

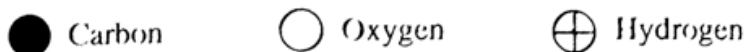
4.1 Answer key for Part A (multiple-choice questions)

	A	B	C	D
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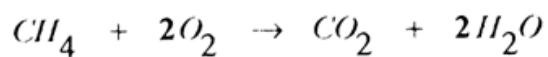
4.2 Answer key for Part B (constructed-response questions)

16. Write the balanced equation for the reaction that involves burning methane (CH_4). Using the symbols below, represent this balanced equation using the particle model.

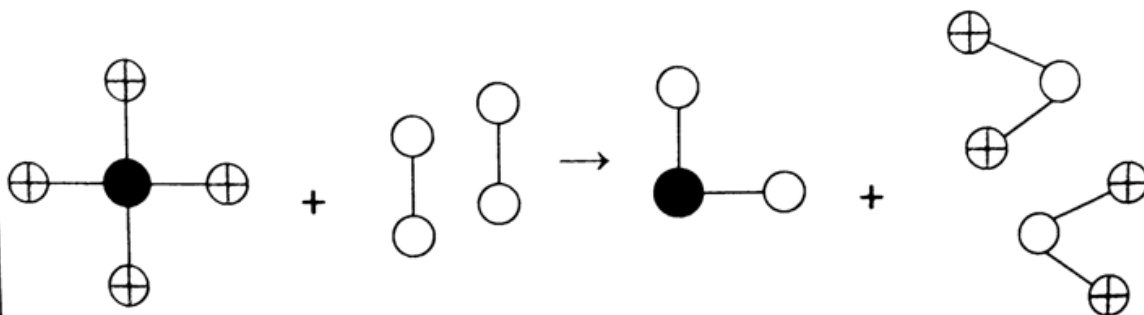
Symbols



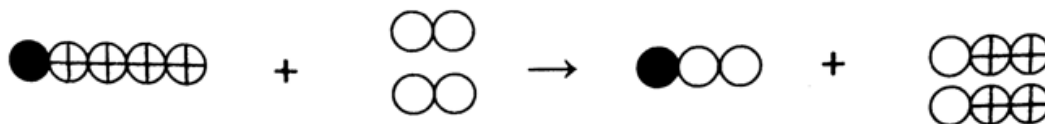
Balanced equation



Representation of the balanced equation using the particle model



OR

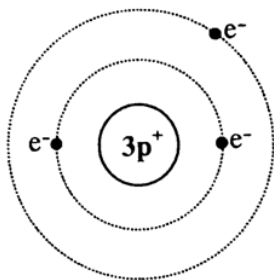


Note: The second representation shown above reflects the fact that students are not required to show the arrangement of the atoms.

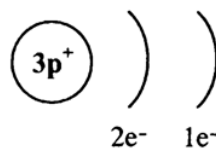
17. Write the symbol for the alkali metal in Period 2, and represent this element using the Rutherford-Bohr model.

Symbol: *Li* (*lithium*)

Representation:



OR



Note: Accept the simplified atomic model without taking into account the number of neutrons.
Accept *lithium* instead of the symbol.

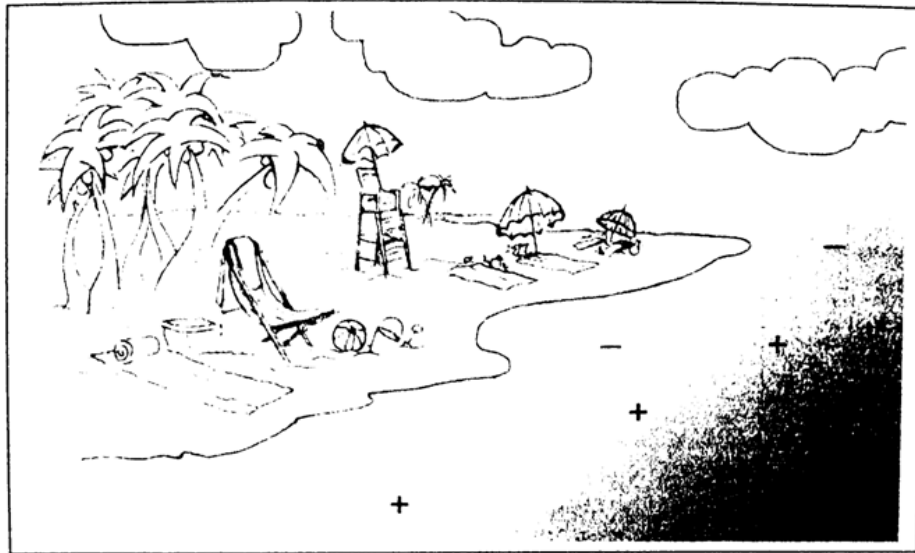
18. Can using electric cars have an impact on the greenhouse effect? Explain your answer.

Example of a correct answer

By using electric cars, we can reduce the greenhouse effect because these cars use electricity instead of burning oil, which releases CO₂. One of the gases responsible for the greenhouse effect is CO₂, and electric cars do not release any CO₂.

19. a) Complete the diagram below by illustrating the property of ocean water that makes it dangerous to go swimming during a thunderstorm.

b) Explain your diagram using the appropriate terms.



Explanation

You have to get out of the water to avoid being electrocuted by lightning, since the ocean water contains moving ions (salts, minerals or electrolytes) that conduct electricity.

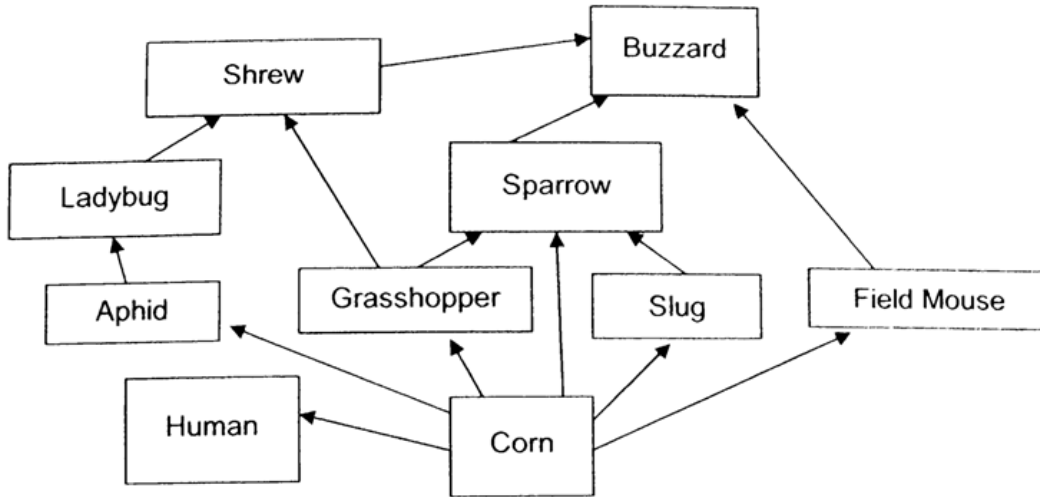
Note:

A complete explanation must include the following 3 elements:

- existence of charges
- moving charges
- electrical conductivity

Students who illustrate only one type of charge can earn only 2 marks even if their explanation is complete.

20. Which would have the greater impact on the food web of the corn field: the extinction of ladybugs or the extinction of slugs? Explain your answer by comparing the impact of the extinction of each of these two animals.



Ladybug

Ladybugs eat aphids and if ladybugs become extinct, aphids will have no predators.

Since corn is eaten by aphids, the corn supply could diminish more quickly, thereby affecting all the organisms in the food web.

Slug

Slugs are eaten by sparrows, but these birds have other food sources.

The extinction of slugs would therefore not have much of an impact, since this would not really endanger the life of other organisms.

Conclusion

The extinction of ladybugs would therefore have a greater impact on the food web than the extinction of slugs.

21. Which model or models qualify for the ECO-STAR label? Justify your answer by showing all your work.

Model X

$$P = \frac{E}{\Delta t} = \frac{157 \text{ W} \cdot \text{h}}{5 \text{ h}} = 31.4 \text{ W}$$

Model Z

$$P = \frac{E}{\Delta t} = \frac{392 \text{ W} \cdot \text{h}}{3.5 \text{ h}} = 112 \text{ W}$$

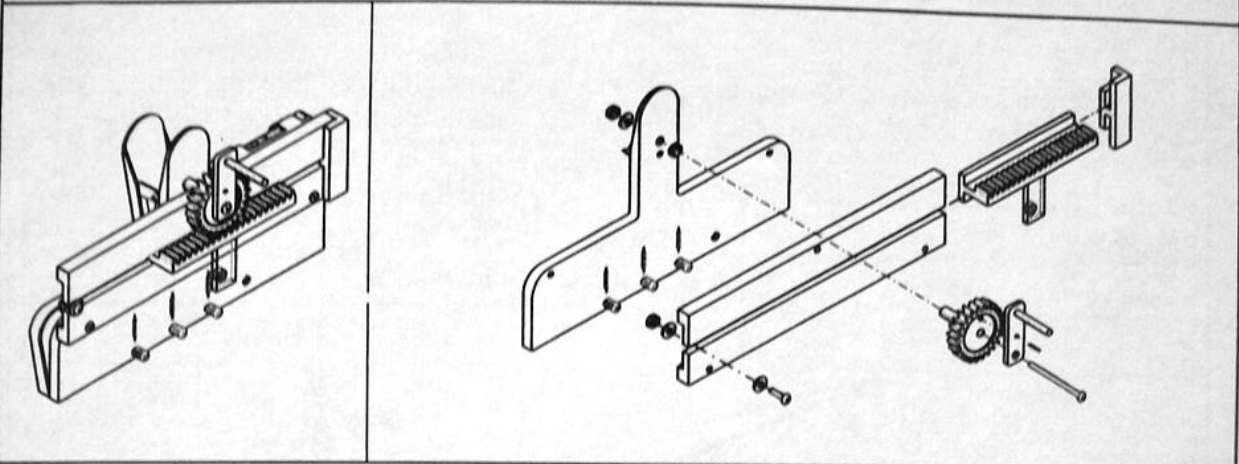
Model Y

$$P = \frac{E}{\Delta t} = \frac{255 \text{ W} \cdot \text{h}}{3 \text{ h}} = 85 \text{ W}$$

Models X and Z qualify for the ECO-STAR label, since their power ratings meet the required standards. Model X has a power of 31.4 W, and the standard is 37 W; model Z has a power of 112 W, and the standard is 115 W. Model Y does not qualify, since it has a power of 85 W and the standard is 78 W. Its power rating is too high.

4.3 Answer key for Part C (technological analysis questions)

22. Using scientific and technological vocabulary, explain the electrical and mechanical operation of the memo holder by describing what all the listed components do.



Crank: *When you turn its arm, the crank drives the pinion, making it rotate (transmits rotational motion).*

Rack and pinion: *The rotating pinion moves the rack to the left or to the right (transforms rotational motion into translational motion).*

Runner: *The runner guides the rack, ensuring its (translational) motion.*

Magnet and magnetic switch: *As soon as the magnet attached to the rack passes over a magnetic switch, the electrical circuit closes.*

Indicator lights: *The corresponding indicator light comes on (depending on the direction in which the rack is moving) to indicate the importance of the message.*

Metal end fitting and stop screw: *The stop screw and the metal end fitting prevent the rack from sliding out of the runner.*

23. Two links are identified in the diagram below.

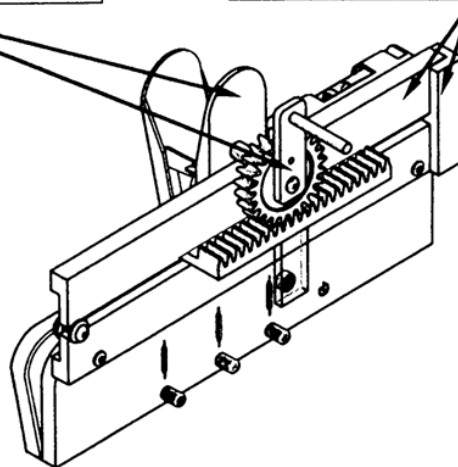
Circle the four characteristics that describe each link.

Characteristics of the link between the
front jaw and the crank

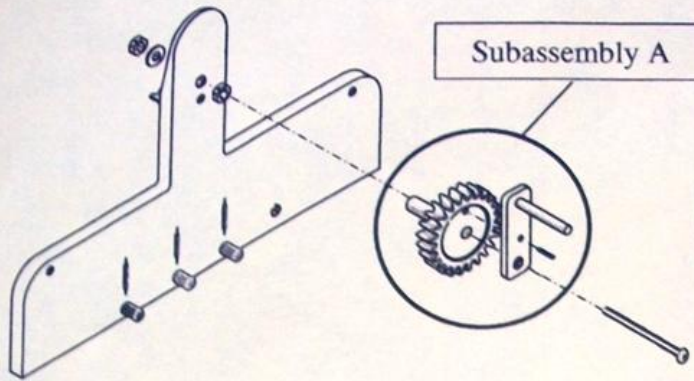
	or	<i>Indirect</i>
<i>Rigid</i>	or	
<i>Removable</i>	or	
	or	<i>Partial</i>

Characteristics of the link between the
metal end fitting and the runner

<i>Direct</i>	or	
<i>Rigid</i>	or	
<i>Removable</i>	or	
<i>Complete</i>	or	



24. a) To move appropriately, subassembly A represented below needs a guiding control.
Which part acts as the guiding control for this subassembly and what type of guiding is involved?



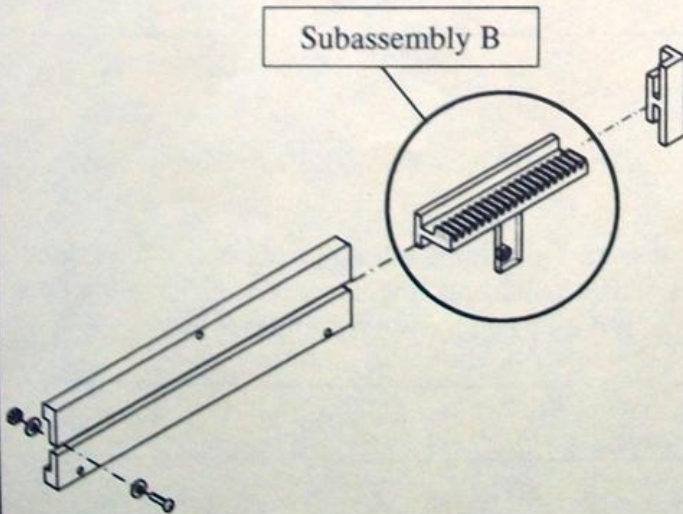
Part acting as the guiding control:

Bolt

Type of guiding involved:

Rotational

24. b) To move appropriately, subassembly B represented below needs a guiding control.
Which part acts as the guiding control for this subassembly and what type of guiding is involved?



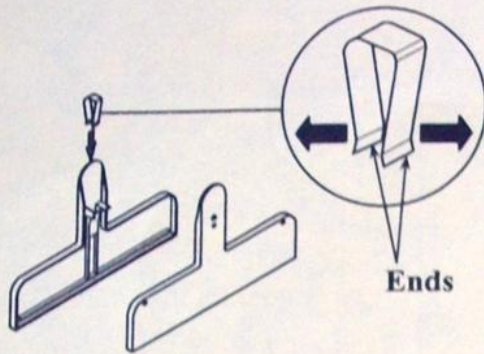
Part acting as the guiding control:

Runner

Type of guiding involved:

Translational

25. a) To what constraint are the two ends of the clip subjected when the memo holder is opened?



Constraint: *Tension*

25. b) The following are mechanical properties of materials.

– Hardness – Elasticity – Malleability – Stiffness – Resilience

What mechanical property must the clip have so that it can be subjected to this constraint when the memo holder is used? Explain why.

Mechanical property: *Elasticity*

Because: *The clip must return to its original shape for the memo holder to close properly.*

Note: Do not accept malleability as an answer. This clip is malleable because it is made of a material that can be flattened or bent without breaking. However, malleability does not explain why the clip behaves as it does when the memo holder is used.