The First Three Minutes – Final Exam **Name** _____

Instructions:

- Place your name on all of the pages.
- Do all of your work in this booklet. Do not tear off any sheets.
- Be clear and neat in your work. Any illegible work, or scribbling in the margins, will not be graded.
- All short answers and essays should be responded to with full sentences conveying thoughtful responses.
- If you need more space, you may use the back of a page and write *On back of page #* in the problem space. **No other paper is allowed.**

Try to answer as many problems as possible. Provide as much information as possible. Show sufficient rationale for full credit.

Pay attention to the point distribution. Not all problems have the same weight.

Page	Pts	Score
1	15	
2	30	
3	17	
4	18	
5	10	
6	10	
Total	100	

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I. (12 Pts) People Match - Find the best match and place the letter in the space provided.

A. Albert Einstein	B. Alexander Friedmann	C. Aristotle	D. Claudius Ptolemy
E. Edwin Hubble	F. Fred Hoyle	G. Johannes Kepler	H. Karl Schwarzschild
I. Max Planck	J. Nicolaus Copernicus	K. Isaac Newton	L. James Clerk Maxwell
M. Niels Bohr	N. Lois de Broglie	O. Erwin Schrodinger	P. Stephen Hawking

a. Introduced the mathematics of the fabric of spacetime. ___

b. Predicted electromagnetic waves. ___

c. Suggested that matter can behave like waves. ___

d. Credited with 2000 yr old view of the world. ___

e. Father of classical physics. ___

f. Introduced heliocentric system. ___

g. Modeled atom as a mini solar system. ___

h. Promoted geocentric view of solar system. ___

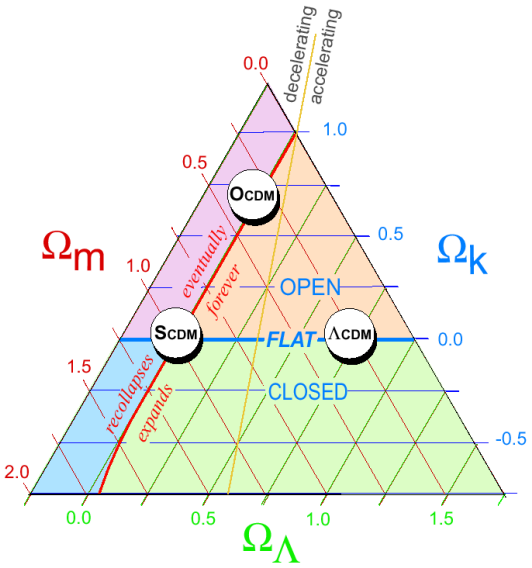
i. Introduced spherical solution of spacetime equations. ___

j. Proponent of the steady state model. ___

k. Introduced quantization of energy. ___

l. Discovered classical planetary motion. ___

II. (3 Pts) Densities – What is the below diagram called and what are the densities shown?



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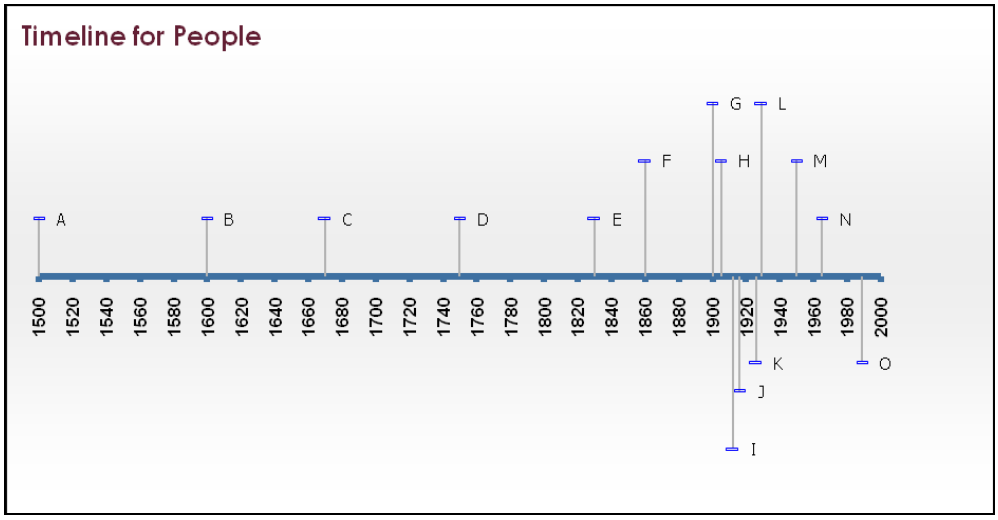
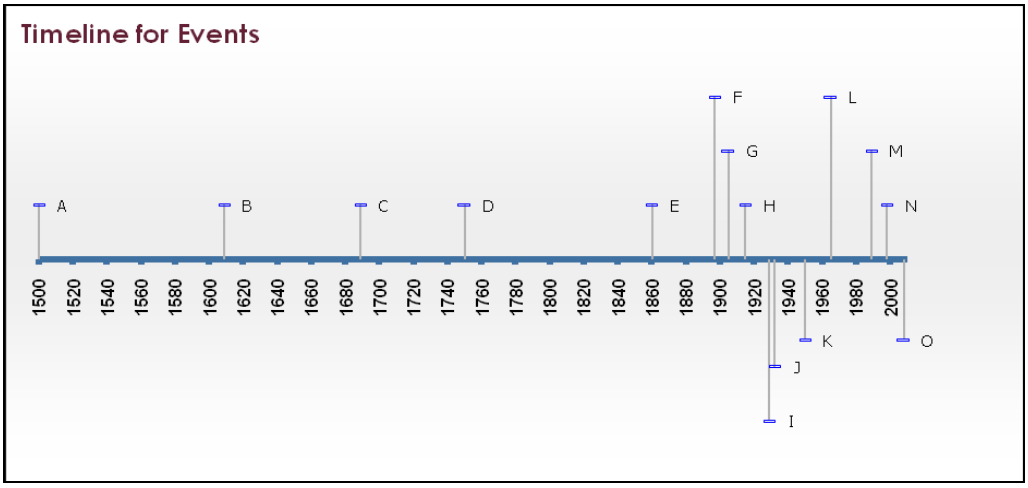
(15 Pts) People Timeline – Fill in the blank with location letter from timeline.

___ Bohr	___ Hoyle	___ Penzias and Wilson
___ Copernicus	___ Hubble	___ Planck
___ Einstein	___ Kepler	___ Schrodinger
___ Faraday	___ Maxwell	___ Schwarzschild
___ Franklin	___ Newton	___ Smoot and Mather



III. (15 Pts) Event Timeline - Fill in the blank with location letter from timeline.

___ CMB Radiation Discovered	___ Franklin's Kite Experiment	___ Law of Gravitation
___ COBE Probe Launched	___ Galileo's Telescope	___ Neutron Discovered
___ Dark Energy Discovered	___ General Relativity	___ Special Relativity
___ Electrons Discovered	___ Heliocentric Model	___ Steady State Model
___ EM Waves Predicted	___ Hubble Expansion	___ WMAP Last Data Release



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IV. (12 Pts) Terms Match

Find the best match and place the letter in the space provided.

A. Dark Energy	B. Doppler Effect	C. Fission	D. Gluon
E. Higgs Boson	F. Homogeneous	G. Isotropic	H. Light Spectrum
I. Meson	J. Neutrino	K. Photon	L. Quark
M. Relativity	N. Strong Force	O. Time Dilation	P. Weak force

a. Quantum of light. ___

b. The universe looks the same from any location. ___

c. Used to detect composition of stars. ___

d. The God Particle. ___

e. A pion is one of these. ___

f. Baryons, like protons, are made of these. ___

g. Process in the splitting of atoms. ___

h. Force holding quarks together. ___

i. Theory about space and time. ___

j. The cosmological constant is said to account for this. ___

k. Elementary particle causing quarks to interact. ___

l. Example of a lepton. ___

V. (5 Pts) Numbers

a. How old is the universe? _____

b. How many galaxies are there? _____

c. How fast does light travel in a vacuum? _____

d. How big is the universe? _____

e. What is the current CMBR temperature? _____

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VI. (18 Pts) Short Answers – Answer all questions in sentence-paragraph form.

a. Describe two observations that support the existence of dark matter.

b. What is the inflationary model and what does it solve?

c. How many forces are there in the current universe? What are these forces?

d. What is the breakdown in percentages of the universe into matter, normal matter, dark matter, dark energy, electromagnetic radiation, etc?

e. What was Einstein's biggest blunder?

f. What was the Steady State Model? Why is it no longer a viable theory?

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VII. (10 Pts) Essay – Pick one of the below topics and write a coherent essay about the topic. Support your answer with what we learned this semester, listing at least six to eight important facts. Use back of exam if needed.

a. What makes cosmology a science? Be careful to describe what makes an endeavor scientific. Give examples of how cosmology is science, where it is not science and when did it become more than just philosophy?

b. What is a black hole? What is the Schwarzschild radius? What is an event horizon? How can black holes be detected if they cannot be seen? Describe two strange effects that occur near the event horizons of black holes, and that are predicted by Einstein's Theory of General Relativity.

c. Describe the Big Bang Model. What happened during the first three minutes? What evidence supports the current models? What was the history of the universe before the big bang and what is the fate of the universe?

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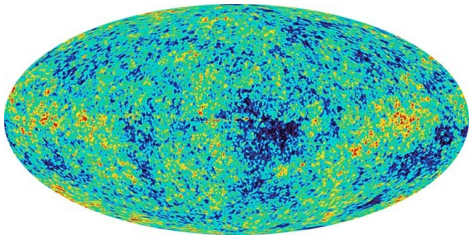
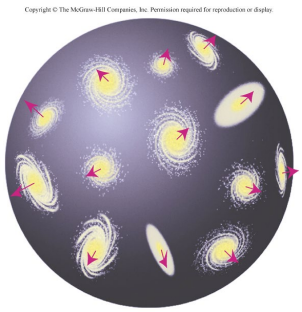
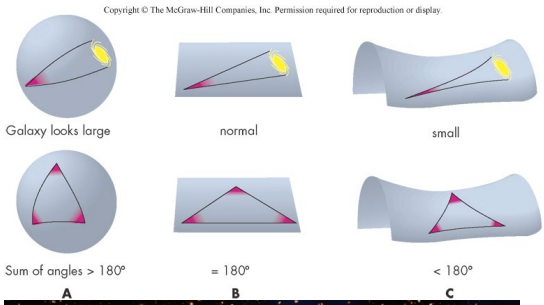
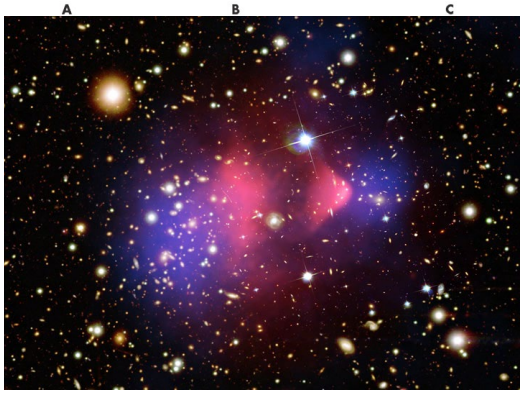
VIII. (10 Pts) What do the following pictures describe? Place you answer to the right of the picture.

a. 

b. 

c. 

d. 

e.