2000 Credit Paper

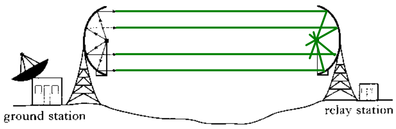
1. a. Stays above the same point on the Earth’s surface OR Height of 36 000 km above Earth’s surface round equator OR Period of 24 hours Any 2 x [1]

b. $\lambda = \frac{v}{f} = \frac{3x10^8}{6x10^9} = 0.05$ m (½,½,1)

(1 for correct speed)

c. 4 GHz (not 6 because it is used for the received signal (1)

d.



[2]

2. a. $t = \frac{d}{v} = \frac{2}{340} = 0.005\ 88$ s (½,½,1)

$t = \frac{d}{v} = \frac{19}{340} = 0.055\ 8$ s (1)

Time difference in hearing is 0.0499 s

b. i. Time difference in result is 0.03 s, so lane 8 actually took less time to swim so should be given the race (1,1)

ii. Loudspeakers should be put behind each swimmer so they all hear the horn at the same time (1)

3. a. i. 175 Ω (from graph) (1)

ii. $I = \frac{V}{R} = \frac{230}{175} = 1.31$ A (½,½,1)

iii. $P = I^2 R = 1.31^2 x175 = 302$ W (½,½,1)

So the 300 W is fitted (1)

b. The resistance is lowest in the first 0.5 seconds, so the current will be largest causing the the greatest chance of blowing the filament. (1,1)

4. a.i. It is double insulated, so does not require an earth wire [1]

ii. Blue and brown (1,1)

iii. 6.52 A needed so fit a 13 A [1]

b. i. $I = \frac{V}{R} = \frac{230}{5000} = 0.046$ A [½,½,1]

ii. The current is too small to blow the fuse so the supply would not be cut off and the person would be electrocuted (1,1)

iii. To cut off the supply if the current becomes too large [1]

iv. The current would now be larger because the resistance of the dummy would be less. (1,1)

5 a.i. Beta particles are less penetrating than gamma rays [1]

ii. Radiation kills living cells (can cause genetic damage) [1]

b. i A – The radiation causes fogging on the photographic film [1]

B – The more radiation that is received the darker the film will [1]

ii. The additional film badge will give a more accurate measure of the radiation received by the hands, as not all of the radiation will reach the badge on the clothing . (1,1)

iii. Do not eat in the lab, point away from the body, use tongs where possible, store in lead lined boxes, etc. [1]

6. a. i. P supplies light to send down into the patients body [1]

Q takes light back up to the doctor’s eye [1]

ii. Cold light means that there is no Infra Red component that could cause damage to the patients internal organs [1]

iii. Discharge lamp, less heat will be produced than by filament lamp (1,1)

b. Heat energy → electrical energy [1]

c. i. 0.03 mV (from graph) (1)

ii. Any value greater than 0.03 mV (1)

7. a. Solar cell $\rightarrow$ amplifier $\rightarrow$ voltmeter [1]

b. i. voltage gain = $\frac{V_{out}}{V_{in}}$

$= \frac{120}{0.3} = 400$ [½,½,1]

ii. $V_1 = \frac{R_1}{R_{total}} x V_S = \frac{180}{400} x 0.0004$

(1 convert 0.4 mV into V)

= 0.000 18 V = 0.18 mV (½,½,1)

8.a.i. NOT gate [1]

ii.

	No can in light beam	Can in light beam
Light level at LDR	high	low
Resistance of LDR	low	high
V_{in}	high	low
V_{out}	low	high

(8 x ½)

b. i. binary [1]

decimal [1]

ii. A – AND gate (1)

B

Input 1	Input 2	Output
0	0	0
0	1	0
1	0	0
1	1	1

[4 x ½]

iii. Capacitor (1)

9. a. $v = \frac{d}{t} = \frac{90000}{3600} = 25$ m/s [½,½,1]

b. $v = \frac{d}{t} = \frac{14}{0.4} = 35$ m/s (½,½,1)

This is 10 m/s over the speed limit (1)

c. i. 5 seconds (from graph) (1)

ii. $a = \frac{v-u}{t} = \frac{50-0}{10} = 5$ m/s^2 [½,½,1]

iii. dist = area under speed/time graph

= lb = 40x50 = 2 000 m [½,½,1]

iv. dist = area under speed/time graph

= ½bh = ½x20x50 = 500 (1)

dist = area under speed/time graph

= ½bh = ½x24x40 = 480 (1)

dist between them = 500 - 480

= 20 m (1)

10. a.i. $P = \frac{E}{t} = \frac{8.64x10^7}{6x3600} = \frac{8.64x10^7}{21600}$

= 4 000 W = 4 kW [½,½,1]

ii. $\Delta T = \frac{E_H}{cm} = \frac{8.64x10^7}{2625x144} = \frac{8.64x10^7}{378000}$

= 228.6 ^{o}C (1½,½,1)

iii. Actual temperature will be less because heat energy will be lost to the surroundings during the night (1)

b. So that the heat can be released slowly or so that people do not come into direct contact with the blocks (1)

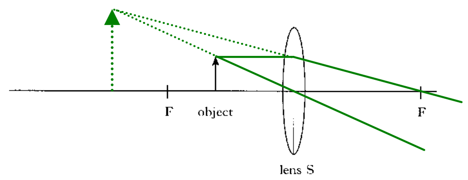
c. Convection or radiation (1)

11. a. To collect as much light as possible so that very distant objects may be observed [1]

b. i. $P = \frac{1}{f} = \frac{1}{0.02} = 50$ D [½,½,1]

ii. Q (it has the shortest focal length) (1)

c.



[3, 1 for each line, 1 for image]

12. a. Inertia [1]

b. i. 8.8 N/kg (from graph) (1)

ii. w = mg = 20 000 x 8.8

= 176 000 N [½,½,1]

iii. weight decreases [1]

mass stays the same [1]

c. It falls towards the Earth but because of its forward speed it follows the curve of the Earth's surface following a circular path. [1,1]

Total marks	KU	[50]
	PS	(50)

	KU	PS
Grade 1 -	≥ 35	≥ 35
Grade 2 -	≥ 25	≥ 25
Grade 7 -	≤ 24	≥ 24

(N.B. half marks are rounded up)

2001 Credit Paper

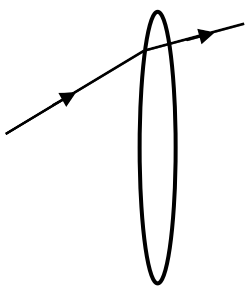
1. a. 1 500 m/s (1)
   ii. Answer to include a halving (of either distance or time after/before calculation) [1]
   d = vt = 1 500 x 0.1 = 150 m [½,½,1]
   iii. $\lambda = \frac{v}{f} = \frac{1500}{30x10^3} = 0.05$ m [½,½,1]
   b. Diagram should have same frequency/wavelength, smaller amplitude, inversion not required (1, 1)
   c. The time interval will be the same, the speed of the wave does not depend on its frequency. (1, 1)

2. a. $I = \frac{P}{V} = \frac{75x10^{-3}}{3}$ = 25 mA [½,½,1]
   b. 100 mA (1)

3. a. Ammeter is in series and reads 100 mA, voltmeter is in parallel and reads 2.5 V (1, 1)
   b. i. $V_R = V_S - V_L$ = 12 – 2.5 = 9.5 V (1)
   ii. $R = \frac{V}{I} = \frac{9.5}{0.1}$ = 95 Ω (½,½,1)

4. a. 1 – reverse magnetic field [1]
   2 – reverse direction of current [1]
   b. i. LHS – field coil
   RHS - commutator [1, 1]
   ii. A – gives smoother rotation, greater turning force
   B – lighter, stronger magnetic field, less fragile [1, 1]

5 a.i. Long sight means that you can see clearly distant objects but cannot see clearly close up objects. [1]
   ii. $f = \frac{1}{P} = \frac{1}{2.5}$ = 0.4 m [½,½,1]
   b.



(1)

6. a. Time taken for the activity of a source to drop to half of its original value. [1, 1]
   b. i. becquerel [1]
   ii. Every time a radioactive particle hits the counter it causes a small current to be produced which is counted by a scalar timer. [1, 1]
   iii. killing germs, killing cancerous cells, fogging photographic film etc. [1]

7. a. i. $\frac{R_T}{R_R} = \frac{V_T}{V_R}$ so $\frac{R_T}{4300} = \frac{0.7}{4.3}$
   $R_T = \frac{0.7x4300}{4.3}$ = 700 Ω (½,½,1)
   ii. A – 80 °C (1)
   B – The temperature will be less, because the resistance of the thermistor will have to be greater to get to the 0.7 V switch on voltage. (1, 1)
   b. i. transistor [1]
   ii. As the temperature falls the resistance of the thermistor increases.(½) This means the voltage across the thermistor increases.(½) If gets to more that 0.7 V(½) the transistor switches on. (½) Current will flow through the relay coil closing the relay switch. (½) This completes the circuit an switches on the heater. (½).

8.a.i. Gain = $\frac{P_{out}}{P_{in}} = \frac{64}{16x10^{-3}}$ = 4 000 [½,½,1]
   ii. V^2 = PR = 64 x 9 = 576
   V = $\sqrt{576}$ = 18 V (½,½,1)
   b. $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{9} + \frac{1}{9} = \frac{2}{9}$
   $R_P = \frac{9}{2}$ = 4.5 Ω [½,½,1]
   c. 256 Hz (same as input) [1]

9. a.i. $v = \frac{d}{t} = \frac{320}{21}$ = 15.2 m/s [½,½,1, 1 s.f.]
   ii. The cyclist will speed up and slow down during the journey, the inst speed shows only the speed at that time. (1, 1)
   b i. $E_K = ½ mv^2 = ½ x 80 x 14.4^2$ = 8 410 J (½,½,1)
   ii. $F = \frac{W}{d} = \frac{8410}{50}$ = 168 N [½,½,1]

10. a.i. a = $\frac{v-u}{t} = \frac{15-0}{10}$ = 1.5 m/s^2 [½,½,1]
ii. F = ma = 268 000 x 1.5
= 402 000 N [½,½,1]
iii. Unbalanced force is greater during 10 – 40 s, the graph is steeper there. (1, 1)
iv. length of runway = distance travelled
= area under graph [½]
= ½ bh + lb + ½ bh [½]
= ½x10x15 + 30x15 + ½x30x65 [½]
= 75 + 450 + 975 [½]
= 1 500 m [1]
b. i. The engine thrust is greater than the air friction force. (1)
ii. The lift is equal to the weight (1)

11. a.i. Fossil fuel - Non radioactive waste. (1)
Nuclear - Only 5 kg of waste OR more energy per kg. (1)
ii. Must be near a source of water, as both need 550 kg per second for cooling. (1, 1)
b. i. nuclear $\rightarrow$ heat [1]
ii. kinetic $\rightarrow$ electrical [1]
c. i. neutron, neutrons, heat [1, 1, 1]
ii. The two produced neutrons can hit other nuclei causing fission. This in turn produces other neutrons and so on. [1, 1, 1]

12. a. E_H = mL = 12 x 10^{-3} x 3.34 x 10^5
= 4 008 J (½,½,1, 1 for correct L)
b. From the water. (1)
c. i. E_H = cmΔT = 4180 x 0.2 (18-15)
= 2 508 J (½,½,1, 1 for correct c)
ii. 4.8 ^{o}C, if all energy comes from water not surroundings. [1, 1]

13. a. Our atmosphere absorbs X-rays (1)
b. gamma, X-ray, visible, radio (4 x 1)
c. There are many different signals coming from space so many different type of detector are needed. [1, 1]
d. Fire Q for a set length of time (causing an acceleration) (½) switch it off (travels at constant speed) (½) fire P for the same length of time as Q (causing a deceleration) (½) it will then be stopped ahead of the shuttle (½)

Total marks	KU	[50]
	PS	(50)

	KU	PS
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