed. As speed increases to the speed of light, mass increases to infinity. Therefore, at high speeds, a dramatic increase of thrust is required for a comparatively small increase in speed to propel the large mass. There is the implication in "Dune" that Heighliners generate a Holtzmann field, which neutralizes the ship's mass to some degree. Why is this a problem in the "Real" universe? Explain.
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e. If you can neutralize mass of a ship, would that neutralize gravity?
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f. If you couldn't neutralize the mass of a ship, would the ship itself warp space as it gains speed near the speed of light? How would neutralizing mass counteract the notion of warping/folding space?
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15. For years, astronomers have believed that the ultimate fate of the Universe would fall into one of two categories: heat death or recollapse. In the "heat death" scenario, the Universe would expand, and cool, forever. Utltimately there would not be enough energy to drive chemical, or biological, processes. In the recollapse scenario, the self-gravity of the Universe would ultimately pull all of the rapidly receding galaxies back together, in a scenario called the "Big Crunch" causing another "Big Bang". Recently, though, observational evidence has pointed to a third scenario: that the expansion of the Universe is literally accelerating, and that it may one day literally tear itself apart in what has been com to be known as the "Big Rip". The explanation for this acceleration is heretofore unexplained, but one of the likely suspects is the "Casimir Effect". The Casimir Effect is a result of what has been called vacuum energy—a form of energy that is pervasive thoroughout the Universe. When two metallic plates are brought very close---approximately one hundredth millionth of a meter—vacuum energy between the plates creates a strong attractive forces, (Casimir Force). It is been postulated that the Casimir Force, can similarly be a repulsive force, and may be responsible

for the accelerated expansion of the Universe. Recently, applications of the Casimir Force have allowed scientists to levitate microscopic objects. How could this be related to “Dune”s Holtsmann field? (Research the Casimir Force, the “Big Rip” and Metamaterials to see how Science Fiction can become Reality) Discuss you findings.
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16. Discuss how Kynes plans to terraform Arrakis: What considerations would Kynes need to include?