Magnetic field and Faraday-Lenz law

This is an experimental activity related with observations of magnetic field characteristics and electromagnetic induction . You will use PHET simulations. Each student must record observations for each experiment.
The group must submit clear notes and related explanations for each exercise.

Experiment#1

Objective : Observation of magnetic field due to a magnet and due to Earth. For this exercise you will use the following link https://phet.colorado.edu/en/simulation/legacy/magnet-and-compass

a-Identify colors for poles N,S of compass. Move compass around magnet, activate field lines passing through magnet body, use the field meter to check the magnitude of B-vector at different locations, take a screenshot and draw field lines due to magnet.

b- Click on "Show planet Earth" take a snapshot and label magnetic poles of earth on it.

Do the recorded observations fit to what you expect?

Experiment#2

Objective: Observation of magnetic field due to current through a coil. For this exercises you will use the following link https://phet.colorado.edu/en/simulation/faraday

Select electromagnet, DC source, one loop. Click on "show compass", " show field lines"," show electrons".
a-Select 1 loop. Put 0 V at source, i.e. zero current through loop. Do you see any field lines?
Next, change the source voltage to 8V or 10V. Do the shape of field lines compare to magnet bar field lines?
b-Refer to direction of current through loop and check if direction of field lines fit to what you expect.
c-Place the field line meter close to axe of the loop and measure the magnetic field strength. Next, increase the number of loops to 2,3,4 and record corresponding B-strength values. How do those strength values compare?
d- Select AC source. What do you see? Explain why it happens.

Experiment#3

Objective: Observation of induced emf through a coil by changing magnetic flux through it. For this exercises you will use the following link https://phet.colorado.edu/sims/html/faradays-law/latest/faradays-law_en.html

Activate the voltmeter and the field lines.

a-Move the N-pole of magnet toward the coil and observe what happens if you move it slowly or quickly.
b- Move the N-pole of magnet away the coil and observe what happens if you move it slowly or quickly.
c- Move the magnet upward/downward and observe what happens if you move it slowly or quickly.
d- Flip the magnetic poles of magnet (place pole S near the loop) and observe what happens.
e- Move the S-pole of magnet toward the coil and observe the direction of motion for the needle of voltmeter.

Does it fit to what you expect from Lenz law?

Experiment#4

Objective: Observation of induced emf of a "transformer". For this exercises you will use the following link https://phet.colorado.edu/en/simulation/faraday

Select "transformer", DC source, one loop. Click on "show compass", " show field lines"," show electrons".

a- Put voltage = 0V at source of primary coil. Keep the mouse on primary coil and move it through the secondary coil. Next, move the secondary coil over primary coil. Do you see any light on? Explain.

b- Put the voltage 10V at source of primary coil. Next, move primary coil through secondary coil and vice versa. Do you see any light on? Explain what happens.

c-Put 3 coils at secondary coil. Repeat the experiments. What difference you see compared to (b)?

d- Select the AC source instead of AC source. Explain what do you see.

Experiment#5

Objective: Observation of induced emf by a "generator". For this exercises you will use the following link https://phet.colorado.edu/en/simulation/faraday

Select "generator", one loop. Click on "show compass", " show field lines"," show electrons". Use the lamp and the voltmeter to observe.

a- Next, open the tap around 30% and observe. Explain what happens.

b- Keep the tap at same position and increase the number of loops to 2,3 - what do you see? Explain

c-Next, change the tap to 100%. What difference you see compared to (b)? Explain.