Practice Question Set For A-Level
Subject : Physics
Paper-3 Topic: Section B (Section 11_ Engineering Physics)

Name of the Student:____
Max. Marks : 18 Marks **Time : 18 Minutes**

Mark Schemes

Q1.

(a) (angular speed =) 22 000 (rev min^{-1}) $\times \frac{2\pi}{60}$ **(1)**
(= 2300 rad s^{-1})

energy stored (= $\frac{1}{2}I\omega^2$) = $\frac{1}{2} \times 0.60 \times 2300^2$ **(1)**
(= 1.6 MJ)

2

(b) (i) $t\left(=\frac{E}{P}\right) = \frac{1.6 \times 10^6}{8.7} = 1.84 \times 10^5\ s$ **(1)**

(51 hours)

(ii) torque = $\frac{power}{average\ speed} = \frac{8.7}{(2300/2)} = 7.5(6) \times 10^{-3}$ Nm **(1)**

[or $T = I\alpha = \frac{0.6 \times 2300}{1.84 \times 10^5} = 7.5$ N m] **(1)**

2

(c) in B more of the mass is at greater **radius** than in A **(1)**
so I greater and so energy stored greater **(1)**

2

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Q2.

(a) (refrigerator operates between a cold space and a hot space)

Q_{out} is the energy removed from the fridge contents (or from the cold space) **(1)**

Q_{in} is the energy given to the surroundings (or to outside the fridge/hot space) **(1)**

2

(b) (i) power for cooling ice = 5.5 × (420 × 10^3)/3600 = 642 W **(1)**

P_{in} = 642/4.5 = 142 W **(1)**

or energy taken from ice in 1 hour = 5.5 × 420 × 10^3 = 2310 kJ

W_{in} = 2310/4.5 = 513 kJ **(1)**

$P_{in} = \dfrac{513 \times 10^3}{3600}$ = 142 W **(1)**

2

(ii) Q per s = 142 + 642

= 784 W (give CE) **(1)**

or $Q_{in} = Q_{out} + W_{in}$ = 513 kJ + 2310 kJ = 2820 kJ

Q_{in} per s = $\dfrac{2820 \times 10^3}{3600}$ = 784 W **(1)**

1

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Q3.

(a) (i) work done (per kg) = area enclosed (by loop) **(1)**
suitable method of finding area (e.g. counting squares) **(1)**
correct scaling factor **(1)**
(to give answer ≈ 500 kJ)

(ii) P (= work done per kg x fuel flow rate)
= 500 (kJ) × 9.9 (kgs^{1}) = 5000kW **(1)**
(4950kW)

(iii) (output power = indicated power – friction power)
P_{out} = 4950 – 430 = 45(20) kW **(1)**
(use of P = 5000 gives P_{out} = 45(70)kW)
(allow C.E. for values of P in (ii))

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(b) (i) P_{in} (= fuel flow rate × calorific value)
= 0.30 × 44 × 10^6 = 13(.2) × 10^6W **(1)**

efficiency = $\dfrac{4520 \times 10^3}{13.2 \times 10^6} = 34\%$ **(1)**
(allow C.E. for value of P_{out} in (a) (iii) and P_{in} in (b) (i))

2

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