4.3 Working Scientifically: Measuring, Recording and Risk: 30-minute Pack

Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 For each hazard, choose the control measure from the list that best fits it.

Hazards:
(i) A splash of dilute acid could reach the eyes.
(ii) A boiling tube has just been heated.
(iii) A power pack is plugged in beside a sink of water.

Control measures: tie long hair back; keep electrical equipment away from water; wear eye protection; hold the tube with a holder and let it cool before touching it.

(3)

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2 A pupil gently heats 10 cm³ of dilute alkali in a test tube over a Bunsen burner. The hazard is that hot liquid could spit out and reach the eyes. Four precautions are suggested.

A Wear eye protection.
B Tie long hair back.
C Point the open end of the tube away from everyone.
D Wash hands after the practical.

Choose the two precautions that reduce the risk of liquid reaching the eyes. Then explain why one of the other two does not reduce this risk.

(3)

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3 A gas syringe collects 0.12 dm3 of gas from a reaction in 40 s. Convert the volume into cm3 and then calculate the mean rate of gas production in cm3 per second.

(4)

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4 A pupil records the temperature of cooling water every minute.

Time (min)	Temperature (°C)
0	80
1	75
2	71
3	86
4	64
5	61

Identify the reading that is most likely a recording error, give a reason, suggest what the correct value probably is, and state what the pupil should do to check it.

(4)

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5 Year 9 pupils will do pond dipping from a muddy bank. Write a short risk assessment by giving two different hazards. For each hazard, state how a person could be harmed and give one control measure that fits that hazard.

(5)

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6 Convert each measurement into the unit shown.

(a) 350 g into kg.
(b) 2.4 m into cm.

(2)

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7 A pupil times how long a 2 cm strip of magnesium ribbon takes to stop fizzing in 20 cm^3 of dilute hydrochloric acid at 40°C. She measures the acid in a 100 cm^3 measuring cylinder marked every 10 cm^3 and reads it from above. Her thermometer reads 2°C when placed in melting ice. She does not wear eye protection. Her times for three trials are 38 s, 41 s and 62 s. She writes 'Time = 38 s, 41 s, 62 s' and calculates the mean of all three.

Evaluate how well she measured and recorded and how safely she worked. Calculate the mean she used, show what the mean would be without the 62 s trial, and suggest improvements.

(6)

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Mark scheme · 4.3 Working Scientifically: Measuring, Recording and Risk: 30-minute Pack

Question 1

(i) Wear eye protection. **B1**

(ii) Hold the tube with a holder and let it cool before touching it. **B1**

(iii) Keep electrical equipment away from water. **B1**

Answer: **(i) Wear eye protection; (ii) Use a holder and let it cool; (iii) Keep electrical equipment away from water.**

Question 2

A is chosen. **B1**

C is chosen. **B1**

B controls a different hazard, hair catching fire in the flame, or D deals with chemicals left on the skin after the practical; neither stops liquid reaching the eyes. **B1**

Answer: **A and C. B controls a different hazard (hair catching fire).**

Question 3

0.12 x 1000. **M1**

120 cm^3. **A1**

120 / 40. **M1**

3 cm^3 per second. **A1**

Answer: **120 cm^3; 3 cm^3 per second.**

Question 4

The 86°C reading at 3 minutes. **B1**

Cooling water cannot get hotter, and the reading breaks the falling pattern. **B1**

Probably 68°C, with the digits swapped (accept any value between 64°C and 71°C if supported). **B1**

Check the original written note or repeat the cooling run, and record the correction clearly rather than quietly changing it. **B1**

Answer: **86°C at 3 min. Water was cooling so it cannot rise. Probably 68°C. Check the original note or repeat the run.**

Question 5

First valid hazard, for example slippery bank or deep water. **B1**

Harm that fits the hazard, for example falling in or drowning. **B1**

A control measure that fits it, for example stay behind the marked line with supervision, or keep away from deep edges. **B1**

Second different valid hazard with a harm that fits it, for example germs in pond water causing illness, or sharp objects in mud causing cuts. **B1**

A fitting control for the second hazard, for example cover cuts and wash hands before eating, or wear gloves. **B1**

Answer: **Hazard 1: slippery bank, a person could fall in; stay behind the marked line with a supervisor. Hazard 2: germs in pond water, which could cause illness; cover cuts and wash hands before eating.**

Question 6

(a) 0.35 kg. **B1**

(b) 240 cm. **B1**

Answer: **(a) 0.35 kg; (b) 240 cm.**

Question 7

Level 0 No relevant content. **0**

Level 1 Gives isolated relevant statements about measuring, recording or safety, with little use of the data or justification. **1-2**

Level 2 Calculates a mean correctly and identifies some measuring, recording or safety weaknesses with some linked improvements, but coverage of the three areas is incomplete. **3-4**

Level 3 Calculates both means correctly and gives a coherent evaluation of measuring, recording and safety, linking each weakness to a specific improvement. Award 6 for a thorough, well-supported response; 5 for a mostly complete response. **5-6**

Indicative content:

- Mean of all three = (38 + 41 + 62) / 3 = 141 / 3 = 47 s. Without 62 s: (38 + 41) / 2 = 39.5 s.
- The 62 s trial is far from the others and should be investigated before being left out; it should stay in the table with a note, and a further repeat would help decide.
- A 100 cm^3 cylinder marked every 10 cm^3 has a resolution too coarse for 20 cm^3 of acid; use a 25 cm^3 or 50 cm^3 cylinder with smaller divisions.
- Reading from above gives parallax error; read with the eyes level with the bottom of the meniscus.
- The thermometer reads 2°C in melting ice that is at 0°C, so it has a zero error of +2°C; the acid may really be at 38°C, not 40°C. Check against ice, or use a different thermometer, and correct or replace.
- Units are written in the cells; put them once in the column heading, for example Time (s), and use a table with one row per trial.
- Eye protection should be worn because acid could splash into the eyes; this controls the hazard of acid in the eyes.
- Keep the acid volume, magnesium length and acid concentration the same, and repeat the trials to check consistency.

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