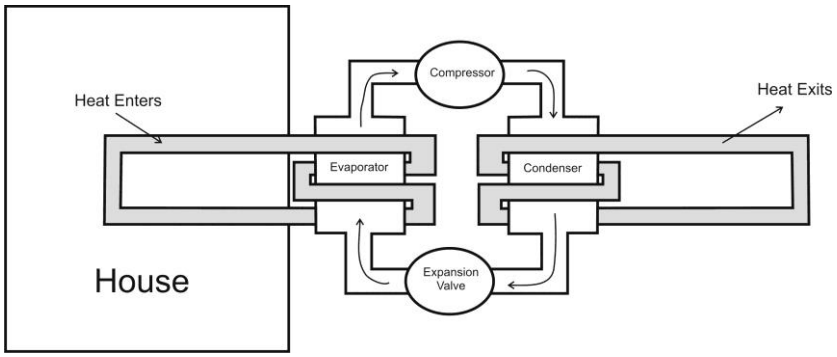
EPS 200 (Stapleton) Name: _____

Final Exam Review, Part II – ANSWERS

Complete the diagram on the right so that it shows a heat pump that is set up to cool a house during the **summer.**



101. Label the compressor, expansion valve, condenser and evaporator.
102. Explain why the evaporator and the condenser need to be in those locations. **Evaporation (turning from a liquid to a gas) requires energy. As the refrigerant in the evaporator evaporates, the evaporator takes energy from its environment, cooling everything around it, including the grey pipes. In the summer, the homeowner would want these cooling pipes inside the house. In the condenser, the refrigerant condenses, and in order to do that, the refrigerant needs to lose heat. As the refrigerant condenses, it release its heat to its environment, heating up everything around it – including the grey pipes that wrap around it. During the summer, these hot pipes need to be outside the house.**
103. Use arrows to show the direction of refrigerant circulation. **See diagram.**
104. Show where heat enters and exits the heat pump's system. **Heat flows into the cool pipes that are cooled by the cool evaporator. Heat leaves the hot pipes that are heated by the hot condenser.**
105. Explain how the heat pump parts would be organized differently in the winter. **During the winter, the pipes that enter the home would be the ones that wrap around the condenser.**

The diagrams below show four repeating stages in the cycle of a Stirling Engine.

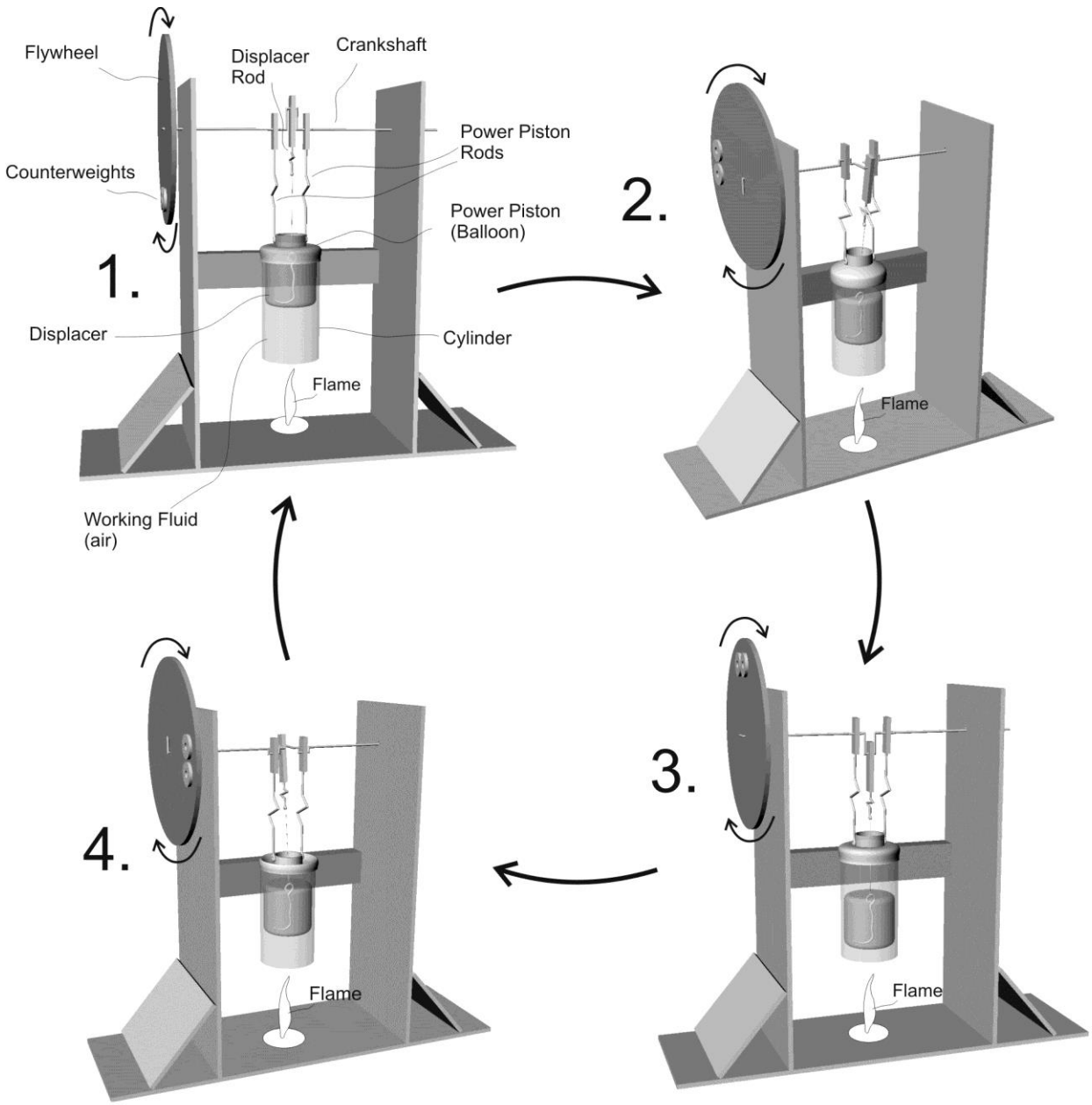
106. Between stages 1 and 2, you can see by the position of the counterweights that the flywheel rotates 90 degrees clockwise. Why does the flywheel turn? **The working fluid is displaced to the bottom of the cylinder (near the flame), so it heats up. This increases the pressure inside the cylinder, causing the power piston (balloon) to inflate upward. This inflation pushes the power piston rods, and the power piston rods turn the crankshaft which turns the flywheel.**

107. Why does the power piston "suck in" between stages 3 and 4? **The working fluid is displaced to the top of the cylinder (away from the flame), so it cools down, causing pressure in the can to decrease and "suck in" the balloon.**

108. What is the pupose of the flywheel, and between which stages is it most important? Why? **The flywheel gives the crankshaft momentum to keep turning, even when it isn't being pushed or pulled by the power piston rods. This is most important between stages 2-3 and 4-1. The "push" occurs between stages 1 and 2, when the balloon inflates, and the "pull" occurs between stages 3 and 4, as the balloon deflates. There is no push or pull between 2&3 and 4&1.**

109. If there were no flame, this Stirling Engine could function as a heat pump. Someone could rapidly turn the flywheel as shown in these diagrams (clockwise). If this were done…

    a. Between which stages would compression of the working fluid occur? How can you tell? **Between stages 2 and 4. In stage 2, the balloon is pulled out as far as it will go. When it reaches stage 4, the balloon is pressed in as far as it can go.**
    b. Where is the working fluid during the middle of this compression? (top or bottom of the cylinder) **In the middle of compression (stage 3) the working fluid is at the top of the cylinder.**
    c. Between which stages would expansion of the working fluid occur? How can you tell? **Between stages 4 and 2. In stage 4, the balloon is pressed in as far as it can go. When it reaches stage 2, the balloon is pulled out as far as it will go.**
    d. Where is the working fluid during the middle of this expansion? (top or bottom of the cylinder) **In the middle of compression (stage 1) the working fluid is at the bottom of the cylinder.**
    e. Which end of the can would become the colder end, and which end would be the hotter end? **The top will be the hot end, because the working fluid is at the top during the middle of the compression phase. The bottom is cold, because the working fluid is at the bottom during the middle of the expansion phase.**



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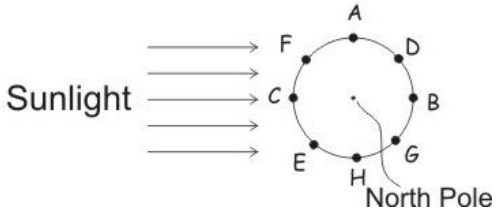
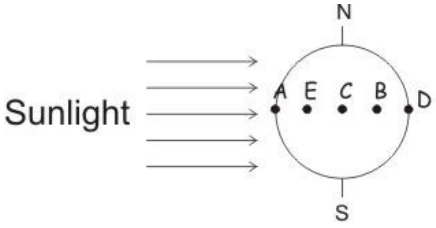
110. Give the approximate time of day at each letter in the first diagram on the right.
A: 6AM B:12AM C:12PM D:3AM E:3PM F:9AM G:9PM H:6PM

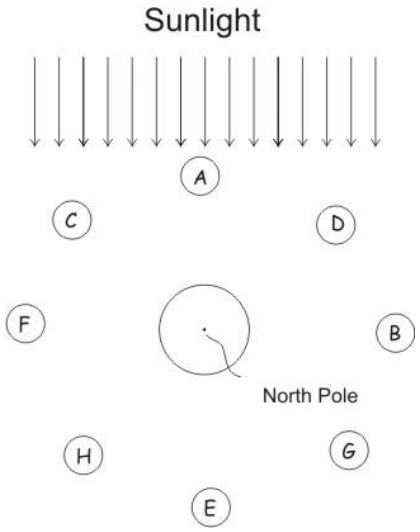


111. Give the approximate time of day at each letter in the second diagram on the right. **A: 12PM B: 9PM C:6PM D:12AM E:3PM**



112. Draw a waxing gibbous moon.
113. Draw a waning crescent moon.

114. Draw a waxing quarter moon.



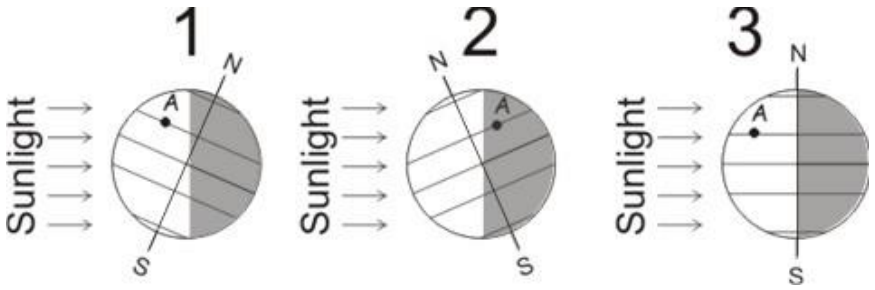
115. Identify the phases of moons A, G, and E, in the diagram on the right.
A:New G:Waning Gibbous E:Full

116. Which moon on the right might produce a solar eclipse?**A**
117. Which moon might produce a lunar eclipse?**E**

118. Which moons produce spring (strong) tides?**A,E**
119. Which moons produce neap (weak) tides?**F,B**

Consider the diagram below. Approximately ho many hours of daylight does latitude A receive when the Earth is in…

120. Position 1? **9**
121. Position 2? **15**
122. Position 3? **12**
123. What is the approximate date when the Earth is in position1? **December 20**
124. What is the approximate date when the Earth is in position2? **June 20**
125. If position 3 follows position 2, what is the approximate date for position 3? **September 22**
126. Provide the approximate date ranges for each of the seasons. **Winter: 12/20-3/20. Spring: 3/20-6/20. Summer: 6/20-9/20. Fall: 9/22-12/20.**



How long (time) does it take each of the following to occur?

127. 1 Earth rotation **24 hours**
128. 1 Earth Revolution (orbit) **1 year**
129. 1 Moon revolution (orbit) **roughly 4 weeks**