2017 NYGH S3 Advanced Physics MYE
Answers to Section A

Note: Advanced physics questions (MCQ): 6, 9, 15, 19 and 20

1	D	**6**	**D**	11	D	16	B
2	A	7	C	12	B	17	A
3	B	8	C	13	C	18	C
4	D	**9**	**B**	14	C	**19**	**A**
5	C	10	B	**15**	**B**	**20**	**C**

6. With air resistance, the net force & hence the acceleration of the object decreases to zero. The velocity would increase to a maximum constant value (terminal velocity).

9. Let C be at the surface of the viscous medium.
A to C: $u = 0$, $s = 2.0$ m, $a = 10$ m s^{-2}, t_1? $s = ½ at^2$ ➔ $t_1 = 0.632$ s
$v = u + at$ ➔ $v = 6.32$ m s^{-1}
C to B: constant $v = 6.32$ m s^{-1}, $s = 1.8$ m, t_2? $s = vt$ ➔ $t_2 = 0.285$ s

15. Consider both blocks moving together (single freebody).
$F_{net} = ma$
➔ $54 – 6 = (6.0 + 2.0)$ a ➔ $a = 6.0$ m s^{-2}
Consider 6.0 kg mass alone.
$F_{net} = ma = 6.0$ a

19. $r = 1.50 \times 10^{11}$ m
T = 1 year = 365 days, convert to seconds
angular velocity $\omega = 2\pi/T = 2\pi / (365 \times 24 \times 60 \times 60)$
Speed $v = r\omega$

20. $F = mg = \dfrac{GMm}{r^2}$

Gravitational field strength, $g = \dfrac{GM}{r^2}$ at surface of a planet of mass M and radius r.

Earth: g_1, M_1 and r_1
Another planet: g_2, M_2 and r_2

Using EPR approach:

- Equation: $g = \dfrac{GM}{r^2}$
- Proportional: $g \approx \dfrac{M}{r^2}$
- Ratio: $\dfrac{g_2}{g_1} = \dfrac{M_2}{M_1} \times \left(\dfrac{r_1}{r_2}\right)^2 = \dfrac{2}{1} \times \left(\dfrac{1}{2}\right)^2 = ½$

$g_2 = 2g_1$

Answers to Section B (same as 2017 Sec 3 Physics MYE)

Answers to Section C

28	**(a)(i)**	r = radius + height = $6.4 \times 10^6 + 600 \times 10^3$ m r = 7.0×10^6 m g = F/m = GM/r^2 = 8.2 m s^{-2}
	(a)(ii)	a = v^2/r where a = g = 8.2 m s^{-2} ➔ $v = \sqrt{(ar)}$ v = 7576 ≈ 7600 m s^{-1}
	(a)(iii)	F = mg = 11000 x 8.2 = 90200 ≈ 90 000 N
	(a)(iv)	*Any relevant point below:* At this orbit, it is further up in the Earth's atmosphere / air is very thin / the telescope is not affected by atmospheric pollution / images obtained would be very clear *Note:* *The difference in height has little effect on distance/field of view of outer space, since this difference in height << distance to outer space.* *If the telescope is located on Earth's surface, it is impossible to 'crash'!*
	(b)(i)	a = g = 10 m s^{-2} and r = 40 m a = $v^2/r = r\omega^2 = r\,(2\pi/T)^2$ ➔ $\sqrt{(g/r)} = 2\pi/T$ ➔ $T = 2\pi\sqrt{(r/g)}$ T = 2π = 12.57 ≈ 13 s
	(b)(ii)	*Any relevant point below:* He may have a sense of confusion as to what is "up" or "down" / he has to walk along a "curved"/ "circular" floor, or floor is not flat / he may feel giddy or nauseous due to high speed of rotation / he is unable to to experience day and night (view through window) / he experiences different values of g at difference distances (r from centre)