Friction Mark Scheme

Q1.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An explanation that makes reference to the following points: • The centripetal force is provided by friction (1) • There is a max (frictional) force **Or** (frictional) force is the same when coin starts to slide (1) • $F=m\omega^2r$ so as r increased ω decreased (1)	For MP3 accept ω^2 for ω	3

Q2.

Question Number	Acceptable answers	Additional guidance	Mark
	• A (resultant) force F is required to maintain circular motion (1) • This force is friction (between car/slider and track) (1) • As v increased F required increased until it exceeds friction and car slides off track (1)	alt: A (resultant) force acts to the centre of the circle.	3

Q3.

Question Number	Answer	Mark
(a)	Velocity/direction changing **Or** (object is) accelerating (1) Force towards centre of circle (1)	2
(b)	High(er) speed means large(r) force **Or** small(er) radius means large(r) force (1) (For sharp bends) centripetal/resultant/required force would need to be greater than maximum frictional force **Or** (for sharp bends) friction cannot provide the (required) centripetal/resultant force (1)	2

Q4.

Question Number	Acceptable answers	Additional guidance	Mark
(i)	• If the track is curved then a centripetal force is required • This force provided by reaction force between wheel and rails • The centripetal force is given by $F = mv^2/r$ • There will be a maximum speed at which the train will leave the track (and the train must travel at less than this speed) as there is a maximum value of reaction/friction (between wheels and rails)	Accept Force towards the centre Accept This force is provided by friction (between rail and wheels) Accept Train slips off track if centripetal force is larger than reaction/friction can provide	4
(ii)	• Use of constant = v^2/r • $r = 5800$ m	Example of calculation As v^2/r = constant (k) $k = 200^2$ (km h^{-1})^2/ 1800 m = 22.22 $r = 360^2$ (km h^{-1})^2 / 22.22 m (km h^{-1})$^{-2}$ $r = 5840$ m	2