I will now combine the questions from the Cambridge IGCSE™ Combined Science exam paper (0653/42), Paper 4 Theory (Extended) from May/June 2023, with their respective mark schemes.

**Question 1:**

**1. (a) (i)** Draw a food chain using the information in Fig. 1.1.

* **Mark Scheme:** Mango (fruit) → (fruit) flies → thrushes → eagle; correct order = 1 mark, arrows in correct direction = 1 mark. [2 marks]

**1. (a) (ii)** Complete sentences about the thrushes in Fig. 1.1.

* **Mark Scheme:** Secondary; three. [2 marks]

**1. (b) (i)** Calculate the mass of protein eaten from 85 g of mango fruit.

* **Mark Scheme:** 0.82 × 85 / 100; 0.697; 0.7 g. [3 marks]

**1. (b) (ii)** State the enzyme and the products of fat digestion.

* **Mark Scheme:** Lipase; fatty acids and glycerol. [2 marks]

**1. (b) (iii)** Suggest why eating mango fruit could help prevent constipation.

* **Mark Scheme:** Contains fiber. [1 mark]

**Question 2:**

**2. (a) (i)** State the compound that provides hydrogen ions in electrolysis.

* **Mark Scheme:** Water. [1 mark]

**2. (a) (ii)** Describe what happens to hydrogen ions during electrolysis.

* **Mark Scheme:** Hydrogen ions attracted to/move to cathode/negative electrode; reference to gain of electrons; (two) hydrogen atoms join to form a molecule (of hydrogen gas). [3 marks]

**2. (b) (i)** State the name of gas X shown in Fig. 2.1.

* **Mark Scheme:** Chlorine. [1 mark]

**2. (b) (ii)** Describe the test for gas X and state the observation for a positive result.

* **Mark Scheme:** (Damp) litmus (paper) and bleached/goes white. [1 mark]

**2. (c) (i)** State two properties of platinum that make it suitable for use as an electrode.

* **Mark Scheme:** Is inert/is unreactive and conducts (electricity). [1 mark]

**2. (c) (ii)** State the name of the collection of metals in the Periodic Table that includes platinum.

* **Mark Scheme:** Transition (elements/metals). [1 mark]

**Question 3:**

**3. (a) (i)** Describe the motion of the car for the first 10 s of its journey.

* **Mark Scheme:** At constant speed/at 20 m/s. [1 mark]

**3. (a) (ii)** Mark with an X a point at which acceleration is not constant on Fig. 3.1.

* **Mark Scheme:** X at top/bottom of line between t = 45 s and t = 50 s/between t = 58 s and t = 60 s. [1 mark]

**3. (b)** Show that the car did not exceed the speed limit of 100 km/h.

* **Mark Scheme:** Max speed of car = 25 m/s; unit conversions: 25 × 3600 / 1000 / 90 km/h (less than 100 km/h). [2 marks]

**3. (c)** Calculate the distance traveled between t = 0 and t = 25 s.

* **Mark Scheme:** Use of area under graph; 20 × 10 + ½ × 20 × 15; 350 m. [3 marks]

**3. (d) (i)** State the name of the distance from the lamp to the lens in Fig. 3.2.

* **Mark Scheme:** Focal length. [1 mark]

**3. (d) (ii)** Calculate the time taken for the light from the green traffic light to reach the driver’s eye.

* **Mark Scheme:** Speed = distance / time; t = 15 / 3 × 10^8; 5.0 × 10^-8 s. [2 marks]

**Question 4:**

**4. (a)** Complete Table 4.1 showing functions of leaf parts.

* **Mark Scheme:** A – Palisade cell; D – transports sugars/organic substances. [3 marks]

**4. (b) (i)** Complete the balanced equation for photosynthesis.

* **Mark Scheme:** 6 H2O + 6 CO2 → C6H12O6 + 6 O2. [2 marks]

**4. (b) (ii)** Explain the effect of a temperature of 45 °C on photosynthesis rate.

* **Mark Scheme:** Enzymes denatured; active site changes shape; substrate no longer fits/less enzyme activity. [3 marks]

**4. (c)** Complete sentences about the response of the plant shoot to light.

* **Mark Scheme:** Phototropism; auxin; elongation. [3 marks]

**Question 5:**

**5. (a)** Complete Table 5.1 by suggesting missing values.

* **Mark Scheme:** Experiment 4 – 30; Experiment 5 – 1.5. [2 marks]

**5. (b)** Explain why the rate of reaction is higher for experiment 2 than for experiment 1.

* **Mark Scheme:** Higher temperature gives particles more energy/move faster; more frequent collisions/effective collisions. [3 marks]

**5. (c)** Deduce which experiment has the most closely packed acid particles and give a reason.

* **Mark Scheme:** Experiment 3; highest concentration of acid. [2 marks]

**5. (d) (i)** Suggest a reason for the result for copper.

* **Mark Scheme:** Copper does not react with dilute acid. [1 mark]

**5. (d) (ii)** Suggest a metal that could produce a greater volume of gas and give a reason.

* **Mark Scheme:** Any metal above magnesium in reactivity series; more reactive. [1 mark]

**Question 6:**

**6. (a) (i)** State the source of the Sun’s energy.

* **Mark Scheme:** Nuclear fusion. [1 mark]

**6. (a) (ii)** State one other energy resource that does not come from the Sun’s energy.

* **Mark Scheme:** Nuclear. [1 mark]

**6. (b) (i)** Describe what happens to water pumped down the borehole in Fig. 6.1 and give a reason.

* **Mark Scheme:** Water heated/turns to steam; because rock at bottom is hot. [2 marks]

**6. (b) (ii)** Calculate the force applied by the pump to the water.

* **Mark Scheme:** Force = pressure × area; area = π × radius^2; 6 × 10^6 × π × 0.12^2; 27 000 N (to 2 sig fig). [4 marks]

**6. (c) (i)** State the form of useful energy stored by water in the lake.

* **Mark Scheme:** Gravitational potential. [1 mark]

**6. (c) (ii)** Calculate the energy stored in water pumped to the lake.

* **Mark Scheme:** Energy = mass × g × height; 1000 × 10 × 200; 2 000 000 J. [2 marks]

**Question 7:**

**7. (a) (i)** State the name of the process by which oxygen moves into red blood cells.

* **Mark Scheme:** Diffusion. [1 mark]

**7. (a) (ii)** State two other features of a gas exchange surface.

* **Mark Scheme:** Any two from: thin/thin walls; large surface area; moist. [2 marks]

**7. (b)** Describe how goblet cells protect the gas exchange system from particles in the air.

* **Mark Scheme:** Produce mucus; traps particles. [2 marks]

**7. (c)** State the name of one other lung disease caused by smoking tobacco.

* **Mark Scheme:** Emphysema/chronic bronchitis. [1 mark]

**Question 8:**

**8. (a)** State which two compounds in Fig. 8.1 are alkanes and give a reason.

* **Mark Scheme:** Decane and pentane; only single (carbon-carbon) bonds. [2 marks]

**8. (b)** State two conditions needed for cracking.

* **Mark Scheme:** Heat and catalyst. [2 marks]

**8. (c)** Describe what happens to carbon-carbon bonds during cracking.

* **Mark Scheme:** Long chains broken down into shorter ones. [2 marks]

**8. (d)** Explain why pentane and decane are in different fractions.

* **Mark Scheme:** Different boiling points. [1 mark]

**8. (e) (i)** State one use of refinery gas.

* **Mark Scheme:** Fuel. [1 mark]

**8. (e) (ii)** State the meaning of feedstock.

* **Mark Scheme:** Raw material for chemical processes. [1 mark]

**Question 9:**

**9. (a) (i)** Calculate the resistance of the electric bell.

* **Mark Scheme:** Resistance = voltage / current; 6.0 / 0.75; 8.0 Ω. [2 marks]

**9. (a) (ii)** Add a voltmeter symbol to Fig. 9.1 to show how it is connected.

* **Mark Scheme:** Voltmeter across bell. [2 marks]

**9. (b)** Suggest why the bell no longer works but the lamp still works with longer wires.

* **Mark Scheme:** Increased resistance of wire; voltage drop across wire; not enough voltage for bell. [2 marks]

This completes the combination of questions and their respective mark schemes from the specified IGCSE Combined Science exam paper.