DUNMAN HIGH SCHOOL
2022 H2 PHYSICS (YEAR 5)

2022 DHS H2 Physics Promo Exam Mark scheme

Section A Multiple Choice Questions

1	2	3	4	5	6	7	8	9	10
D	A	D	C	B	C	A	C	C	D

11	12	13	14	15
D	B	B	A	B

1 Answer: D

A is precise and accurate,
B is not precise and accurate,
C is not precise and not accurate.

2 Answer: A

From first principles,

$f_{\text{average}} = (\frac{1}{50} + \frac{1}{200})^{-1} = 40 \text{ mm}$

$f_{\text{max}} = (\frac{1}{47} + \frac{1}{195})^{-1} = 37.9 \text{ mm}$

$\Delta f = f_{\text{max}} - f_{\text{average}} = 40.0 - 37.9 = 2.1 \text{ mm}$

3 Answer: D

Using '$s = ut + \frac{1}{2}at^2$',

$10.0 = 0 + \frac{1}{2}(9.81)t^2$

$t = 1.43 \text{ s}$

Using '$v^2 = u^2 + 2as$',

$v^2 = 0 + 2(9.81)(10.0)$

$v = 14.0 \text{ m s}^{-1}$

4 Answer: C

acceleration of (X+Y), $a = \dfrac{F}{m_X + m_Y}$, $(m_X > m_Y)$

a is also the acceleration of X (or Y) (so A is incorrect)

isolate Y: $F_{X \text{ on } Y} = m_Y a = \left(\dfrac{m_Y}{m_X + m_Y} \right) F$

$\neq F$ (so B is incorrect)

$< F$ (so C is correct)

$= -F_{Y \text{ on } X}$ (so D is incorrect)

5 Answer: B

assume X moves to the left with speed v' after collision;

elastic head-on collision $\Rightarrow$ relative speed of approach $=$ relative speed of seperation

$\Rightarrow v - 0 = 0.67v + v'$

$\Rightarrow v' = v - 0.67v = 0.33v$

$\Rightarrow$ X moves to the left with speed 0.33 v

6 Answer: C

The work done on the sample is the area under the graph. At x = 10.0 cm,

$$W = \frac{1}{2}(60)(0.06) + \frac{1}{2}(60 + 70)(0.10 - 0.06)$$
$$= 4.4 \text{ J}$$

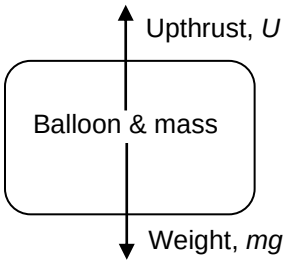
7 Answer: A

$U = mg$

U = (80.0 x 9.81)

$V \rho_{air} g$ = 80.0 x 9.81,

so V= 65 m^3



8 Answer: C

D is incorrect as the velocity changes throughout the motion, hence momentum changes.
C is correct as the kinetic energy is converted to gravitational potential energy on the upward journey and vice versa on the downward journey.
B is incorrect as the kinetic energy at the highest point is 0.
A is incorrect as the potential energy increases uniformly with height but not time.

9 Answer: C

let the tensions in the rightmost, centre, and leftmost rod be T_1, T_2 and T_3 respectively,

for the rightmost mass: $T_1 = (1.0\text{ kg})(4.0\text{ m})\omega^2 = 4.0\omega^2$
for the centre mass: $T_2 - T_1 = (1.0\text{ kg})(3.0\text{ m})\omega^2 = 3.0\omega^2$
for the leftmost mass: $T_3 - T_2 = (1.0\text{ kg})(2.0\text{ m})\omega^2 = 2.0\omega^2$

combining the above, we have

$$\begin{aligned} T_3 = T_2 + 2.0\omega^2 &= \left(T_1 + 3.0\omega^2\right) + 2.0\omega^2 \\ &= \left(4.0\omega^2 + 3.0\omega^2\right) + 2.0\omega^2 \\ &= 9.0\omega^2 = 9.0\left(2.0\right)^2 \\ &= 36\text{ N, which is the horizontal force exerted by the rod on the pivot} \end{aligned}$$

10 Answer: D

For a satellite in orbit, gravitational force provides centripetal force

$$G\frac{Mm}{r^2} = mr\omega^2 = mr(\frac{2\pi}{T})^2$$

$$T^2 = \frac{4\pi^2}{GM}r^3 \Rightarrow T^2 \propto r^3$$

$$(\frac{T_{\text{Europa}}}{T_{\text{Io}}})^2 = (\frac{r_{\text{Europa}}}{r_{\text{Io}}})^3$$

$$(\frac{T_{\text{Europa}}}{1.77})^2 = (\frac{6.71}{4.22})^3$$

$$T_{\text{Europa}} = 3.5\text{ days}$$

11 Answer: D

Equation of line: $T\text{ / K} = T\text{ / °C} + 273.15$
Comparing to the form Y = m X + C,
gradient = 1, and vertical intercept = 273.15

12 Answer: B

Total number of molecules in bulb X and Y is conserved,

$$n_{X,i} + n_{Y,i} = n_{X,f} + n_{y,f}$$

$$n = \frac{pV}{RT}$$

$$\frac{p_i V_X}{RT_1} + \frac{p_i V_Y}{RT_1} = \frac{p_f V_X}{RT_1} + \frac{p_f V_Y}{RT_2}$$

$$\frac{p_i}{T_1}(V_X + V_Y) = p_f\left(\frac{V_X}{T_1} + \frac{V_Y}{T_2}\right)$$

$$\frac{1.0\times10^5(0.600+0.300)}{25+273.15} = p_f\left(\frac{0.300}{25+273.15} + \frac{0.600}{150+273.15}\right)$$

$$p_f = 1.245\times10^5 \text{ Pa}$$

$$= 1.25\times10^5 \text{ Pa}$$

13 Answer: B

$$Pt = ml_v + mc\Delta\theta$$

$$l_v = \frac{Pt}{m} - c\Delta\theta$$

$$= \frac{2000(270)}{0.300} - 1800(85-27)$$

$$= 1695600 \text{ J}$$

$$= 1700 \text{ kJ kg}^{-1} \text{ (to 2sf)}$$

14 Answer: A

velocity is given by the gradient of displacement-time graph
at point P it is the greatest (so maximum velocity) and negative (so moving upwards)

15 Answer: B

	displacement x	kinetic energy E_K	restoring force F
A	0 ✗	0	maximum
B	0	maximum	0
C	maximum	0	0 ✗
D	maximum	maximum ✗	maximum

$F = -kx, \quad E_K = \frac{1}{2}m\omega^2\left(x_0^2 - x^2\right)$