IBEHS 4C03: Statistical Methods in Biomedical Engineering

iBioMed Racing

Carol Bassim , DMD, MHS
Assistant Professor, CLA
Division of Education and Innovation
Department Of Medicine

location: MDCL
phone: (905) 525-9140
email: bassimc@mcmaster.ca
web: http://ibiomed.mcmaster.ca

McMaster University
BRIGHTER WORLD

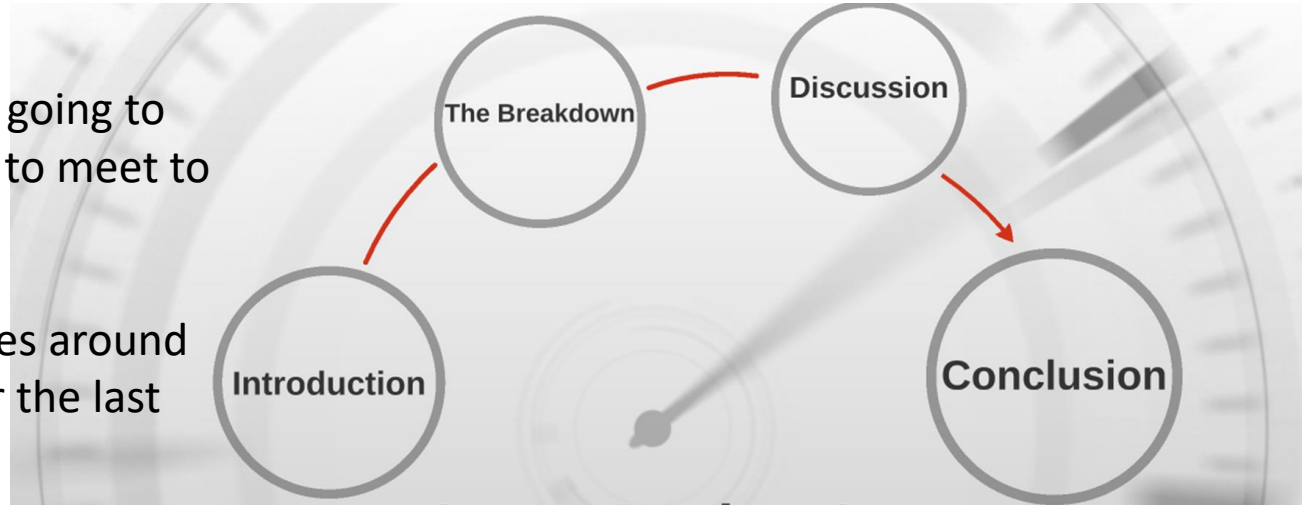
Instructions:

Divide into teams and decide on roles.

Team members are:

- Owners
- Partners
- Chief Racing Engineer and Team
- Chief Engine Mechanic and Team
- Sponsors from Goodlife Tire and Oil Company and from IAM Energy Drink
- Racing Driver
- Financial Team
- Race Coordinator

Introduction:



You and your racing team need to decide if you are going to race **today, in the next half hour!** You are all going to meet to decide what to do now.

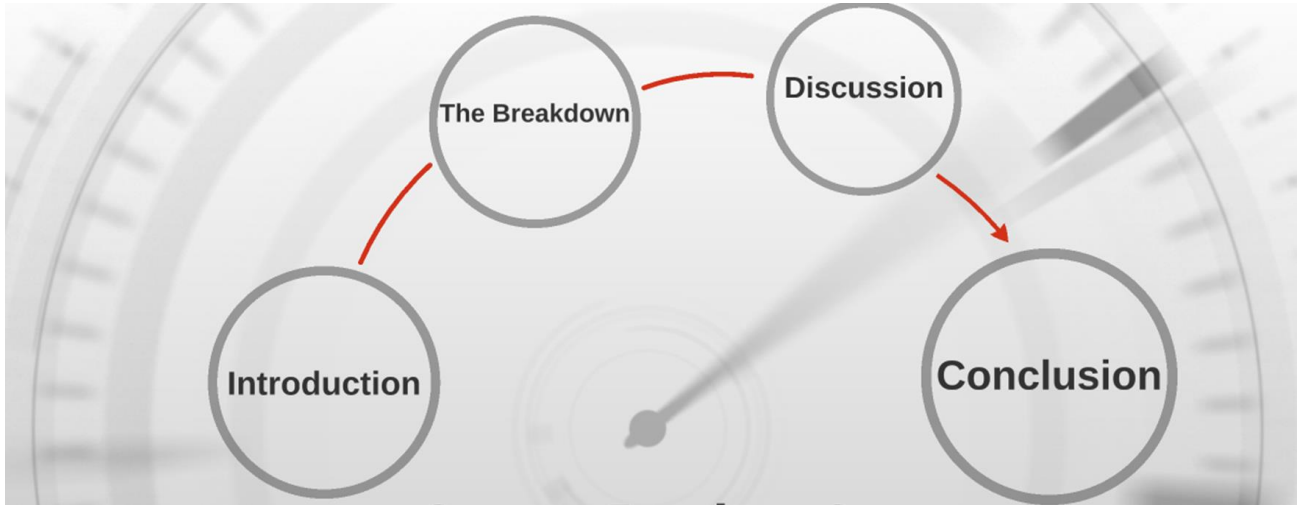
This is big race for you and your team: it only comes around every 2 years, and you have been planning for it for the last year.

It will be broadcast live on national television and could bring major prize money, and everyone involved loves racing.

Your team company is OK on operating money, but the financial team is getting a bit concerned about the future. They say you really need this race to keep or gain sponsorships.

Your big sponsor, Goodlife Tire and Oil, is concerned about your race standings, and a new startup, IAM Energy Drink is saying that they are considering sponsorship but need to see you in a big race before deciding.

Breakdown:



You are all excited, **but there is a problem!**

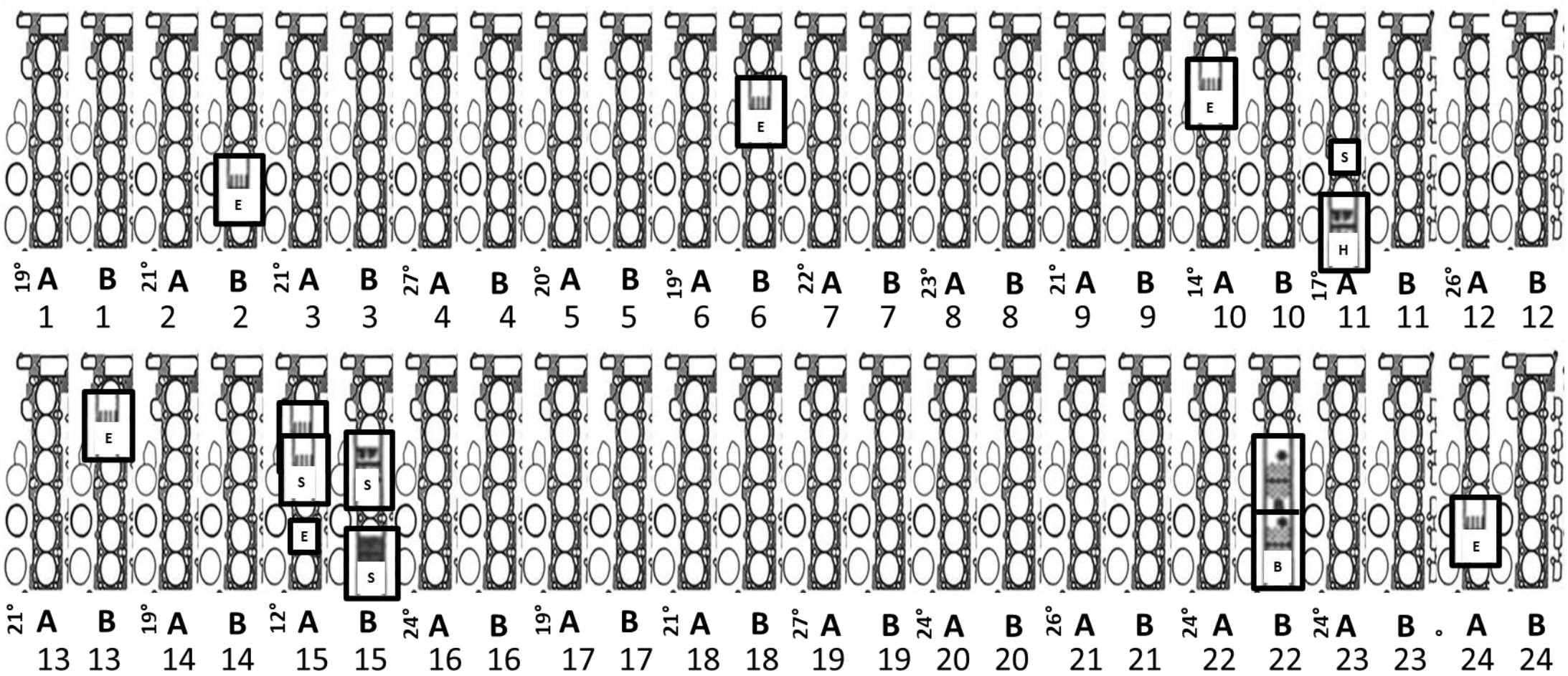
The Engine Mechanics team has been complaining over the last year about engine problems. It is common knowledge that they have been worried about their engine and about this upcoming race.

When asked, the Chief Engine Mechanic says that there have been engine problems: over the last year, 8 out of the 24 races have had problems with the Head Gasket assemblies.

The Chief Mechanic asks one of his team to overview the Head Gasket maintenance and failures log.

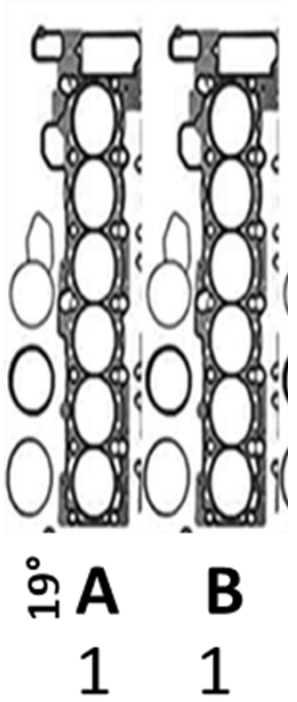
The member of the Engine Team pulls out the Head Gasket maintenance and failures log for the last year of 24 races. They also mention that they have had a hunch that the head gasket may be tending to breaking in cooler weather, so they have been marking down the ambient air temperature (°C) in the log as well.

Head Gasket (°C)

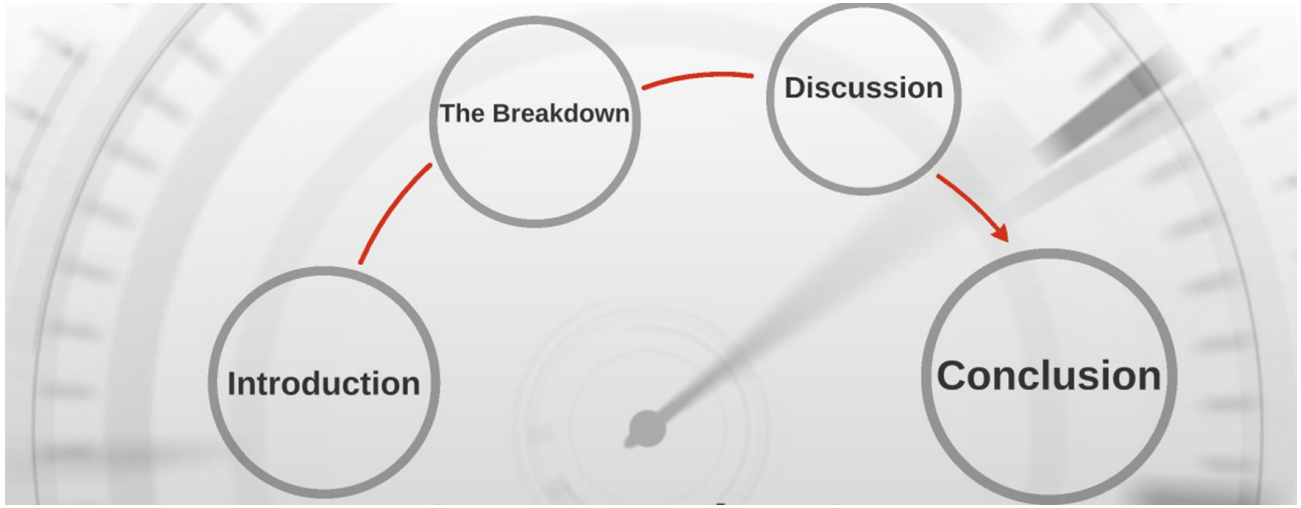


- **E Erosion**
- *** No Erosion**
- **S Fluid Leak Rating**
- **Shading Corrosion**

The head gasket has 6 cylinder ports, and they all need to be intact for the engine not to fail. The log shows the post-race notes for each race (1 through 24) the cylinder ports of the gaskets, top (A) and bottom (B), the log notes, and the ambient temperature on the race day.



Discussion:



The temperature today of the race is 36°C, unseasonably cool.

You go around the table once for comments:

Owners:

Chief Engine Mechanic:

Partners:

Race Car Driver:

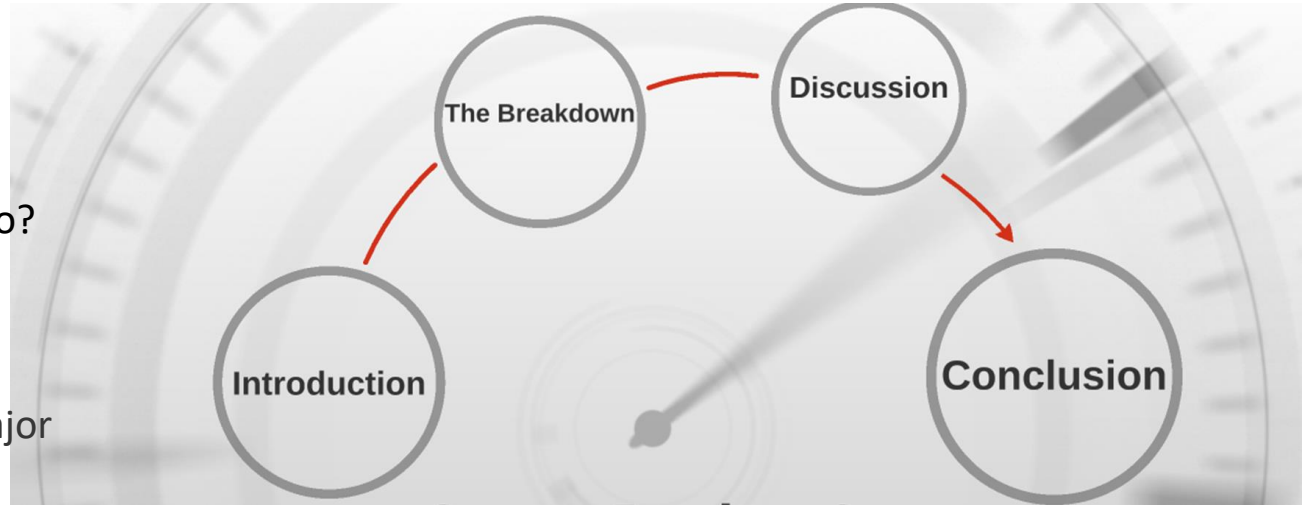
Chief Racing Engineer:

Race Coordinator:

Sponsors:

Financial Team:

Discussion by Roles:



Owners: There are consequences to pulling out of the race and for racing if there would be a crash. What should we do? How cold is today again?

Engine Mechanic: “If the head gasket fails during race conditions, the engine will blow up and we could have a major car crash, involving fatalities”

Partners: Concerned about the future effects for their investments for a canceled race or for a catastrophic engine failure.

Race Car Driver: “I want to go fast”

Chief Racing Engineer: The weather is cold today, but we have had Zero engine failure in the last 24 races and have only had something like 22 out of 6*24 = 144 gasket cylinder couplings problems. That’s about 15% for any problem, none of which led to a failure, right? And I know that the probability of a gasket port working in even very cold conditions is 99.7%. Are we OK with that?

Race Coordinator: Burns's First Law of Racing says, "Nobody ever won a race sitting in the pits.” but safety first.

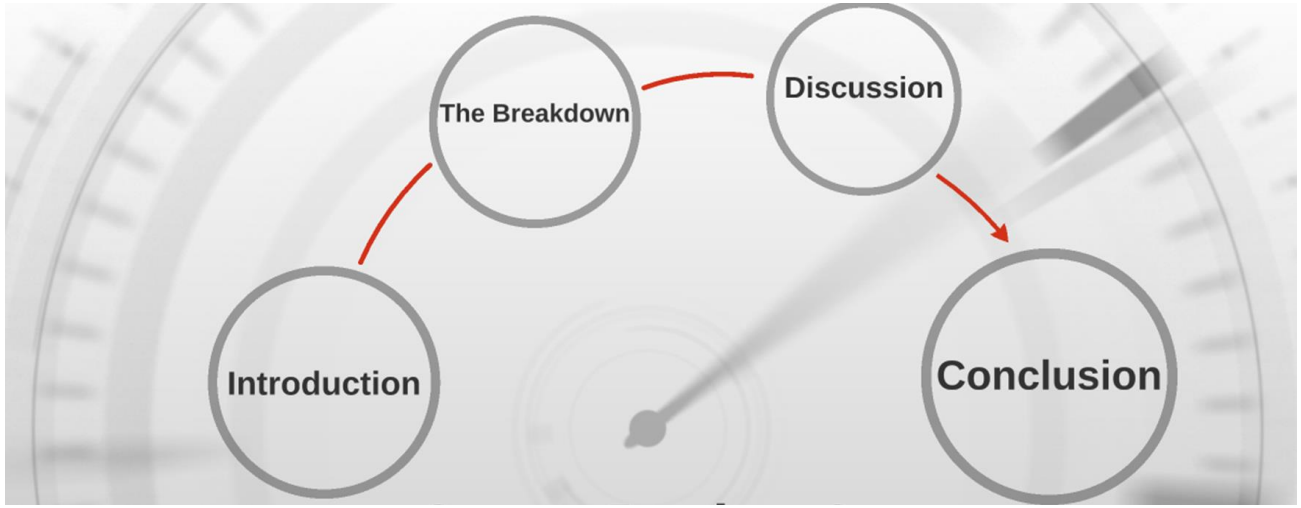
Sponsors: You need to race to keep and increase sponsorship, but an engine failure on TV jeopardizes relationships too. Maybe it will be OK and just race?

Financial Team: The $200,000 entry fee has been paid and is non-refundable. Goodlife Tire has sponsored us for $500,000 for this past year and IAM Energy is interested in a $300,000 sponsorship. A new engine would cost $60,000 and a new race car would cost $600,000. Your race insurance is up-to-date.

Conclusion:

Decide now as a team what to do:

Race or Don’t Race?



Activity:

1. Think through and create a better data graph that could help in the discussion.

2. Use the rules of probability to find the probability of an engine failure, assuming that all of the gasket ports fail independently of each other.

3. Decide again as a team what to do: Race or Don't Race?