

PHYSICS 7 MIDTERM #1

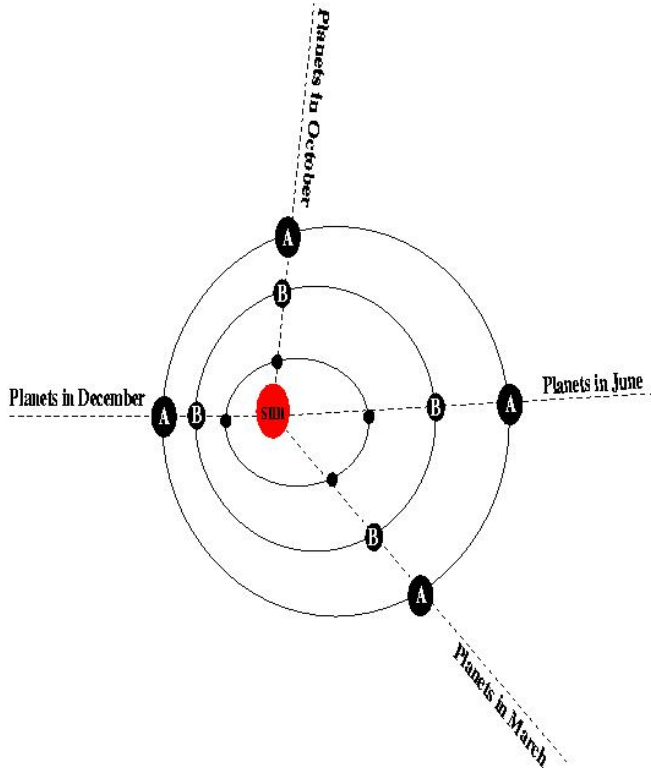
Oct 22

Instructor: J. Wudka.

1. Heraclitus the Young drops a rock and sees it fall down. Being a pupil of Aristotle he believes that this is caused by

- (a) The gravitational attraction of the Earth
- (b) The magnetic attraction of the Earth
- (c) The fact that the Earth rises up to meet the rock
- (d) The natural motion of the rock which makes it move towards the center of the universe
- (e) The wind that is created as the rock moves

2. In a far far far far galaxy there is a solar system where all planets are always aligned, as shown in the picture



An astronomer on planet B will see that planet A

- (a) Undergoes retrograde motion

- (b) Does *not* undergo retrograde motion
- (c) Approaches planet B all the time
- (d) Moves away from planet B all the time
- (e) It always blocked by their sun

3. Maxwell's equations

- (a) Describe only electric effects
- (b) Describe only magnetic effects
- (c) Are inconsistent with charge conservation
- (d) Cannot account for the fact that moving charges generate magnetic fields
- (e) Describe all magnetic, electric and light phenomena

4. Kepler's third law states that the square of the time it takes to go around the orbit is proportional to the cube of the distance to the Sun. Because of this a planet that is closer to the Sun than Mercury would

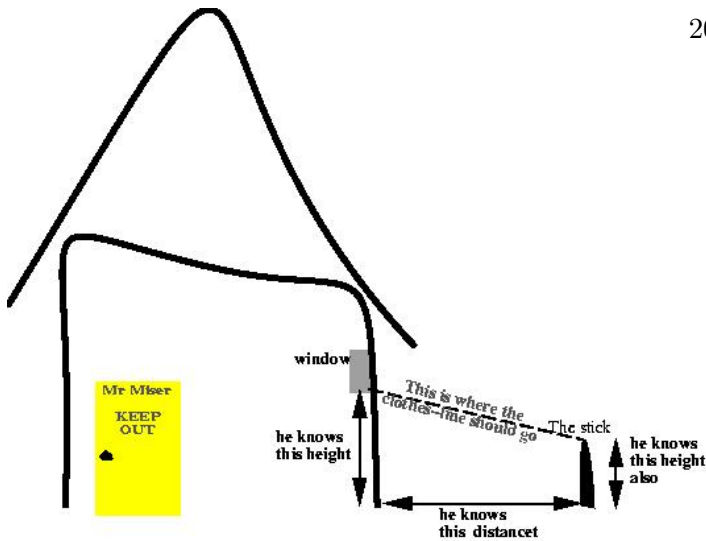
- (a) Take the same time as Mercury to go around its orbit
- (b) Take a shorter time than Mercury to go around its orbit
- (c) Be swallowed by the Sun
- (d) Take longer than Mercury to go around its orbit
- (e) Be impossible to see due to the Sun's glare

5. A scientific theory is valid

- (a) If its predictions agree with experiments
- (b) If most scientists believe in it
- (c) If it explains the same things as other theories
- (d) It is very simple to explain
- (e) It makes sense

6. During the Middle Ages science was
 - (a) Almost completely lost throughout the whole world
 - (b) Completely lost in the East and Middle East but flourished in Europe
 - (c) Flourished throughout the world
 - (d) Almost completely lost in Europe but flourished in the East and Middle East
 - (e) Practiced by all Church officials
7. Early Chinese astronomy was
 - (a) So primitive we have no record of it
 - (b) Based on the use of the telescope
 - (c) Purely philosophical with no observational component
 - (d) Imported from Europe during the Crusades
 - (e) Accurate enough for modern astronomers to verify some of the observations then made
8. Deep in space, far from all stars, Xyt and Tyx make the same experiments, each in her own spaceship, after first insuring the ships move at constant speed in a straight line with respect to each another. They find that some experiments give *different* answers and conclude that
 - (a) Velocity is relative
 - (b) The discrepancy is due to the fact that space is absolute
 - (c) Acceleration is absolute
 - (d) Galileo's claim that "there is no absolute motion" is wrong
 - (e) The discrepancy is due to the fact that time is relative
9. Humphrey and Stanley work in a circus. They are both cannon-men: they are put inside a cannon which propels them. Packing the *same* amount of gunpowder Humphrey travels 100 feet before landing while Stanley travels one mile. This means that
 - (a) Humphrey is just as heavy as Stanley
 - (b) Gravity produces a different acceleration on Humphrey than on Stanley
 - (c) We are looking at them from a non-inertial reference frame
 - (d) Newton's third law is violated
 - (e) Humphrey is heavier than Stanley
10. Conservation of charge
 - (a) Is only approximate: charge changes a very small bit with time, but is very hard to observe
 - (b) Was an old concept proved wrong by Maxwell
 - (c) Means that the total positive charge minus the total negative charge never changes in a closed system
 - (d) Holds only in absolute vacuum
 - (e) Is a program of the Environmental Protection Agency
11. Heracles the astronaut goes to the Moon taking a rock from Earth. After he lands he drops the rock. According to Aristotle the rock
 - (a) Will rise to the sphere of the fixed stars
 - (b) Will fall back to the Moon
 - (c) Will move around the Earth in a circle
 - (d) Will circle the Sun in an ellipse
 - (e) Will fall towards the Earth

12. The numbers 10^{-9} and 10^9 correspond to
- (a) 1,000,000 and 1,000,000,000 respectively
 - (b) 0.0000001 and 0.000000001 respectively
 - (c) 0.000000001 and 1,000,000,000 respectively
 - (d) 1,000,000 and 0.00000000001 respectively
 - (e) None of the above
- and
13. The *earliest* Greek cosmologies imagined
- (a) A heliocentric solar system
 - (b) A flat Earth
 - (c) A cone-shaped Earth
 - (d) A square Sun
 - (e) An infinite number of galaxies
14. Eratosthenes measured the Earth's diameter by looking at the shadow cast by two columns separated by a large distance (on one particular day of the year one column cast no shadow, the other column did cast a shadow). Mr Paw lives on top of planet ZZ and he finds that *no matter where the columns are placed* their shadows always have the same length. He concludes that planet ZZ
- (a) Is curved as a doughnut
 - (b) Is flat as a tortilla
 - (c) Is shaped like a horse-saddle
 - (d) Has the shape of an ice cream cone
 - (e) Is a cube
15. Ockham's razor argues that
- (a) The simplest theory should be examined first
 - (b) The simplest theory is necessarily correct
 - (c) The simplest theory is necessarily wrong
 - (d) There is no absolute truth in science
 - (e) Simplicity is not a deciding factor in choosing a theory
16. A popular senator claimed that "...student performance in examinations has risen steadily, this is thanks to better teacher preparation, reduced class sizes, parent cooperation, and my personal good will." Keeping Ockham's razor in mind you conclude
- (a) I should vote for him
 - (b) I should vote against him
 - (c) Educational funding should be kept at the present level
 - (d) His scheme is simple enough, he is a good senator
 - (e) He using educational success to justify his performance in this area while in fact they are unrelated.
17. The fact that the Earth is ball-shaped was
- (a) Discovered by Maxwell using electricity and magnetism
 - (b) Discovered by Columbus
 - (c) Known since the classical period of Greek culture
 - (d) Discovered by the Arabs and exported to Europe during the crusades
 - (e) Finally accepted by the Church in 1983
18. A miser wants to put a clothes line to hang the wash to dry. The line is to go from his window to a stick in the yard as shown in the figure



The miser knows the height of the stick, the height of the window, and the distance from the house to the stick (as indicated in the figure). Then

- (a) He can find out the length of the clothes-line by measuring the shadow of the stick at noon
- (b) He cannot find the length of the clothes-line with the information he's got
- (c) He can find out the length of the clothes-line by measuring the shadow of the stick in winter
- (d) He can find out the length of the clothes-line by measuring the shadow of the stick in summer
- (e) He can find the length of the clothes-line using Pythagoras' theorem

19. The Aristotelian description of the universe is

- (a) A heliocentric model
- (b) A model where the planets move around the Earth and the Earth moves around the Sun
- (c) A model where the planets, the Sun and the moon are perfect spheres and move around the Earth
- (d) A model where the planets, the Sun and the moon are made of the same stuff as the Earth
- (e) Identical to that of Copernicus

20. In the chart below

Planets must move in circles around the Earth

??

Geocentric model with epicycles

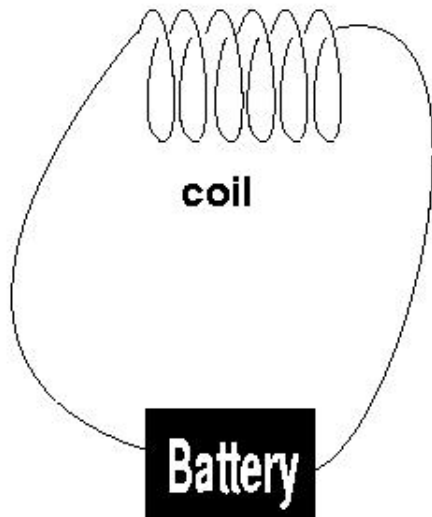
fill in the box with the ?? using one of the following answers

- (a) Planets sweep equal areas in equal times
 - (b) Retrograde motion of Mars
 - (c) Planets move in circles about the Sun
 - (d) $F = ma$
 - (e) The universe started at a given remote time
21. Which of the two types of waves are closer in wavelength?
- (a) X rays and gamma rays
 - (b) Radio and gamma rays
 - (c) Microwaves and ultraviolet light
 - (d) X rays and microwaves
 - (e) Visible light and gamma rays
22. Scientific theories are replaced because
- (a) The people that believe in them die
 - (b) They become unfashionable
 - (c) They are voted out

- (d) They are unable to explain certain data and/or observations
- (e) They require complicated mathematics
23. A generator is a machine that generates electricity, it works based on the principle that
- (a) Equal charges attract
- (b) Equal charges repel
- (c) Moving magnets generate electric currents
- (d) Magnets have north and south poles
- (e) Magnets attract iron
24. Galileo found that the Moon had mountains and this distressed Aristotle's followers because
- (a) The Moon was supposed to be made of cheese
- (b) This meant that the moon did not move
- (c) This could only happen if the Earth circled the Moon
- (d) This showed that the Sun moves around the Earth
- (e) This contradicted the idea that the Moon was a perfect sphere
25. One very modern idea about nature first proposed by Pythagoras was that
- (a) The Sun is at the center of the solar system
- (b) Space and time are absolute
- (c) Nature can be understood using mathematics
- (d) Nature cannot be understood using mathematics
- (e) Velocity is relative
26. Comets would be puzzling to Aristotle because
- (a) They have tail
- (b) They disappear after some time contradicting the idea that the heavens are unchangeable
- (c) They do not move in ellipse about the Sun
- (d) They are round
- (e) They move in circles around the Earth
27. Two planets used to be 10,000 km apart, but Monday Zeus separated them further, so now they are 20,000 km apart (that is, the distance between them doubled). The gravitational attraction between the planets is now
- (a) The same as before
- (b) Four times smaller
- (c) Zero because gravity only acts along the line joining the planets
- (d) Twice as large
- (e) Four times larger
28. Copernicus' model and its generalizations
- (a) Had the planets move around the Earth in ellipses
- (b) Had the fixed stars closer to the Earth than Mars
- (c) Was completely ignored until the 19th century
- (d) Was replaced by the geocentric model
- (e) Had the planets move around the Sun in perfect circles with the planets rotating about their axes
29. One characteristic of ancient cosmologies is that
- (a) They were all heliocentric

- (b) They were all based on the use of the telescope
 - (c) They were all verified experimentally
 - (d) They were little more than stories relating the creation of the world
 - (e) They were all imported from Egypt
30. The epicycle model was created to
- (a) Reconcile the observations with the idea that the planets move in circles
 - (b) Complicate matters so that only a few astronomers would understand the way in which the solar system works
 - (c) Account for Kepler's third law
 - (d) Provide a simpler alternative to the heliocentric model
 - (e) Satisfy Galileo's ideas about motion
31. It is complicated to apply the scientific method to human affairs because
- (a) Science has nothing to do with humans at all
 - (b) It is the stars that determine the manner in which we act
 - (c) When making experiments and observations it is difficult to isolate all the factors influencing the results
 - (d) The scientific method keeps changing
 - (e) Scientists cannot agree on anything worth-while observing in humans
32. Thales and Aristotle believed that the dominating element on our planet is
- (a) Earth
 - (b) Air
 - (c) Fire
 - (d) Hydrogen
 - (e) Helium
33. A rock, when dropped a height of 16 feet, takes 1 second to hit the ground. If the rock is split in half, each of the halves when dropped from the same height (assume there is no air resistance)
- (a) Will take less time being more "earthy"
 - (b) Will take less time being less "earthy"
 - (c) Will take 1 second
 - (d) Will take less than 1 second because the acceleration produced by gravity is smaller for a small mass.
 - (e) Will take more than 1 second because the acceleration produced by gravity is larger for a small mass.
34. A rocket takes off from the Moon towards deep space. Moon people see the fiery lift-off and note that
- (a) It moves because it expels gases at high speeds in accordance with Newton's third Law
 - (b) It's the fire that makes it move
 - (c) It moves because Nature dislikes a vacuum and so the rocket is constantly being sucked upwards
 - (d) It moves due to the gravitational repulsion from the Moon
 - (e) It does not move at all, it's the Moon that's receding
35. Jane takes a wire and connects it to a battery, he then places it close to a permanent magnet. She finds that

Permanent magnet



- (a) The wire does not affect the permanent magnet no matter how it is oriented
- (b) The permanent magnet stops being a magnet
- (c) The permanent magnet becomes stronger
- (d) Electricity stops flowing through the wire
- (e) The wire will attract or repel the permanent magnet depending on their orientation

36. Newton stated that gravitational attraction was *universal*, this means that

- (a) It is produced by *anything* that has mass, animate or inanimate
- (b) It acts only over small distances
- (c) It acts only on large bodies such as planets and moons
- (d) Two bodies attract with the same force no matter how far apart they are
- (e) Two bodies attract with the same force no matter what their mass is

37. You observe a body in empty space far away from any other object, and find that even though nothing is going on with the body itself, it follows a complicated path curving one way and then another, you can be sure that

- (a) Your frame of reference is inertial
- (b) Newton was wrong
- (c) You are in a *non*-inertial frame of reference
- (d) Galileo was wrong
- (e) There are little green men on the body that make it move this way and that

38. Newton stated that space was absolute. This means that when you measure the distance between two points

- (a) The result depends on the time at which you make the measurement
- (b) The result depends on your velocity when you make the measurement
- (c) The result is independent of your velocity but depends on your acceleration
- (d) The result is completely independent of the time of measurement, and of your velocity and acceleration
- (e) The result is independent of your acceleration but depends on your velocity

39. Mr Q proposes a hypothesis which explains the motion of *all* the planets. He is successful predicting their motion *except* for Pluto. A reasonable step to take would be

- (a) To completely scrap the theory
- (b) To attempt a modification of the hypothesis aimed at describing the motion of Pluto
- (c) To ignore Pluto completely

- (d) To simply state that there are unknown factors which affect Pluto and no other planet
- (e) To claim that Pluto has an attitude

40. Mr. Zip the Martian believes himself to be *very* punctual, leaving for work at precisely the same time every day. His friend Mr. Paw lives on Mercury and finds that, according to Paw's clock, Zip is late for part of the year. They argued about it but it turns out that *both* are right because

- (a) The clocks on Mercury cannot be accurate due to the proximity of the Sun
- (b) In order for Paw to see Zip light has to travel from Mars to Mercury, and sometimes this takes longer due to the relative positions of these planets
- (c) The gravitational pull on the clocks on Mercury is so strong they slow down
- (d) The gravitational pull on the clocks on Mercury is so weak the clocks speed up
- (e) In order for Paw to see Zip light has to travel through Mars' atmosphere which slows light down

41. Newton would state that *any* observer would find that this exam lasts 1.5 hours because he assumed that

- (a) Time intervals depend on acceleration, but an observer, by definition cannot be accelerating
- (b) Time intervals depend on velocity, but an observer, by definition, cannot be moving with respect to the system he/she is observing
- (c) Time is absolute
- (d) Time is relative
- (e) All observers have, by definition, the same clocks

42. The early Greek heliocentric model was rejected because

- (a) It could not answer objections such as "if the Earth rotates why do things stay on the surface and are not ejected into space?"

(b) It contradicted the Bible

(c) It claimed that the Earth was round and Eratosthenes showed that the Earth is flat

(d) It went against their religion

(e) Its proponents were foreigners

43. Electric charges

(a) Attract or repel depending on their sign

(b) Always attract

(c) Always repel

(d) Attract unless they are very far apart, in which case they repel

(e) Repel unless they are very far apart, in which case they attract

44. When a cart is not pushed it stops; according to Aristotle this is so because

(a) There is friction which brings the cart to a stop

(b) There is a pull by the heavenly bodies that makes the cart slow down and stop

(c) There is a vacuum created behind the cart which sucks it backwards and makes it stop

(d) All motion requires a force

(e) There is a gravitational pull by the Earth which slows it down until it stops

45. Kepler's first law states that

(a) Planets move in circles with the Sun in the precise center

- (b) Planets move in ellipses with the Sun in one of the foci
- (c) Planets move in circles with the Sun on the rim
- (d) Planets move in circles with the Earth in the precise center
- (e) Planets exhibit retrograde motion
46. The statement “there is no absolute motion” means that
- (a) All velocities are possible
- (b) Nothing can move faster than light
- (c) Accelerations are relative
- (d) Velocities are relative
- (e) Space and time are absolute
47. According to Copernicus the reason we see the Sun rise in the East and set in the West is that
- (a) The Sun moves around the Earth
- (b) Mars moves on an epicycle
- (c) The Sun, being a perfect body must move in circles
- (d) The Earth repels the Sun in the morning and attracts it in the afternoon
- (e) The Earth turns around its axis
48. Galileo observed Jupiter’s satellites for the first time. According to Aristotle these bodies should
- (a) Circle Jupiter
- (b) Circle the Sun
- (c) Be stationary
- (d) Circle the Earth
- (e) Move in a straight line at constant speed
49. Pythagoras claimed that planets move in circles
- (a) While constantly falling towards the Sun
- (b) While constantly moving away from a central fire
- (c) And their motion is determined by the gods
- (d) And in doing so they give off celestial music that we do not notice because we are quite used to it
- (e) Around the earth
50. Consider the following invented story: Hermonides the famous Greek astronaut, left for Mars on 234 B.C and returned with some of the material of which the Mars is made (a Mars rock); just after landing Hermonides accidentally drops the Mars rock. *Assuming Aristotle’s ideas of motion are correct*, the Mars rock would
- (a) Start moving in a circle around the Earth
- (b) Fall straight down
- (c) Rise straight up
- (d) Stay suspended in mid air
- (e) Disappear

NAME and SS#:_____

**Provide short (coherent) answers to the following questions (yes/no answers are not acceptable).
Use this sheet and the back of the page**

1. Ungh the troglodyte pushes block of ice on top of a frozen lake and sees that it just keeps going. Explain why this would be puzzling to Aristotle.
2. An evil god plays a trick on us and on December 31st 1999 makes the Earth stop rotating about its axis. This creates a world-wide calamity, explain why.
3. Give one important difference between waves and particles *and* a simple example illustrating this difference.