P2 Work Energy Power EXTENDED Questions - KEY

P2.11

(a)	volume = 1728 (cm^3) / use of 12^3 ; mass = 20.5 / 10 **OR** 2.05 kg ; 2.05 × 1000 **OR** 2050 g ; (density =) 1.2 (g / cm^3) ;	4
(b)	evaporation can occur at any temperature / boiling only happens at the boiling point ; evaporation happens at the surface / boiling occurs throughout the liquid ; during boiling all / most molecules have enough energy to leave / evaporation lets only the molecules with most kinetic energy out ; evaporation can occur using the internal energy of the system / boiling a(n external) source of heat ; evaporation produces cooling / boiling does not produce cooling ; evaporation is a slow process / boiling is a rapid process ; **max 2**	2

P2.12

Question	Answer	Marks
2(a)	(volume =) $\pi r^2 h$ or $\pi(0.035^2) \times 0.12$ **or** 4.62×10^{-4} (m^3)	C1
	$\rho = m / V$ in any form OR $(m =) \rho V$	C1
	(mass = $900 \times 4.62 \times 10^{-4}$ =) 0.41 (kg)	A1
	0.66 kg **or** 250 g or 0.25 kg correctly added to previous result	B1
2(b)(i)	manometer	B1
2(b)(ii)	$P = \rho g h$ in any form or $(\rho =) P / gh$	C1
	(ρ = 400 / (10 × 0.05) =) 800 kg/m^3	A1
2(b)(iii)	liquid on left goes further up tube	B1
	pressure of gas greater than air pressure + pressure from liquid column	B1

P2.13

over

4(a)	mass = 0.25 (kg) OR $\rho = m / V$	**C1**
	volume = ($\pi \times 0.03^2 \times 0.1 = 2.8 \times 10^{-4}$ (m^3))	**C1**
	density = ($0.25 / 2.8 \times 10^{-4}$) = 890 kg / m^3	**A1**
	OR	
	mass = 250 (g) OR $\rho = m / V$	
	volume = ($\pi \times 3^2 \times 10$ =) 280 cm^3	
	density = (250 / 280 =) 0.89 g / cm^3	
	OR	
	$\rho = F / A = h\rho g$	
	$\rho = F / Ahg$ OR $2.5 / \pi \times 0.03^2 \times 0.1 \times 10$	
	= 890 kg / m^3	
4(b)(i)	manometer	**B1**
4(b)(ii)	(P =) hdg OR $0.02 \times 800 \times 10$	**C1**
	160 Pa	**A1**
4(b)(iii)	Value of h stays the same	**M1**
	Difference in height not dependent on cross-sectional area of tube OR Pressure of a liquid column depends only on values of h, d and g	**A1**

P2.14

4(a)	mass = 0.25 (kg) OR $\rho = m / V$	**C1**
	volume = ($\pi \times 0.03^2 \times 0.1 = 2.8 \times 10^{-4}$ (m^3))	**C1**
	density = ($0.25 / 2.8 \times 10^{-4}$) = 890 kg / m^3	**A1**
	OR	
	mass = 250 (g) OR $\rho = m / V$	
	volume = ($\pi \times 3^2 \times 10$ =) 280 cm^3	
	density = (250 / 280 =) 0.89 g / cm^3	
	OR	
	$\rho = F / A = h\rho g$	
	$\rho = F / Ahg$ OR $2.5 / \pi \times 0.03^2 \times 0.1 \times 10$	
	= 890 kg / m^3	
4(b)(i)	manometer	**B1**
4(b)(ii)	(P =) hdg OR $0.02 \times 800 \times 10$	**C1**
	160 Pa	**A1**
4(b)(iii)	Value of h stays the same	**M1**
	Difference in height not dependent on cross-sectional area of tube OR Pressure of a liquid column depends only on values of h, d and g	**A1**

P2.15

3(a)	$mv - mu$ or $mu - mv$ in any form	**B1**
3(b)(i)	(impulse =) Ft in any form	**C1**
	(impulse =) 2.4 N s	**A1**
3(b)(ii)	$Ft = mv - mu$ in any form OR $(v - u =) Ft / m$	**C1**
	43 m / s	**A1**
3(b)(iii)	1 kinetic energy (of racquet) to elastic / strain energy (in ball or strings)	**B1**
	2. elastic / strain energy (in ball or strings) to kinetic energy (of ball)	**B1**

P2.16

2(a)	1st box: force	**B1**
	2nd box: impulse	**B1**
2(b)(i)	**1** $(p =) mv$ **or** 0.046×65	**C1**
	3.0 kg m/s **or** 3.0 N s	**A1**
	2 $(F =) m(v - u) / t$ **or** $3.0 / 0.00050$ **or** $a = (v - u) / t$ **and** $F = ma$ **or** $0.046 \times 65 / 0.00050$ **or** $0.046 \times 130\,000$	**C1**
	6000 N **or** 6000 N	**A1**
2(b)(ii)	elastic (energy) **or** strain (energy)	**B1**

P2.17

4(a)(i)	area under graph / working / 75 + 150 + 450 ; 675 (m) ;	**2**
4(a)(ii)	working or 3 / 50 ; 0.06 (m / s^2) ;	**2**
4(a)(iii)	max speed = 3 m / s ; KE = ½ mv^2 / ½ × 400 × 9 ; 1800(J) ;	**3**
4(b)	pressure = force / area / 4000 / 4 × 0.035 ; 28 600 (N / m^2) ;	**2**
4(c)(i)	allow between 20 000 Hz and 35 000Hz ;	**1**
4(c)(ii)	compressions are regions where the particles in air are close together / rarefactions are regions where the particles in air are spread out ; compressions are regions with air at higher pressure than normal / rarefactions are regions with air at lower pressure than normal ;	**2**
4(d)	radio waves or microwaves ;	**1**

P2.18

4(a)(i)	area under graph / working / 75 + 150 + 450 ; 675 (m) ;	2
4(a)(ii)	working or 3 / 50 ; 0.06 (m / s^2) ;	2
4(a)(iii)	max speed = 3 m / s ; KE = ½ mv^2 / ½ × 400 × 9 ; 1800(J) ;	3
4(b)	pressure = force / area / 4000 / 4 × 0.035 ; 28 600 (N / m^2) ;	2
4(c)(i)	allow between 20 000 Hz and 35 000Hz ;	1
4(c)(ii)	compressions are regions where the particles in air are close together / rarefactions are regions where the particles in air are spread out ; compressions are regions with air at higher pressure than normal / rarefactions are regions with air at lower pressure than normal ;	2
4(d)	radio waves or microwaves ;	1

P2.19

9(a)(i)	31000 (N) ;	1
9(a)(ii)	WD = F × D or 31000 × 50 ; = 1550 000 (J) ;	2
9(a)(iii)	1550 000 (J) ;	1
9(a)(iv)	pressure = force / area or 31000 / 2400 ; 13 (N / cm^2) ;	2
9(b)(i)	value below 20 Hz ; 20 Hz is the minimum frequency humans can hear ;	2
9(b)(ii)	compression region of high pressure / rarefaction region of low pressure ; compression particles closer together / rarefaction particles further apart ;	2
9(b)(iii)	distance between two compressions or rarefactions ;	1

P2.20

over

(a) (i) *advantage* – uses renewable / sustainable (energy) resource / saves fossil fuels / free energy source / no pollution, CO_2, waste etc.
and
disadvantage – visual pollution / noise / only works when it's windy / high capital investment costs / damage to wildlife / needs lots of land ; [1]

(ii) (efficiency) = $\frac{\text{power out}}{\text{power in}}$;

$= \frac{900}{1500} \times 100 = 60\ (\%)$; [2]

(b) (i) (nuclear to) thermal / heat <u>energy</u> ;
heat water to produce steam ;
(drives) turbine and generator ;
reference to kinetic energy ; [max 3]

(ii) (nuclear) fusion ; [1]

(c) (current) = $\frac{\text{power}}{\text{voltage}}$;

$= \frac{33\,000\,000}{132\,000} = 250\ (\text{A})$; [2]