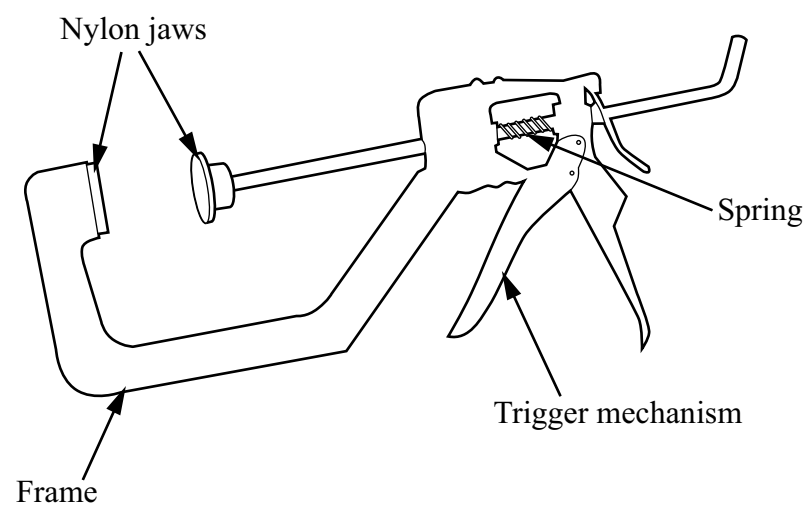


Answer ALL the questions. Write your answers in the spaces provided.

1. The drawing below shows a workshop clamp.

It is sold in do-it-yourself stores.



(a) Two specification points for the workshop clamp are that it must:

- be able to be used with only one hand
- not cause damage to the work that is being clamped.



Under each of the following headings, give **one** more point that should be included in the specification for the workshop clamp.

For each point, give **one** reason why it should be included.

(i) **Quality**

Point

Reason

.....

.....

(2)

(ii) **Environment**

Point

Reason

.....

.....

(2)

(iii) **Safety**

Point

Reason

.....

.....

(2)

(b) The frame is made from mild steel.

One reason for making the frame out of mild steel is that it can be easily joined by welding.

Give **two** other reasons why mild steel is a suitable material from which to make the frame.

1

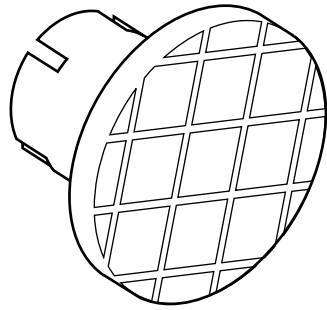
2

(2)



(c) The diagram shows one of the nylon jaws.

The nylon jaws are manufactured using the injection moulding process.

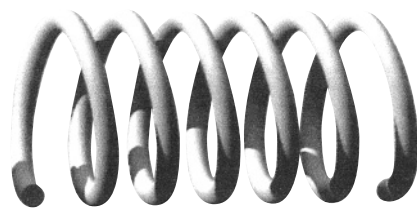


Give **two** reasons why the injection moulding process is suitable for manufacturing the nylon jaws.

- 1
 - 2
- (2)**

(d) The diagram shows a spring.

The spring is made from hardened steel.



Give **two** properties of hardened steel that make it suitable for the spring.

For each property give **one** reason why it makes hardened steel suitable for the spring.

- Property 1
 - Reason
 -
 - Property 2
 - Reason
 -
- (4)**



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(e) The manufacturer of the workshop clamp uses sampling during production.

Explain **one** reason for sampling during the manufacture of the workshop clamp.

.....
.....
(2)

(f) The frame is finished by plastic coating.

Explain **one** reason why the frame is finished by using plastic coating.

.....
.....
(2)

(g) Two purposes of the workshop clamp are to:

- be able to be used with only one hand
- not cause damage to the work that is being clamped.

Explain under the following headings, how the workshop clamp achieves these purposes.

(i) Be able to be used with only one hand.

.....
.....
.....
.....
(2)

(ii) Not cause damage to the work that is being clamped.

.....
.....
.....
.....
(2)

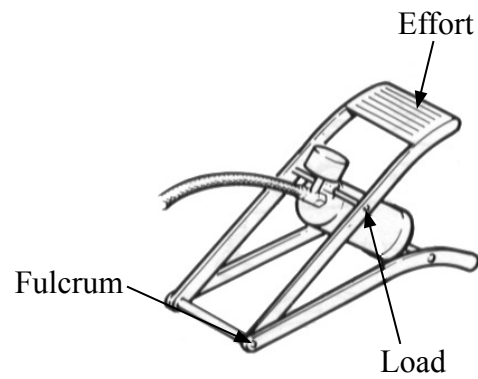
(Total 22 marks)

Q1



2. The drawing below shows a foot pump.

The foot pump is an example of a lever.



(a) Name this class of lever.

..... (1)

(b) The fulcrum of the foot pump is made from brass.

Give **two** properties of brass that make it suitable for the fulcrum.

1

2

(2)

(c) The frame of the foot pump is made from mild steel.

(i) Other than plastic dip coating, name **two** suitable finishes that can be applied to the mild steel frame.

1

2

(2)

(ii) Give **three** reasons for applying a finish to the mild steel frame.

1

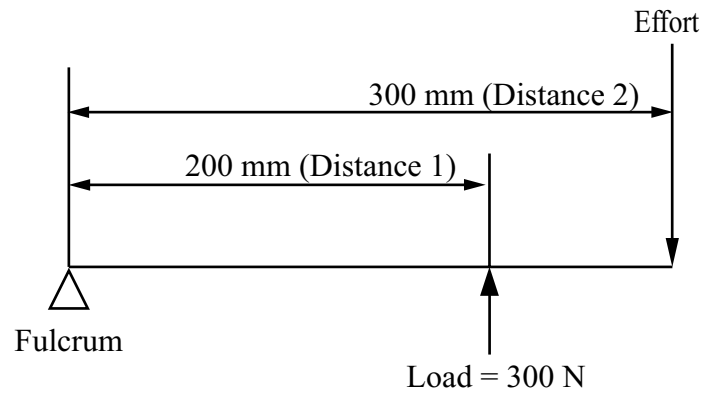
2

3

(3)



(d) A line diagram of the foot pump is shown below.



The load on the foot pump is 300 N.

Calculate the effort required to balance the 300 N load using the formula:

$$\text{Effort} = \frac{\text{Load} \times \text{Distance 1}}{\text{Distance 2}}$$

Show your working out.

.....
.....
.....
.....
.....

(3)

(e) The foot pump is marked with an electronic point of sale (EPOS) bar code.

Describe **one** advantage for the retailer of collecting product sales information from EPOS bar codes.

.....
.....

(2)



Leave
blank

(f) CNC machines are used to manufacture the foot pump using batch production.

Give **three** advantages of using CNC machines instead of manually controlled machines for batch production.

1

2

3

(3)

(g) The foot pump is manufactured in batches.

Explain **two** reasons why the foot pump is manufactured in batches.

1

.....

2

.....

(4)

(h) The manufacturer of the foot pump sells to many retail outlets.

Describe **one** way in which a computerised system could help the manufacturer to manage its business.

.....

.....

(2)

Q2

(Total 22 marks)



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3. A company is designing a battery powered go-cart.

The specification for the battery powered go-cart is that it must:

- have brakes which are easy to operate
- be easy to steer
- have wheels fixed to the axle but allows them to be easily removed
- be made using materials and processes suitable for batch production.

(a) In the spaces opposite, use sketches and, where necessary, brief notes to show **two different** design ideas for the battery powered go-cart that meet this specification.

Do **not** evaluate your designs in part (a).

Candidates are reminded that if pencil is used for diagrams/sketches, it must be dark (HB or B). Coloured pens, pencils and highlighter pens must **not** be used.

PLEASE DO NOT WRITE OR DRAW IN THIS SPACE.

PLEASE USE THE SPACES OPPOSITE FOR YOUR DESIGNS.



Leave blank

(b) Three of the original specification points are repeated below.

Evaluate how **one** of your design ideas succeeds or fails to meet each of the specification points.

Write the number of your chosen design idea (1 or 2) here

(i) The battery powered go-cart must have brakes which are easy to operate.

.....
.....
.....
.....

(2)

(ii) The battery powered go-cart must be easy to steer.

.....
.....
.....
.....

(2)

(iii) The battery powered go-cart must have wheels fixed to the axle but allows them to be easily removed.

.....
.....
.....
.....

(2)

(Total 22 marks)

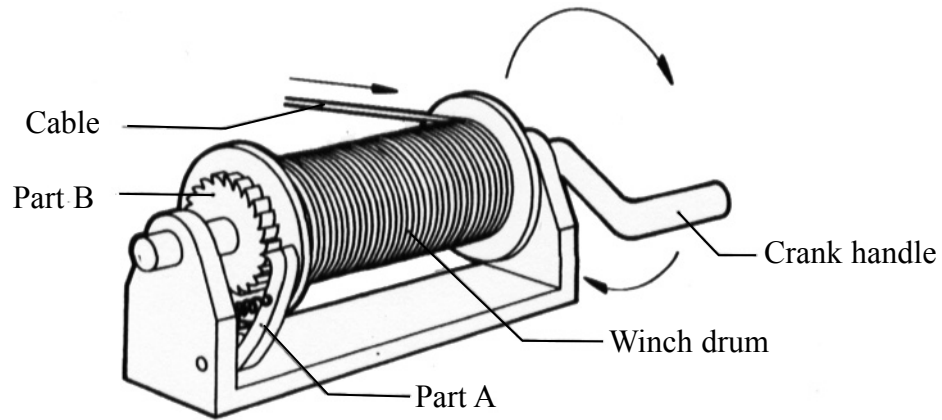
Q3



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4. The drawing below shows a winch mechanism.



(a) Name the type of motion made by the crank handle.

..... (1)

(b) (i) Name the parts labelled A and B on the winch.

Part A

Part B

(2)

(ii) Describe the working action of parts A and B as the crank handle is rotated.

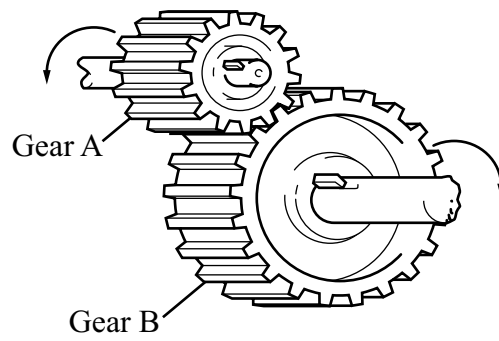
.....

.....

(2)



(c) A second mechanism, shown below, could be added to the winch in order to increase the velocity ratio (V.R.).



(i) Name the type of mechanism shown above.

..... (1)

(ii) Gear A, the driver gear, has 14 teeth. Gear B, the driven gear, has 21 teeth.

Calculate the velocity ratio (V.R.)

$$\text{V.R.} = \frac{\text{number of teeth on driven}}{\text{number of teeth on driver}}$$

..... (2)

(iii) A new gearing system is introduced which has a V.R. of 5:2. The input rotational speed is 125 rpm.

Calculate the output speed of the new gearing system.

..... (2)

(iv) Name **one** other type of mechanism that could be used to increase the V.R.

..... (1)



Leave blank

(d) Petrol driven motors could be used to drive the winch mechanism.

Give **three** disadvantages to the environment of using petrol driven motors to drive the winch mechanism.

- 1
- 2
- 3

(3)

(e) New products are designed to contain parts that can be recycled once they reach the end of their useful working life.

Describe **two** benefits to the environment of new products containing parts that can be recycled when they reach the end their useful working life.

- 1
-
- 2
-

(4)

(f) Moral implications play an important part in the design of new products.

Many products are designed with built-in obsolescence.

Explain **two** reasons why manufacturers choose to include built-in obsolescence in their products.

- 1
-
- 2
-

(4)

Q4

(Total 22 marks)

TOTAL FOR PAPER: 88 MARKS

END

