2015 High School Design Rules

Disclaimer: The rules are subject to change prior to the competition. Rules have been updated as of October 19, 2015. The updates are in red ink.

Note: The egg drop apparatus for the first competition and the self propelled vehicle for the third competition do not have to be the same vehicle. If students want to design a vehicle that can perform both tasks and meets the dimensional requirements for both competitions, they may do so. Please familiarize yourself with the scoring guides for each competition. These are the scoring sheets that judges will use on the day of the competition.

General Rules:
1. Students may work in teams of up to four members
2. Students will have one attempt for each competition
3. No explosives, chemicals, compressed air, CO₂, or animals may be used during the competition
4. Anyone violating the spirit of the competition will be disqualified
5. Although some competitions have point deductions, no team will receive a score of less than zero for one competition
6. In the event of a tie, the team with the higher score in Competition 2: Crack the Safe will win
   a. If both teams have the same Competition 2 score, the team with the higher Competition 3: Break-out score will win
**Competition 1: Drop-In (Egg-drop)**

- **Description:** students will design a protective vehicle to safely drop a medium sized egg from the second floor of M2SEC to the first floor
- **Competition Goals:**
  1. Keep the egg protected during the fall and impact
  2. Have the vehicle descend as slow as possible to the ground
  3. Land as close to the middle of the target as possible.

**Rules:**

1. Vehicle must arrive to the competition pre-assembled
2. The vehicle must protected a refrigerated raw chicken egg
3. No balloons can be used in this competition
4. No electronics or motors in this competition
5. Maximum vehicle dimensions before competition:
   - length: 12"
   - width: 12"
   - height: 12"
      - Note: The entire vehicle must fit within the 12" x 12" x 12" dimensions only for this portion of the competition. This includes any parachutes or other drag devices. Reference rule 6b for clarification.
      - Teams will be presented an egg to secure while in line. Once they have it secured, they will place their entire vehicle inside the dimensioned box. Once the judge is satisfied that it meets requirements, one student will be sent to drop the vehicle.
6. One student will drop the vehicle while the other team members go downstairs and prepare to open the securing apparatus
   - To drop, the student will hold the bottom of the device with one or two hands.
   - At this point, the parachute is not included within the 12" x 12" x 12" dimensions. The carrier portion of the apparatus still must be within the 12" x 12" x 12" dimensions. Examples of this include:
      - The parachute or drag device may hang down below the drop elevation
      - The parachute or drag device may rest on top of the vehicle
7. Egg-drop will occur exactly 1 time
8. See Appendix A for drawing of the drop
9. Students will be given 1 minute to secure the egg in it's original condition in the vehicle

Contact hsd@ku.edu with any questions
a. Penalty: 10 point deduction on final score for exceeding extraction time limit

10. Students will be responsible for dropping the vehicle
   a. There will be a height marker to drop the vehicle from

11. Timing will be conducted by two officials
   a. The times from the two scoring officials will be averaged
   b. Timing will be scored using a step-model
   c. Step-model example:
      i. 0-1.49 seconds
      ii. 1.50- 2.24 seconds
      iii. 2.25- 2.99 seconds
      iv. 3.00-3.99 seconds
      v. 4.00-4.99 seconds
      vi. 5.00+ seconds
   d. Higher times will earn more points

12. Scoring will be judged on final landing position of the vehicle
   a. the highest point area the vehicle is touching gets the point. Vehicles off of the landing area will receive zero points.

13. After the competition, the egg must be removed from the vehicle and presented to the judging crew in original condition for maximum points
   a. Students will have 1 minute to remove the egg from the vehicle to present it for judging
   b. Penalty: 10 point deduction for taking longer than 1 minute to present the egg
   c. Care should be taken to protect the egg until the judging crew member has satisfactorily examined and scored the egg
   d. The egg will be scored based on the condition it is presented to the judges, if the student competitor drops or cracks the egg, the egg will be scored in that condition
   e. If the egg is intact after landing, and the student competitor drops or cracks the egg before the judging crew can evaluate it, the egg will be scored in the condition that is presented to the judge.
   f. There are three possible conditions:
      i. Broken: Interior contents of the egg are exposed
      ii. Cracked: Visible fractures of the egg but no leakage of the contents
      iii. Immaculate: No cracks or scuffs on the egg
   g. Score deductions occur from cracked eggs or broken eggs
   h. Judge’s decision is non-debatable

Contact hsd@ku.edu with any questions
i. If competitors refuse egg condition before placing into vehicle (per note below), they will not be penalized

**Note:** Competitors are responsible for examining and accepting the condition of the egg before loading into vehicle.

- Ways to get points: (Maximum possible points: 100)
  - Points based on the time it takes to drop to the target
  - Points based on the final landing position on the ground
  - Points based on the final condition of the egg

See scoring guide for further insight into instructions and point distributions.
Competition 2: Crack the Safe

- **Description:** The competition will consist of a safe with a numeric combination lock, no pre-competition preparation is necessary
- **Competition Goal:** students will work together to break into a safe using different methods to reveal the correct key number

**Rules:**

1. No electronic devices will be allowed in the competition
   a. Prohibited devices include: calculators, cellphones, tablets, and laptops
   b. Judges will monitor students during the competition to make sure they are not using devices
   c. Students will be disqualified from the competition if they are found using the devices
2. There is a 5-minute time limit
3. Students will also be encouraged/timed to complete the exercise before the 5-minute time limit
   a. step-time model for completing the competition under 5 minutes
   b. Step-model example:
      i. 0-0.59 minutes
      ii. 1.00-1.59 minutes
      iii. 2.00-2.59 minutes
      iv. 3.00-3.59 minutes
      v. 4.00-5.00 minutes

**DISCLAIMER:** No more information will be given regarding this competition until the day of the competition

- Ways to get points:(Maximum possible points:100)
  o Points for opening the safe
  o Points for opening the safe under the time limit

See scoring guide for further insight into instructions and point distributions.

Contact hsd@ku.edu with any questions
Competition 3: Break-out

- Competition Goal: Students will design a self-propelled car to race across a level track to escape from the bank

Rules:
1. Students will get one attempt at this competition
2. The car must be self-propelled, wind-up or mouse trap car
   a. Students will have no more than one minute to prepare and launch their car
   b. Penalty: 20 point deduction off of final score for exceeding preparation time limit
3. No electronic devices are allowed within the vehicle
   a. Prohibited items include motors, fans, and batteries
4. The use of balloons is permitted for this competition
5. Vehicle must launch independently, no external devices allowed
   a. Launching area must be free of car components, otherwise there will be a 20 point deduction.
   b. Cannot propel your car using an external device
6. Maximum vehicle dimensions:
   a. length: 8"
   b. width: 8"
   c. height: 8"
   Note: Unlike the egg drop competition, the vehicle must remain within the set dimensions for the entirety of the competition
7. Course will consist of a flat 12’ track with ⅛” dowel rods every 3 feet that operate as obstacles
   a. See Appendix B
   b. The course will be constructed out of ½” plywood as the base and 2x4s along the sides
   c. The course will be constructed in 1, 8-foot and 1, 4-foot section of track attached together
   d. The track will be broken up into zones every 3’. For cars that do not make it the full 12’, they will earn points based on what zone the car stops in.
   e. If the car stops in the middle of two scoring zones, the score will be recorded for the part of the attached car that is in the higher of the two point zones
8. A foam brick wall will be at the end of the track.
   a. Points will be given for successfully getting through the wall and crossing the finish line
   b. The full car must be past the finish line to receive points,

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c. If the wall is knocked down but the full car does not cross the line, points will not be given for knocking down the wall

d. Points will be given for crossing the line even if wall is pushed back and still intact

e. Points will be given for crossing the line even if wall is pushed to the side and still intact

9. Timing will be conducted by one official
   a. Timing will be scored using a step-model
   b. Faster times will earn more points
   c. Step-model example:
      i. 0-1.99 seconds
      ii. 2.00-2.99 seconds
      iii. 3.00-3.99 seconds
      iv. 4.00-4.99 seconds
      v. 5.00-5.99 seconds
   d. The timing component of the score is only applied if the vehicle breaks down the foam wall and fully crosses the finish line

10. The foam brick wall will be made up of foams bricks with the following dimensions:
    a. width: 6"
    b. height: 1"
    c. depth: 2"

11. The foam brick wall will be 8" tall by 24" wide, with a depth of 2"

12. If a car leaves the track, it will be scored based on the zone in which it left

**Note:** Pieces of the vehicle that fall off will not be considered as part of the car in the final scoring.

- Ways to get points:(Maximum possible points:100)
  - Points for distance zones
  - Points for time to the finish line

See scoring guide for further insight into instructions and point distributions.

Contact hsd@ku.edu with any questions
Appendix A.

Competition 1: Drop-in

Appendix B.

Competition 3: Break-out

Contact hsd@ku.edu with any questions
Egg Drop

Event Start Time: ______  End Time: ______

Please ensure that you are prepared and ready when getting to the front of the line. If your group is not prepared when you approach the egg distributor, you will be asked to go to the back of the line.

Instructions:
1. Inspect egg given by egg distributor and place in drop apparatus
2. Place your apparatus inside the measuring box. All parachutes, balloons or other drag apparatus’ must fit inside this box.
3. After placing egg in the drop apparatus, have one team member remain upstairs to drop the vehicle while the rest descend the stairs and prepare to open the vehicle once it is dropped. **Bring this paper downstairs!**
4. Have team member drop apparatus when instructed. Teams will be allowed to drop the apparatus only one time.
5. To drop: hold bottom of egg carriage with one or two hands level with the railing. Please note the following:
   - You may not hold the parachute open. You may only **hold the bottom carriage** with one or two hands. The parachute may be placed on top of the apparatus or allowed to hang down. The size restrictions do not apply to the parachute at this point.
6. Be prepared to promptly open apparatus and display the condition of the egg to the egg judge.

**Give this sheet to the egg condition judge after your apparatus has been dropped.**

Final scoring:

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the entire apparatus/parachute fit inside the 12” x 12” x 12” box before the drop?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was the vehicle dropped in a fair way? (ex. Did not throw open parachute or throwing vehicle up)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Was the egg removed and presented in less than one minute?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Deduction</td>
<td>0</td>
<td>-10</td>
</tr>
</tbody>
</table>

Time block scoring of average times (Please circle):

<table>
<thead>
<tr>
<th>Time block range (s)</th>
<th>Points awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1.49</td>
<td>0</td>
</tr>
<tr>
<td>1.50-2.24</td>
<td>5</td>
</tr>
<tr>
<td>2.25-2.99</td>
<td>10</td>
</tr>
<tr>
<td>3.00-3.99</td>
<td>15</td>
</tr>
<tr>
<td>4.00-4.99</td>
<td>25</td>
</tr>
<tr>
<td>5+</td>
<td>35</td>
</tr>
</tbody>
</table>

Target scoring (Please circle):

**Record the highest point value that the vehicle comes to rest on.**

<table>
<thead>
<tr>
<th>Target ring zone</th>
<th>Outside target</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points awarded</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>25</td>
<td>35</td>
</tr>
</tbody>
</table>

Egg condition (Please circle):

**Note: If egg is mishandled and damaged during the opening of the apparatus before egg judge can satisfactorily examine egg; the judge must score the egg as if the damage occurred from the drop.**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Broken</th>
<th>Cracked</th>
<th>Immaculate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points awarded</td>
<td>0</td>
<td>10</td>
<td>30</td>
</tr>
</tbody>
</table>

**Conditions defined:**

- **Broken:** Shell is broken, and inside of egg is visible.
- **Cracked:** Outer shell is cracked but no interior contents of the egg can be seen.
- **Immaculate:** No cracks or scuffs are observed.

*All judging decisions are final and non-debatable.*

Points earned:

- Time: ______
- Target Zone: ______
- Egg condition: ______
- Total points earned: ______

Points deducted:

- Exceeded time to present egg: ______
- Total points deducted: ______
- Final Total: ______

**After scoring please put this sheet in the pile to be given to the score recorder.**
Safe Cracking
Start Time: ______ End Time: ______

*Give this sheet to the timer before the start of the competition.*

**Goal:** Break into the safe as fast as possible.

**Instructions:**
1. Students will have a maximum of 5 minutes to open the safe.
2. A prompt will be on the table in the designated area.
3. The clock will start when students enter the competition space.
4. When you have opened the safe, notify the attending timer immediately.
5. Work for the riddles/problems will not be graded in any way. We only care about whether the safe is open or closed!
6. Timers are not responsible for notifying teams of how much time remains.

**Summary of Rules:**
1. Students may not physically break the safe. (ex: you may not unscrew the latches or break the plywood to gain access)
2. Students may not utilize electronic devices. These include but are not limited to: calculators, cellphones, tablets, laptops.
   a. Students caught utilizing these will be immediately disqualified.
      i. This includes checking the time on your phone.
   b. Simple analog or digital wristwatches are allowed.
3. Students may not exceed the 5 minute time limit

**Scoring:**

Please clearly circle one of the options.

<table>
<thead>
<tr>
<th>Time to open safe (minutes)</th>
<th>0:00 – 0:59</th>
<th>1:00-1:59</th>
<th>2:00 – 2:59</th>
<th>3:00 – 3:59</th>
<th>4:00 – 5:00</th>
<th>Did not open safe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points awarded</td>
<td>100</td>
<td>75</td>
<td>55</td>
<td>40</td>
<td>20</td>
<td>0</td>
</tr>
</tbody>
</table>

If a team was disqualified, please provide a brief description:

_____________________________________________________________________________________
_____________________________________________________________________________________

All judging decisions are final and non-debatable.
Break-Out
Start Time: ______ End Time:______

Give this sheet to the scorer before the start of the competition.

Goal: Have your car go as far and as fast as possible down the track.

Information:
1. Place your car into the measuring box to be sure that it is within the 8” x 8” x 8” dimensions.
2. Prepare to set and release your car.
3. Scoring is based on the end zone that your car ends up in, and additional points are awarded for breaking through a foam brick wall at the end of the track.
   a. The timing score is only applied if the vehicle breaks down the foam wall and fully crosses the finish line.
4. Once the car has come to a stop on the track, allow the scorer to verify its location, then remove it from the track.
5. After competing, please move to the designated area so that other groups can use the track.

Summary of Rules:
1. Students will have a maximum of 1 minute to prepare their car for the competition.
2. Students may not have any illegal propellants as defined by the Rules.
   Prohibited items include but are not limited to: motors, fans and batteries.
3. Students may not push the vehicle while launching. Any action that is determined to be a push will result in immediate disqualification.
4. The launch area must be free of car components.

Scoring:
Does the vehicle fit within the dimensions of 8” x 8” x 8”?
Yes                  No

Did the group exceeded time limit for setting up and launching vehicle?
Yes                  No

Distance achieved (Please circle):

<table>
<thead>
<tr>
<th>Zone</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Finished and broke down foam wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points awarded</td>
<td>20</td>
<td>40</td>
<td>50</td>
<td>70</td>
</tr>
</tbody>
</table>

Finishing is defined as having the wall knocked down and the full car across the line.

Time (Please circle):
Note: the timing score is only applied if the vehicle breaks down the foam wall and fully crosses the finish line.

<table>
<thead>
<tr>
<th>Time (seconds)</th>
<th>0.00 – 1.99</th>
<th>2.00 – 2.99</th>
<th>3.00 – 3.99</th>
<th>4.00 – 4.99</th>
<th>5+</th>
<th>Did not finish or break foam wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points awarded</td>
<td>30</td>
<td>20</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

If a team was disqualified, please provide a brief description:
_____________________________________________________________________________________
_____________________________________________________________________________________

Total Points:______