Materials
- ring stand
- clamps
- plexiglass
- extension cords
- laptop - Dell Latitude
- floodlight
- tape measure
- tape
- cut off hardy brass 3 lb hammer

Objectives
- hit melting metal
- hotter metal over hardy w/sledgehammer
- series of images along break process
- metal w/soda can
- metal w/ice cube
- twists
- forge weld

Trial 1 - Session 2 (saved)
- 105 mm lens, $d = 55$ cm, camera height = 84 cm
- hitting really hot metal w/sledgehammer
- EDR exposure on (Phantom V program) (20)
  - Post Trigger = 1
  - staging light 70 cm, 90 cm tall from subject
  - removed stage light
  - aperture on f/4

- when metal burns, ruins crystalline structure;
  makes it really brittle
  - burned = 2600 - 2800°F
- metal 3/8" square stock mild steel
  - obtained cool footage, out of focus
- hammer - 3 lb
  - resolution 1624 x 512 pixels

Trial 2 - Session 2 (saved) same metal, hammer + process
- moved camera to 40" away, 33" tall
- f/4
Session 2 - Trial 3 <saved>
Metal rod 3/4" x 1/4" breaking over cutoff hardy
  * capturing 1st hit in breaking process
  * camera 40" away, 33" tall
  * heated up close to burning

Session 2 - Trial 4 <saved>
  * 2nd hit on metal rod from above.
  * Same setup as 3rd hit.

Session 2 - Trial 5 <saved>
  * Striking burning rod (same rod as above)
    * hope to break it.
  * hitting narrow edge
    * made a dent

Session 2 - Trial 6
  * new rod, same thickness dimensions
  * hitting on narrow side again

For Final Project:

want: [ ]
then measure vol. displacement vs. velocity of hammer going in.
* get specs on 50, 105, & 50-80 mm lenses today! *

→ need f/# & SS for images taken with D100 on 11/2/05

* Memory card - email Dr. Bales about getting the pictures

105mm lens: NIKON Micro-NIKKOR 5N 227395

* new material: tongs

**cut-off hardy**

29" 27"

40" tall

Molequartz light

**anvil**

metal rod:

3/8" x 3/4"

set aperture at f/4, 105mm lens

same computer settings as in previous labs.

"Hitting rod from solid to broken" in two pieces;
capturing each successive hit w/ HSV

* hitting metal on thinner side to see deformation more easily

* metal reheated between each hit

Trial 1: 1st hit - metal burning 2400-2800

Trial 2: 2nd hit - ""

- metal rod bent, hammered back to straight
- camera recentered

Trial 3: 3rd hit - burning, direct hit.
- 4th hit not recorded; metal straightened
  Trial 5: 5th hit, beautiful, sweet success
  - metal burning
  Trial 6: 6th hit, nice!
  - metal heated for a really long time-
  - removed to cool, computer ran out of space,
    but emptied some files & back on track
  Trial 6: 7th hit - broke the metal
  - end of breaking first rod -

  ► same process w/ smaller metal, ¼" x ¼"

  Trial 7: hit & miss - metal makes squiggly shape
  - burning before when hit
  then hammered back to straight

  Trial 8: 1st hit - direct hit on ¼" x ¼"
  - nice indent, metal burning
  - second hit, not recorded

  Trial 9: 3rd hit, almost straight on, metal burning

  Trial 10: (metal melting and bending on its own)
  - metal orange-red (cooled) when hit
  - 4th hit

  Trial 11: - metal burning, 5th hit; metal bent,
  indent not enlarged (much?)
  - need to review video to check if indent changed

  Trial 12: - 6th hit; metal burning; hit breaks metal hit

  ▲ smaller metal takes as many hits (-1) as
  larger metal (perhaps due in part to "user error")
  - end of ¼" x ¼" rod -
- Start of ½" x ¼" metal rod -
  - rod hit w/ ½" side facing camera

- Trial 13: 1st hit, a little off center but made measurable indent, metal burning
- Trial 14: 2nd hit, nice! Metal burning
- Trial 15: 3rd hit, metal burning. A little off center, but displaced a large amount of metal.
- Trial 16: 4th hit, nice, but not much added displacement noticeable to the eye.
- Trial 17: 5th hit, metal burning; rod broken in 2 pieces w/ this hit.

* Varying force used, melting of metal prior to hit.
Strictly imaging ideas:
- Glass balloon
- Something like peppermint Lifesavers.
- Smashing forging glass
- Melting metal
- Prince Rupert drop
- Viewing cracks in breaking glass
- Bullet + Prince Rupert drop breaks
- Soldering w/ HSV
- Smashing pumpkins + other food
- Kite images w/ remote control.
- Soda cans w/ sledgehammer
- Reflections in water drops

* Seeing images in water drops
  - Get glass beads or marbles
  - Background - magnification
  - How to project pictures?
  - Use rose photo!

Needs: [Arlis] [Heather] [Everyone]
- Projector, color HSV, pictures
- Glass beads or marbles
- Milk drop setup w/ H2O

NOTE: INSERT BACK COVER UNDER COPY SHEET BEFORE WRITING
Water drop images

- Test w/ dropping marble

Materials:
HSV camera
Dell Latitude
Firewire cable
Gaffer's tape
700mm lens - Nikon Micro-Nikkor 213372
90 mm lens
Tape measure
Teenie-weenie mole molequartz type 4031 serial 6899
Marble box (to catch marble)
Paper cup (w/ hole cut in bottom to serve as funnel)
Bogen 3051 tripod
Pink backdrop

1st try - marble not centered in field of view, blurry ➔ just in wrong place? or moving too fast?

➔ note, tape melting b/c lights so hot

Setup:
- marble - 1/2" diameter

Diagram:
- Backdrop w/ star
- Camera 45" tall
- 60" molequartz light
- Star 3 1/2" wide 3 1/2" tall

- Testing w/ marble:
  Marble dropping apparatus:
  
  ```
  funnel to camera lens 14''
  Few hung upside-down!
  Face 9' 1/2'' tall, 8'' wide
  'dropping apparatus 11/2'' above top of face drawing
  ```

Procedure:
- Hung marble on string through funnel to focus camera
- Sample rate 3800 fps resolution 512x512 exposure 253

- Dropped marble w/ post trigger 1-2 or 3 times; marble deflected on wps, couldn't get falling marble in frame
- Switched to post trigger of 3057, switched to tighter funnel, closer to picture (lower)
- Amy held marble over funnel (1/2 way inside funnel) and counted "3, 2, 1"
- Dropped marble on 1, Heather pressed trigger after fell on "1"
- Captured star in marble - saved nov 23 star for face:

Setup photos:
- D100 ap. on f/22
- SS 1/180

NOTE: INSERT BACK COVER UNDER COPY SHEET BEFORE WRITING
- replaced star w/ face, 9½" tall by 8" wide
- recorded face in marble w/ same procedures - nov23-face1.un
- moved light to 67" away, 32" high, to remove shadow of apparatus from image in marble
  - dropped marble w/ face in background again
    - shadow gone, glare more off to the side.
    - nov23-face2.un
  - good result!
- note - refocused between every shot by holding marble in place below funnel.
Color HSV!

Equipment:

- Dell Inspiron 5150 SN
- Magma Memory SN A3-Z32A-2315 (Photron)
- Tripod - Manfrotto Bogen SN 3021BPRO
- Lens adapter Nikon
- More stage lights:
  - Worklight 872G TR/AR 2001/06 SN 69231232
  - Molecoo! Mole- Richardson Co. #2058
- Map of globe 31" x 19"
- Fan GE 49X491 SN U13057
- Extension cord

Things we borrowed:
- Color HSV w/ cap
- Lens adapter w/ cap
- Magma #12
- Magma power cord
- Computer power cord
- Magma card
- Grey cord cam
- Black cord comp
- Trigger connector

- 1st saved piece w/ 200mm - f/4
- Switched to 105mm - f/2.8
- Much clearer! Saved trial 2
- Procedure same as last time
- Trial 3 - glare & blurry - saved
Switched to 90 mm, f/2.5
  • a lot brighter and clearer!
  • set focus perfectly - if blurry, because moving or not falling straight down
  • Trial 4 - clearer, still a little blurry & big glare, but better.
Calculations \( m \) \& \( f \) for marble

\[
\frac{1}{f} = \frac{1}{i} + \frac{1}{\sigma} \quad \sigma = \frac{f}{m}
\]

\( \sigma \gg 10f \quad m \sigma = f \)

**Globe:**

\[ h_o = 9'' \times 9'' \quad m = \frac{h_i}{h_o} = \frac{0.5''}{9''} = \frac{0.056''}{m} \]

\( \sigma = 9'' \quad f = \sigma m = (9'')(0.056) \]

\( f = 0.5'' \)

**Star:**

\[ h_o = 3.5'' \times 3.5'' \quad h_i = 0.1154'' \]

\[ m = \frac{h_i}{h_o} = \frac{0.1154''}{3.5''} = 0.0330 \]

\( f = m \sigma = 0.297'' \)

\[ \frac{3.25''}{0.5''} = \frac{0.75''}{x} = 0.1154'' \]

**Face:**

\[ \frac{3.5''}{0.5''} = \frac{1.75''}{x} = 0.2925'' \]

\[ h_o = 9.5'' \times 8'' \quad h_i = 0.2925'' \]

\[ f = m \sigma = (0.031)(9'') = 0.279'' \]