

Year 2 Applied Chapter 7: Dynamics and Friction – Exam Questions (Answers)

Q1.

(a)	$R = mg \cos 40$	B1
	Use of $F = \mu R$	B1
	$mg \sin 40 - F = \pm ma$	M1A1
	$acc = 2.55 \text{ (m s}^{-2}\text{)} \text{ or } 2.5 \text{ (m s}^{-2}\text{)}$	A1 (5)
(b)	$v^2 = u^2 + 2as = 2 \times a \times 3$ Speed at B is $3.9 \text{ (m s}^{-1}\text{)} \text{ or } 3.91 \text{ (m s}^{-1}\text{)}$	M1A1 (2)

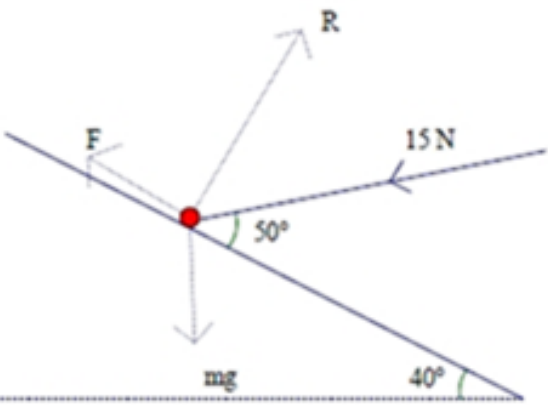
Q2.

(a)	$R = mg \cos \alpha$	B1
	Resolve parallel to the plane	M1
	$-F - mg \sin \alpha = -0.8mg$	A1
	$F = \mu R$	M1
	Produce an equation in μ only and solve for μ	M1
	$\mu = \frac{1}{4}$	A1
		(6)
(b)	Compare $\mu mg \cos \alpha$ with $mg \sin \alpha$	M1
	Deduce an appropriate conclusion	A1 ft

Q3.

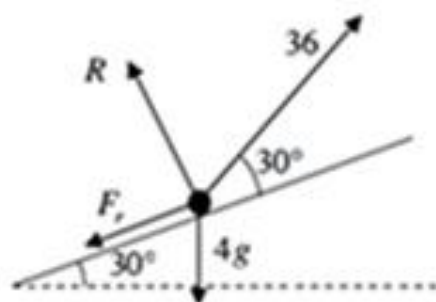
$0.5g \sin \theta - F = 0.5a$	M1 A1 A1
$F = \frac{1}{3}R$ seen	B1
$R = 0.5g \cos \theta$	M1 A1
Use of $\sin \theta = \frac{4}{5}$ or $\cos \theta = \frac{3}{5}$ or decimal equiv or decimal angle e.g. 53.1° or 53°	B1
$a = \frac{3g}{5}$ or 5.88 m s^{-2} or 5.9 m s^{-2}	DM1 A1
	[9]

Q4.

a	 Perpendicular to the slope: $R = 2.7g \cos 40 + 15 \cos 40$ $= 31.8 \text{ (N) or } 32 \text{ (N)}$	M1A2 A1 (4)
b	Parallel to the slope: $F = 2.7g \sin 40 - 15 \cos 50$ ($F = 7.366..$) Use of $F = \mu R$ $\mu = \frac{2.7g \sin 40 - 15 \cos 50}{R} = 0.23 \text{ or } 0.232$	M1A2 M1 A1 (5)
c	Component of wt parallel to slope $= 2.7g \sin 40^\circ (= 17.0)$ $F_{\max} = 0.232 \times 2.7 \times g \times \cos 40^\circ = 4.7... \text{ (N)}$ $17.0 > 4.70$ so the particle moves	B1 M1A1 A1

Q5.

(a)



$$R + 36 \sin 30^\circ = 4g \cos 30^\circ$$

$$R = 15.9, 16$$

M1 A1

M1 A1

(4)

(b)

Use of $F_r = \mu R$

$$36 \cos 30^\circ = F + 4g \sin 30^\circ$$

$$\mu = \frac{36 \cos 30^\circ - 4g \sin 30^\circ}{R} = 0.726$$

$$0.73$$

B1

M1 A1

M1 A1

(5)

(c)

After force is removed

$$R = 4g \cos 30^\circ$$

$$-\mu 4g \cos 30^\circ - 4g \sin 30^\circ = 4a$$

$$a = (-)11.06 \dots$$

$$v^2 = u^2 + 2as \Rightarrow 0^2 = 16^2 - 2 \times 11.06 \dots \times s$$

$$s = \frac{16^2}{2 \times 11.06 \dots} = 11.6 \text{ (m)}$$

$$12$$

B1

M1 A1

M1

A1

(5)

Q6.

(a)

$$s = ut + \frac{1}{2}at^2 \Rightarrow 2.7 = \frac{1}{2}a \times 9$$

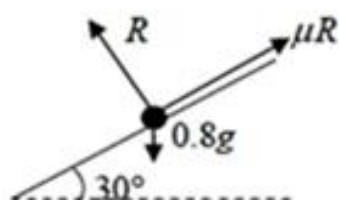
$$a = 0.6 \text{ (m s}^{-2}\text{)}$$

M1 A1

A1

(3)

(b)



$$R = 0.8g \cos 30^\circ (\approx 6.79)$$

Use of $F = \mu R$

$$0.8g \sin 30^\circ - \mu R = 0.8 \times a$$

$$(0.8g \sin 30^\circ - \mu 0.8g \cos 30^\circ = 0.8 \times 0.6)$$

$$\mu \approx 0.51$$

accept 0.507

B1

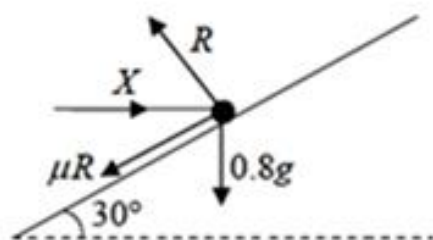
B1

M1 A1

A1

(5)

(c)



$$\uparrow R \cos 30^\circ = \mu R \cos 60^\circ + 0.8g$$

$$(R \approx 12.8)$$

$$\rightarrow X = R \sin 30^\circ + \mu R \sin 60^\circ$$

Solving for X ,

$$X \approx 12$$

accept 12.0

M1 A2 (1,0)

M1 A1

DM1 A1

(7)