Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic: Thermal Physics

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Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

(a) (i) (use of $\Delta Q = mc\Delta\theta$ gives) $Q = 30 \times 1000 \times 15$ **(1)**
$= 4.5 \times 10^5$ J **(1)**

(ii) $P \times t = 4.5 \times 10^5$ **(1)**

$t = \frac{4.5 \times 10^5}{2000} = 225$ s **(1)**

(allow C.E. for value of Q from (i)

4

(b) heat is lost to surroundings or other objects in room or to heater itself **(1)**
more (thermal) energy required from heater **(1)**

[or because convection currents cause uneven heating]
[or rate of heat transfer decreases as temperature increases]

2

[6]

Q2.

(a) (i) mass each sec [=(vol / sec) × density] = $5.2 \times 10^{-5} \times 1000$ **(1)**
$= 0.052$ kg (s^{-1}) **(1)**

(ii) power (= energy supplied per sec = $mc\Delta\theta$) $= 0.052 \times 4200 \times (42 - 10)$ **(1)**
$= 7.0 \times 10^3$W **(1)** (6.99×10^3W)

(allow C.E. for value of mass each sec from (i)

4

(b) $h = \frac{1}{2}gt^2$ gives the time to reach the floor **(1)**

$t \left(= \left(\frac{2h}{g}\right)^{1/2} \right) = \left(\frac{2 \times 2.0}{9.8}\right)^{1/2}$
$= 0.64$s **(1)** (0.639 s)

range = (horizontal) speed of projection × time = $2.5 \times 0.64 = 1.6$ m **(1)**
(allow C.E. for value of t)

3

[7]

Q3.

(a) (i) (use of $d \sin\theta = n\lambda$ gives) $2\lambda = d \sin 35.8°$ **(1)**

$d = \frac{1}{600 \times 10^3}$ (m) **(1)** (= 1.67×10^{-6})

$\lambda \left(= \frac{\sin 35.8}{2 \times 600 \times 10^3}\right) = 4.9 \times 10^{-7}$m **(1)** ($4.87 \times 10^{-7}$m)

(ii) $f \left(= \frac{c}{\lambda} = \frac{3.0 \times 10^8}{4.87 \times 10^{-7}} = 6.1(6) \times 10^{14}(\text{Hz})\right)$

E (= hf = $6.63 \times 10^{-34} \times 6.16 \times 10^{14}$) = 4.1×10^{-19}(J) **(1)** ($4.0(8) \times 10^{-19}$(J))

$E \left(= \frac{4.08 \times 10^{-19}}{1.6 \times 10^{-19}}\right)$ = 2.6 (eV) **(1)** (2.55 (eV)

(for E = 4.1×10^{-19}(J) = 2.56 (eV)

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(b) (i) from C to A **(1)**

(ii) (use of $E_k = 3 / 2kT$ gives) $E_k = 1.5 \times 1.38 \times 10^{-23} \times 5000 = 1.0(4) \times 10^{-19}$J
[or = 0.64(7) eV] **(1)**

(iii) some gas atoms have enough kinetic energy to cause excitation by collision **(1)**
photons (of certain energies) only released when de-excitation or electron transfer to a lower level, occurs **(1)**
gas atoms have a spread of speeds / kinetic energies **(1)**
mean E_k (of gas atoms) proportional to T **(1)**
excitation can occur to level C **(1)**
de-excitation from C to B produces 2.6 eV photon / light of this wavelength **(1)**

(max 6)
QWC 1

[11]