PART 1. SAFETY AT THE RAILWAY

1. Which of the below is the most important Personal Protective Equipment (PPE) to wear whilst working in Puffing Billy Railways locomotive workshop?

   a. Red clothing

   b. Steel cap boots

   c. Pair of thongs

   d. Loose clothing

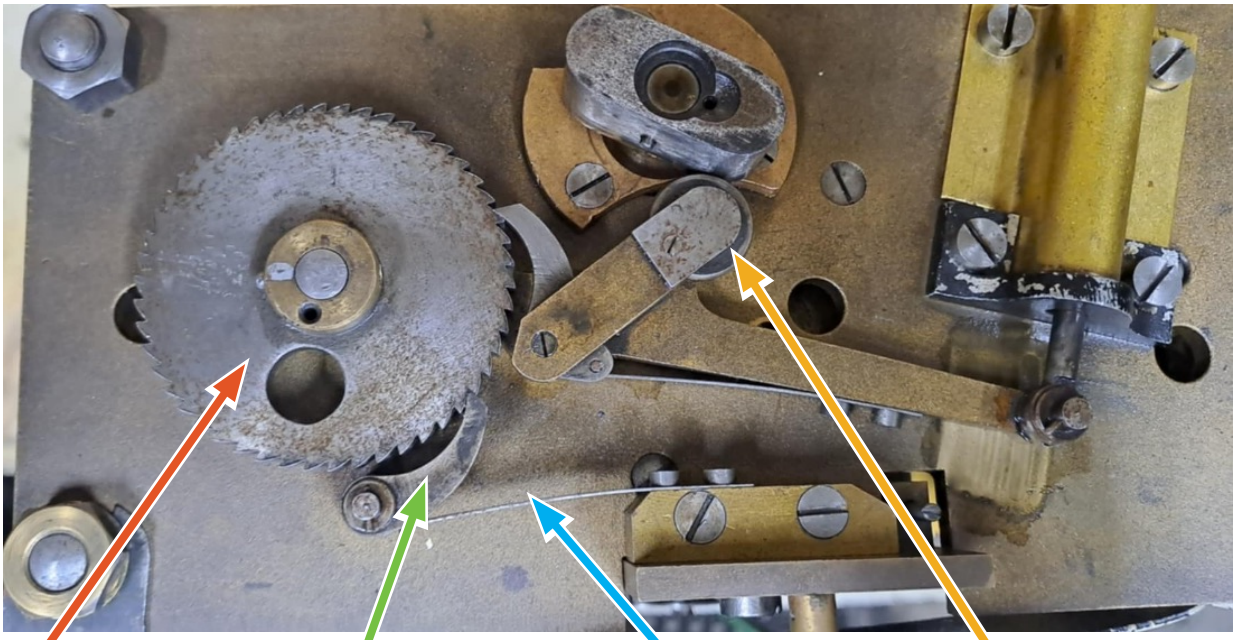
2. Workshop safety is everyone's responsibility. In a workshop an Engineer intends to cut with a grinder a square shape from a piece of metal to fit on the train. The engineer starts by assessing the hazards of the cutting process.

Identify two possible hazards of this cutting process and provide an appropriate control measure for those hazards.

HAZARD	CONTROL MEASURE

PART 2. ENGINEERING CONCEPTS AND PRINCIPLES AT PUFFING BILLY RAILWAY

1. The photo below shows a gear system. Label the parts indicated by the arrows. Circle the correct answer.



A. Gear	**A.** Pawl	**A.** Pawl	**A.** Worm
B. Cam	**B.** Spring	**B.** Leaf Spring	**B.** Cam
C. Spring	**C.** Pulley	**C.** Pulley	**C.** Pulley
D. Pulley	**D.** Crown Wheel	**D.** Pinion	**D.** Pinion

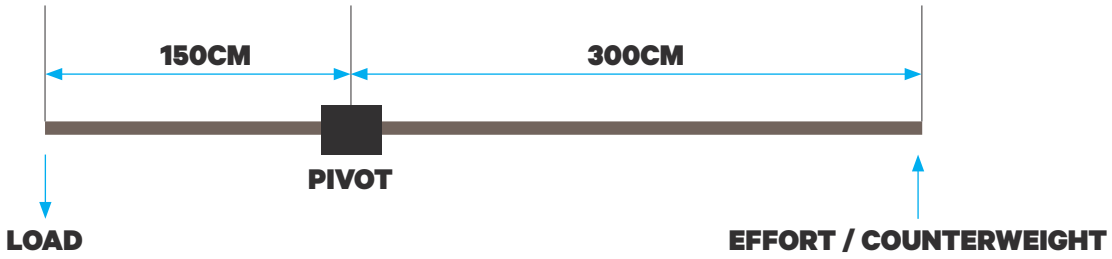
2. Which one of the following best represents the useful energy conversations that take place in a steam locomotive?

A.	Kinetic	Kinetic	Sound
B.	Electrical	Kinetic	Sound
C.	Sound	Electrical	Kinetic
D.	Chemical	Kinetic	Sound

3. While visiting the Locomotive workshops at Puffing Billy Railway find some examples of the simple machines in the table below:

SIMPLE MACHINE	GEARS	PULLEYS	LEVERS	INCLINED PLANES
Examples Eg. lathe				

4. The pivot crane is loading Puffing Billy with coal, the load is cantilevered so that it can be loaded into the top of puffing billy, what is the required counterweight (Effort) so that the crane doesn't fall over.
Assume (gravity g= 10m/s^2) and the load is 500kg of coal.



a) Calculate the required force from the counterweight in Newtons (N)

b) Calculate the mass of the counterweight required (M)

5. A Puffing Billy Railway Engineer will show you around the workshops throughout your excursion. While in the workshop you will be given a calculation to determine the potential and kinetic energy of the locomotive to get over the hill. Show your calculations below.

POTENTIAL ENERGY

VELOCITY AT THE BOTTOM OF THE HILL

KINETIC ENERGY

PART 3. RENEWABLE ENERGY SOURCES

One of the seven key strategic aspirations at Puffing Billy Railway is “Commit to Environmental Sustainability” which emphasises the importance of the stunning Dandenong Ranges that the rail Corridor passes through. Puffing Billy Railway is committed to improving its environmental footprint and actively pursues sustainable outcomes as a matter of priority.

1. What sustainability practices can you observe at the Railway?

2. Which of the following Energy sources is renewable?
   a. Coal
   b. Petrol
   c. Biofuel
   d. Natural gas

3. Name a device used to transform each of the following forms of energy into electrical energy.
   a. Solar Energy
   b. Thermal Energy
   c. Mechanical Energy

4. Given the below data of Puffing Billy's fuel sources, describe and discuss:

FUEL	EFFICIENCY (% AR)	GROSS CALORIFIC VALUE KJ/KG (TYPICAL) (DB)
NATURAL COALS		
Ffos-y-Fran Welsh	96.8	32824
Kazak Russian Coal	86.8	30757
ALTERNATIVE BIOMASS FUELS		
WILDFIRE Biomass waste	81.2	30982
Coal Briquettes	85.9	31002

a. Which fuel source is most efficient to heat water and generate steam?

b. What are the issues associated with burning natural coals?

c. Are there any other energy sources that can be used to heat water and generate steam?

NOTES

Use this space to take notes from the Education and Engineering workshop or brainstorm any ideas that may support your Mechanical system design for your Systems Engineering program back at school.