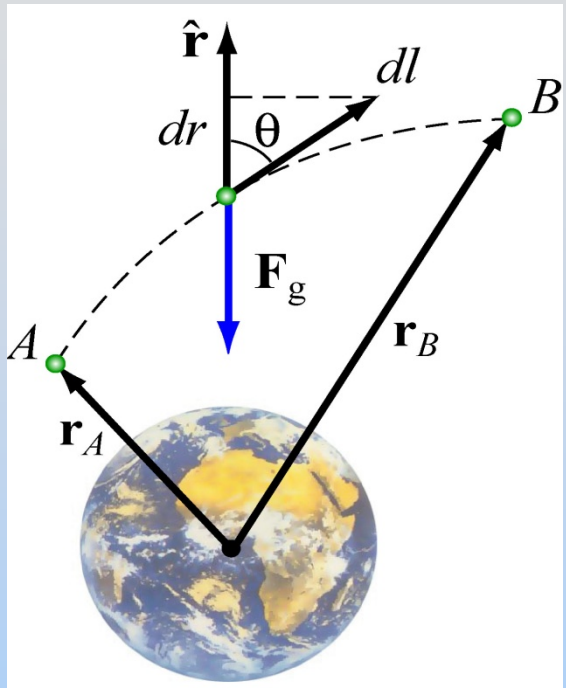
Concept Question: Sign of W_g

Thinking about the sign and meaning of this…

$$W_g = GMm\left(\frac{1}{r_B} - \frac{1}{r_A}\right)$$



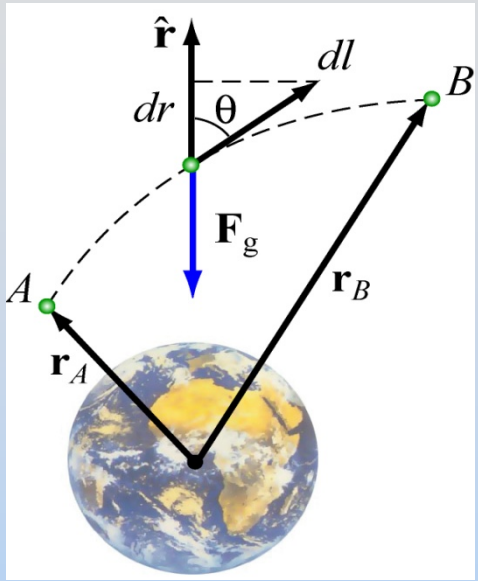
Moving from r_A to r_B:

1. W_g is positive – we do work
2. W_g is positive – gravity does work
3. W_g is negative – we do work
4. W_g is negative – gravity does work
5. I don't know

Concept Question Ans.: Sign of W_g

Answer: 3. W_g is negative – we do work

$$W_g = GMm\left(\frac{1}{r_B} - \frac{1}{r_A}\right)$$



W_g is the work that gravity does. This is the opposite of the work that we must do in order to move an object in a gravitational field.

We are pushing against gravity → we do positive work

Concept Question: Masses in Potentials

Consider 3 equal masses sitting in different gravitational potentials:

A) Constant, zero potential

B) Constant, non-zero potential

C) Linear potential ($V \propto x$) but sitting at V = 0

Which statement is true?

1. None of the masses accelerate
2. Only B accelerates
3. Only C accelerates
4. All masses accelerate, B has largest acceleration
5. All masses accelerate, C has largest acceleration
6. I don't know

Concept Question Answer: Masses in Potentials

Answer: 3. Only C (linear potential) accelerates

When you think about potential, think “height.” For example, near the Earth:

$$U = mgh \text{ so } V = gh$$

Constant potential (think constant height) does not cause acceleration!

The *value* of the potential (height) is irrelevant.

Only the *slope* matters

Concept Question: Positive Charge

Place a positive charge in an electric field. It will accelerate from

1. higher to lower *electric potential*; lower to higher *potential energy*
2. higher to lower *electric potential*; higher to lower *potential energy*
3. lower to higher *electric potential*; lower to higher *potential energy*
4. lower to higher *electric potential*; higher to lower *potential energy*

Concept Question Answer: Positive Charge

Answer:

2. + acc. from higher to lower *electric potential*;
higher to lower *potential energy*

Objects always “move” (accelerate) to reduce their potential energy. Positive charges do this by accelerating towards a lower potential

$$\Delta U = q\Delta V$$

Concept Question: Negative Charge

Place a negative charge in an electric field. It will accelerate from

1. higher to lower *electric potential*; lower to higher *potential energy*
2. higher to lower *electric potential*; higher to lower *potential energy*
3. lower to higher *electric potential*; lower to higher *potential energy*
4. lower to higher *electric potential*; higher to lower *potential energy*

Concept Question Answer: Negative Charge

Answer:

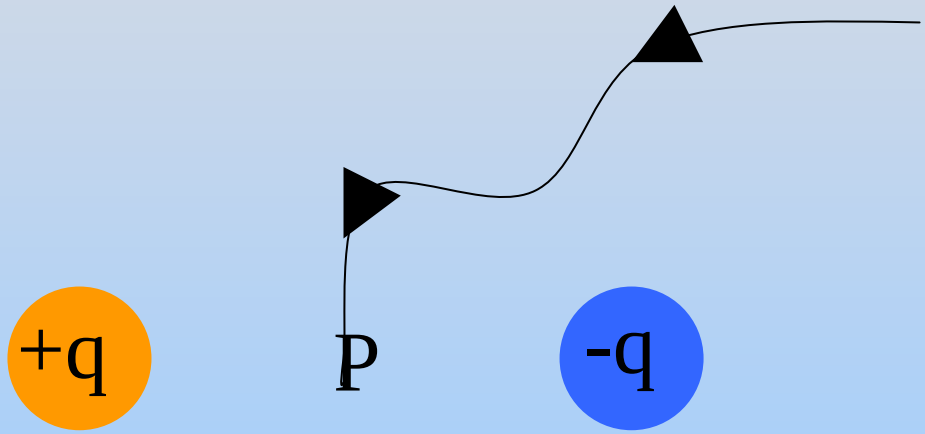
4. Neg. acc. from lower to higher *electric potential,* higher to lower *potential energy*

Objects always “move” (accelerate) to reduce their potential energy. Negative charges do this by accelerating towards a *higher* potential:

$$\Delta U = q\Delta V$$

Concept Question: Two Point Charges

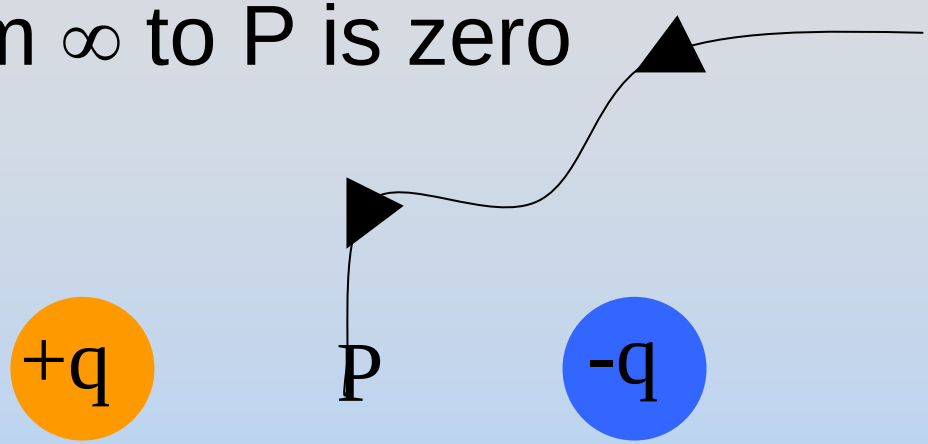
The work done in moving a positive test charge from infinity to the point P midway between two charges of magnitude +q and –q:



1. is positive.
2. is negative.
3. is zero.
4. can not be determined – not enough info is given.
5. I don't know

Concept Question Answer: Two Point Charges

3. Work from ∞ to P is zero



The potential at ∞ is zero.

The potential at P is zero because equal and opposite potentials are superimposed from the two point charges (remember: V is a scalar, not a vector)

8.02SC Physics II: Electricity and Magnetism

Fall 2010