Final Examination — Study Sheet

1. Which Pre-Socratic philosopher claimed that water is the fundamental substance of all matter?

2. Heraclitus is best known for emphasising which concept in his philosophy?

3. Which philosopher first proposed that all matter is composed of indivisible particles he called atoms?

4. Anaximenes is best known for proposing which substance as the fundamental principle underlying all things?

5. The Pre-Socratics are historically significant primarily because they:

6. In Plato's Allegory of the Cave, the prisoners chained inside represent:

7. In the Allegory of the Cave, the sun seen by the freed prisoner outside the cave symbolises:

8. Plato's Theory of Forms holds that the physical, sensory world is:

9. According to Plato, genuine knowledge is obtained through:

10. Plato's Allegory of the Cave appears in which of his works?

11. Aristotle held that objects fall toward the Earth because they:

12. In Aristotle's cosmology, the Earth is situated at:

13. Eratosthenes estimated the circumference of the Earth by comparing noon shadow angles at:

14. Eratosthenes' estimate of the Earth's circumference, made around 240 BCE, was:

15. Aristotle provided early arguments that the Earth is spherical. Which of the following was one of his observations supporting this?

16. Ptolemy's model explained the apparent retrograde motion of planets through the use of:

17. Ptolemy's major astronomical work is known by the Arabic name:

18. The equant was a geometric point in Ptolemy's model from which:

19. Ptolemy's geocentric model remained the dominant astronomical framework for approximately:

20. Copernicus published his heliocentric theory in the work:

21. Kepler's first law states that:

22. Kepler's second law states that:

23. Kepler derived his laws of planetary motion primarily by analysing the observational data of:

24. Kepler's third law states that:

25. What is stellar parallax?

26. Galileo's telescopic observation of which objects provided the first direct evidence that not all bodies orbit the Earth?

27. In his Letter to the Grand Duchess Christina, Galileo argued that:

28. Galileo's telescopic observation revealed that the Milky Way consists of:

29. Galileo is often credited as a founder of modern science primarily because of his:

30. Galileo observed that a ball dropped from the mast of a moving ship lands:

31. Which of the four Galilean moons of Jupiter is closest to Jupiter?

32. Which of the four Galilean moons of Jupiter is the largest moon in the solar system?

33. Which of the four Galilean moons of Jupiter is believed to have a subsurface liquid water ocean beneath its icy surface?

34. Which of the four Galilean moons of Jupiter is the most volcanically active body in the solar system?

35. Newton's law of universal gravitation states that the gravitational force between two masses is proportional to:

36. Newton's first law of motion states that:

37. Newton's second law of motion states that:

38. Newton's third law of motion states that:

39. In the General Scholium, Newton refused to speculate on the underlying cause of gravity by writing:

40. Newton's laws of motion and his law of universal gravitation appear in which work?

41. In the General Scholium, Newton described infinite space as the 'Sensorium Dei', meaning:

42. The frequentist interpretation defines the probability of an event as:

43. The Bayesian interpretation treats probability as:

44. In Laplace's Essay on Probabilities, the need for probability arises primarily from:

45. Laplace imagined a superhuman intellect knowing every particle's position and momentum. Such a being would in principle be able to:

46. The phlogiston theory held that combustion involved the release of a hypothetical substance called:

47. A principal difficulty with the phlogiston theory was that:

48. The caloric theory proposed that heat was:

49. Count Rumford's cannon-boring experiments undermined the caloric theory by demonstrating that:

50. Joule's experiments established the mechanical equivalent of heat, demonstrating that mechanical work and heat are:

51. The first law of thermodynamics is a statement of:

52. The second law of thermodynamics states that in any natural process the total entropy of an isolated system:

53. The Carnot efficiency of a heat engine operating between absolute temperatures T_H and T_C is:

54. Entropy is often described qualitatively as a measure of:

55. In Borges' Library of Babel, the library contains books made of all possible combinations of a fixed character set in a fixed format. This means it contains:

56. The narrator of Borges' Library of Babel regards the library as:

57. In Ted Chiang's The Tower of Babylon, workers who break through the vault of heaven discover that:

58. In Ted Chiang's Exhalation, the protagonist concludes that life in his world is doomed because:

59. Ted Chiang's Exhalation serves as an allegory for:

60. Alan Lightman's short story Smile connects the spontaneous smile of a scientist to:

61. Galileo's Letter to the Grand Duchess Christina was significant because it addressed the question of:

62. Coulomb's law states that the electric force between two point charges is inversely proportional to:

63. A positive test charge placed in an electric field will experience a force directed:

64. Early electric machines of the 17th and 18th centuries generated static electricity primarily through:

65. Oersted's pivotal discovery in 1820 was that a current-carrying wire:

66. When using field lines to visually describe a field, closely spaced lines indicate:

67. Electric field lines originate on which charge and terminate on which charge?

68. Coulomb's law for the electric force has the same mathematical form as Newton's:

69. Gauss's law states that the total electric flux through a closed surface is proportional to:

70. Alessandro Volta is best known for inventing:

71. Mary Shelley's Frankenstein was written during a period of great public fascination with electricity. In the novel, electricity is used to:

72. A scalar quantity is fully described by:

73. Which of the following is a vector quantity?

74. The divergence of a vector field at a point measures:

75. A region of positive divergence in a vector field corresponds to the presence of:

76. Ampere's law relates the magnetic field around a closed loop to:

77. An orientable surface is one that possesses:

78. The electric field surrounding an isolated point charge has:

79. A M"{o}bius strip is an example of a surface that is:

80. A closed surface, such as a sphere, differs from an open surface, such as a disk, in that:

81. The magnetic field produced by a long, straight current-carrying wire forms:

82. Faraday's law of electromagnetic induction states that a time-varying magnetic flux through a loop induces:

83. Ampere's original law relates the line integral of the magnetic field around a closed path to:

84. Maxwell's addition of the displacement current to Ampere's law was crucial because it allowed the prediction of:

85. Using the right-hand rule for a current-carrying wire, if the thumb points in the direction of current, the fingers indicate:

86. The practical principle underlying electric generators and transformers is:

87. Maxwell's unification of electricity, magnetism, and light was significant because it:

88. A lodestone is a naturally occurring mineral that was historically significant because it:

89. The magnetic compass was first used for navigation by which civilisation?

90. A compass needle aligns itself with the Earth's magnetic field because:

91. Gilbert's De Magnete proposed that the Earth itself behaves as:

92. The null result of the Michelson-Morley experiment most directly implied that:

93. Einstein's second postulate of special relativity states that:

94. According to special relativity, a ruler moving past you at nearly the speed of light appears:

95. Time dilation in special relativity means that a rapidly moving clock, as measured by a stationary observer:

96. In a spacetime diagram, the light cone surrounding an event separates:

97. Two events that are simultaneous in one inertial reference frame may not be simultaneous in another. This is called:

98. The speed of light is:

99. In the barn-pole paradox, a pole moving at relativistic speed fits inside a shorter barn. This illustrates that:

100. In the barn-pole paradox, which observer sees the pole fitting inside the barn?

101. In the barn-pole paradox, the observer riding with the pole sees:

102. Two events are space-like separated if:

103. Two events are time-like separated if:

104. The causal structure of spacetime is determined by:

105. The amplitude of a wave describes its:

106. The wavelength of a wave is defined as:

107. When two waves are in phase, they combine to produce:

108. When two waves are perfectly out of phase, they combine to produce:

109. The Doppler effect refers to the change in observed frequency of a wave when:

110. Young's double-slit experiment demonstrates that light produces an interference pattern, which was evidence that light behaves as:

111. Newton believed light was composed of particles because:

112. The law of reflection states that the angle of incidence equals:

113. Diffuse reflection occurs when light reflects off:

114. Snell's law describes the relationship between the angles of incidence and refraction when light:

115. Light refracts when passing between media because:

116. Huygens' principle states that every point on a wavefront acts as:

117. A prism separates white light into its component colours because:

118. The speed of light in a medium is related to the speed of light in vacuum by the medium's:

119. Which of the following is NOT one of Maxwell's equations?

120. The Heisenberg Uncertainty Principle states that it is impossible to measure with infinite accuracy both a particle's position and its: