Mark scheme for Speed, distance and acceleration Foundation tier

1) Double award 2018 Q1

18 (1) 74 (1) **ecf** [1st answer + 56]	
No effect [on thinking distance] (1) Increases / longer [braking distance] (1) NB. '[Take]_longer to brake' or 'longer for..' imply time so not credited. [No reference to time for either or physical cause]	2
Increases / longer [thinking distance] (1) NB. '[Take]_longer to think' implies time so not credited. No effect [on braking distance] (1) [No reference to time for either or physical cause]	2
Question 1 total	**4**

2) Separate Physics 2018 Q7

indicative content.

Section	Descriptions		
	Qualitative	**Numerical**	**Developed**
AB	Acceleration	0 to 25 m/s in 50 s	Constant acceleration (of 0.5 m/s^2)
BC	Constant velocity	25 m/s for 80 s	
CD	Deceleration	25 m/s to 0 in 70 s	Increasing deceleration
DE	Stationary	For 40 s	
EF	Acceleration	0 to 10 m/s in 60 s [or from 240 s – 300 s]	Constant acceleration less than AB (0.17 m/s^2)

3) Double award 209 Q4

Distance travelled / length of track / 2.5 m Accept: [same] car / [same] track
Mean speed = $\dfrac{2.5}{4.0}$ (1-substitution) = 0.625 (1) [m/s] accept 0.63 and 0.6 but **not** 0.62 [m/s] Answer of 0.62 on the answer line with no workings shown award 1 mark
The [mean] time or it decreases (1) at a decreasing rate / at smaller intervals (1) N.B. treat any reference to numbers as neutral
Increases accept quicker or faster
It [0.2 s] is not the smallest range / 0.1 s is the smallest range (1) Most repeatable data is for 10 cm (1)
Reference to human error or reaction times (1) so the timing is closer to the true value / more accurate (1) N.B. treat any reference to precision or reliability as neutral
Question 4 total

4) Separate Physics 2019 Q9

Straight line through origin shows a proportional relationship (1) so true for thinking distance but not braking distance (1) **OR** Braking distance is a curve so it isn't true (1) Thinking distance is a straight line through the origin so true (1) Accept answers based on data
40 mph converted to 18 m/s (1) Distance of 12 [m] seen anywhere (1) Answer = 0.67 [s] (1) Award 2 marks for an answer of 0.3 [s]

Speed (mph)	0	20	30	40	60	70
Total stopping distance (m)	0	12	22 or 22.5 or 23	36	72 or 72.5 or 73	95 or 95.5 or 96

5 or 6 correct (2) 3 or 4 correct (1) 1 or 2 correct (0)

5 points plotted correctly (ignore (0,0) ±< 1 small square (2) **ecf on table** 4 points plotted correctly ±< 1 small square (1) 3 or less points plotted correctly ±< 1 small square (0) Best fit curve **through (0,0)** ±< 1 small square (1) Don't accept double, thick, disjointed, whispy curves
At 30 mph stopping distance = 22 **or** 22.5 m **or** 23 m (**ecf**) (1) At 20 mph the stopping distance = 12 m (**ecf**) (1) 12 m is less than 15 m **or** 12 m is less than the distance after the bend **or** there is a 3 m gap so less chance of a collision (1)

5) Double award 2022 Q2

Factor	Thinking distance	Braking distance	Stopping distance
Worn tyres	✗	✓	✓
Drunk driver	✓	✗	✓
Wet road	✗	✓	✓

Award 1 mark for each correct column

$\text{Time} = \dfrac{9.1}{13}$ (1)

= 0.7 [s] (1)

23 [m] (1)
is less than 30 [m] **or** so it stops [before the crossing] (1)
Award 2 marks for it stops with 7 [m] to spare
No marks can be awarded if no reference to 23 m or 7 m

6) Contingency paper 2022 Q4

Stopping distance
Any 2 × (1) from: • Height of ramp • Angle of slope • Point of release on the slope Don't accept weight
Question 4 total

7) Separate physics 2022 Q7

	30 [m/s]	
	Substitution: $\dfrac{30\,\text{ecf}}{1.5}$ (1) = 20 [m/s²] (1)	

Indicative content
AB – During the first 2.5 s there is uniform / constant acceleration from 0 to 40 m/s.
BC – Between 2.5 and 3 s there is uniform / constant deceleration from 40 to 20 m/s.
CD – After 3 s the car travels at constant speed of 20 m/s for 1 second.

5–6 marks
Comprehensively describes all three parts of the motion in detail and includes all values relevant to the motion.
There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

3–4 marks
Comprehensively describes two of the parts of the motion in detail with some values **or** limited description of all three parts with some values included.
There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

(ii)		$\text{speed} = \dfrac{\text{distance}}{\text{time}}$ or implied (1) Substitution: $\text{speed} = \dfrac{85}{4}$ (1) Speed = 21.25 or 21.3 or 21 [m/s] (1)
		Question 7 total

8) Double Physics 2023 Q2

(a)			B = constant velocity (1) C = accelerating (1) D = decelerating (1) Ignore any ticks in row A. More than one tick in a row no marks can be awarded.	
(b)	(i)		10 [m/s]	
	(ii)		4 [m/s]	
	(iii)		20 [s]	
(c)			6 selected seen anywhere (1) 10 selected seen anywhere (1) $\dfrac{6}{10}$ = 0.6 [m/s^2] (1) N.B. $\dfrac{10}{6}$ = 0.6 [m/s^2] don't award the last mark	1
(d)			Substitution: $\dfrac{270}{50}$ (1) = 5.[4] [m/s] (1)	1
			Question 2 total	**2**

9) Separate Physics 2023 Q6

(a)	(i)	35 [m]
	(ii)	60 [km/h]
	(iii)	80 [km/h]
	(iv)	[Alert driver – thinking distance =] 25 [m] (1) [Tired driver – doubles to] 50 [m] (1) [Braking distance of 20 m stays the same giving stopping distance of] 70 [m] (1) so disagree To award 3 marks the conclusion must be present
	(v)	25 seen anywhere (1) 17 seen anywhere (1) Time = 1.47 [s] (1)

(b)

Thinking distance	Braking distance	Stopping distance	Impact speed
Stays the same (1)	**Increases (1)**	Increases	**Increases (1)**

(c)

Action	Seat belt	Crumple zone
Increases the time of the collision		✓
Reduces force on the car		✓ (1)
Prevents driver continuing through the windscreen	✓ (1)	

Ignore any ticks in row 1
More than 1 tick in a row no marks can be awarded