

Name: \_\_\_\_\_

Date: \_\_\_\_\_



**Cornell University**  
Prison Education Program

Conceptual Physics  
Class 10 Questions  
April 13th, 2018

**Some Useful Facts:**

1. The speed of light is  $3 \times 10^8 m/s$
2. The distance between the Earth and the Sun is about 8 light-minutes
3. The distance between the Earth and the Moon is about 1.5 light-seconds

1. Two *positive charges* are held close together. The following 4 panes will ask you to draw different things, but they are all for the same pair of positive charges.

Ignore the charge on the right.  
Draw the electric FIELD for the  
left charge.



Ignore the charge on the left.  
Draw the electric FIELD for the  
right charge.



Draw the electric FIELD surrounding  
both charges.



Draw a vector on each charge,  
representing the electric FORCE.



2. A positive (blue) and a negative (red) charge are held close together. The following 4 panes will ask you to draw different things, but they are all for the same pair of charges.

Ignore the charge on the right.  
Draw the electric FIELD for the  
left charge.



Ignore the charge on the left.  
Draw the electric FIELD for the  
right charge.



Draw the electric FIELD surrounding  
both charges.



Draw a vector on each charge,  
representing the electric FORCE.



3. Why do actions at a distance have a time delay?
4. Are forces transmitted instantaneously? Why or why not?
5. List 3 examples of fields.
  - (a)
  - (b)
  - (c)
6. We discussed electric and gravitational fields, since fields are associated with forces. Friction is a (contact) force. Is there such a thing as a “friction field”?
7. A (still) proton and an electron are separated by a distance of 9 m. The proton is then jiggled up and down. How long will it take for the electron to experience a change in the electric force as a result of the proton’s jiggling?

8. You are standing on the Earth, and notice the Moon orbiting in the sky. If the Earth were to suddenly vanish beneath you, what would you notice about the moon's motion?
9. When finding the strength of a gravitational field, does the size of the test mass matter? Why or why not?
10. When finding the strength of an electric field, does the charge on the test charge matter? Why or why not?
11. A 2 kg rock is held on the surface of the moon, whose gravitational field is much weaker than Earth's. If the gravitational field at the point of the rock is  $1.6 \text{ m/s}^2$  down, what force does the rock experience?
12. In order to find the strength of the gravitational field on Mars, a 10 kg test mass is held 1 m off the ground, and experiences a weight of 37 N. What is the strength of the gravitational field on the surface of Mars?

13. Use the diagram below to answer the following:

- (a) A “sea of arrows” representing the gravitational field around the Earth.



- (b) Field lines representing the gravitational field around the Earth.



14. What is the difference between a *source* and a *sink* for field lines?

15. Draw the electric field lines around:

(a) A proton (positively charged particle). Is a proton a source or a sink?

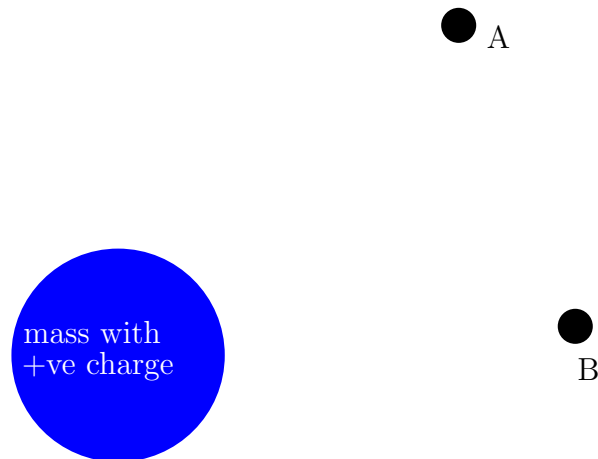


(b) An electron (negatively charged particle). Is an electron a source or a sink?



16. An object has some mass and a positive charge, as shown bellow.

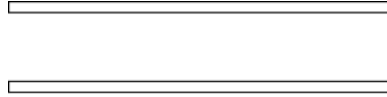
- (a) Draw an arrow representing the direction of the **gravitational field** at point *A*.
- (b) Draw an arrow representing the direction of the **electrical field** at point *A*.
- (c) A test mass with a *negative* charge is placed at point *B*. Draw an arrow representing the **gravitational force** experienced by this test mass, as well as another arrow representing the **electrical force**.



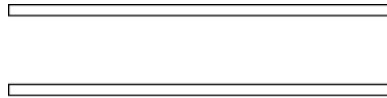


17. Two metal plates are floating in space, separated by some distance.

- (a) If the top plate has a positive charge, and the bottom plate has a negative charge, draw the field lines representing the *electric field* surrounding the two plates.



- (b) If both plates have a positive charge, draw field lines representing the *electric field*. What is the strength of the electric field at a point exactly midway between the two plates?



- (c) Draw field lines representing the *gravitational field*. What is the strength of the gravitational field at a point exactly midway between the two plates?

