PHYSICS

Paper 2 Theory

MARK SCHEME

Maximum Mark: 75

Published

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Section A

1 (a) \((v = u + at)\) at or \(3.4 \times 5.0\)
\[17 \text{ m/s}\] C1

(b) (i) 0 or zero or no resultant force B1

(ii) straight line of positive gradient from (0, 0)
horizontal line at \(v > 0\) and after initial acceleration B1
straight line from (0, 0) to (5.0, 17) and B1
straight line from (5.0, 17) to at least (15.0, 17) B1

(iii) calculate the area under the graph or area of trapezium B1 [7]

2 (a) (i) \((\text{GPE} = ) \quad mgh \quad \text{or} \quad 45 \times 10 \times 1.8\)
\[810 \text{ J} \quad \text{B1}\]

(ii) kinetic either order \(\quad \text{thermal/} \text{internal/} \text{heat/sound} \quad \text{either order}\) B1

(b) (i) upwards / centripetal / towards centre (of circle) B1

(ii) it / weight less (than normal contact force) or upward force greater B1 [6]

3 (a) (i) 20 N B1

(ii) 1. \((\Gamma = ) Fd \quad \text{or} \quad 20 \times 0.35 \quad \text{or} \quad 20 \times 0.70 \quad \text{or} \quad 14\)
\[7.0 \text{ N m} \quad \text{A1}\]

2. friction (at hinge/seal) or air resistance or to cause an initial acceleration B1

(b) (for other directions) perpendicular distance is less B1 [5]

4 (a) temperature at which liquid/water turns to gas/vapour/steam B1

(b) (i) \((T = 24 \degree \text{C}) \quad \text{or} \quad 100 - 24 \quad \text{or} \quad 76\)
\((\Delta Q = ) mc\Delta T \quad \text{or} \quad 1.5 \times 4200 \times 76\)
\[4.8 \times 10^5 \text{ J}\] C1

(ii) heat is lost (to the surroundings) or evaporation at higher temperatures heat is lost at greater rate B1

(c) (i) stays at 100 \degree \text{C}/constant B1

(ii) molecules separate / are pulled apart / are far apart / break bonds / overcome forces of attraction B1
work done separating the molecules or molecules gain PE B1 [9]
5 (a) atoms / molecules / particles move / collide
   atoms / molecules / particles collide with walls / piston
   collisions cause forces
   B1

   (b) \( \rho_2 = \frac{\rho_1 V_1}{V_2} \text{ or } 1.1 \times 10^5 \times 40 / 110 \)
   \( 4.0 \times 10^4 \text{ Pa} \)
   C1

6 (a) any three of:
   filament is heated / hot or thermionic (emission) mentioned
   electrons negative or electrons escape / are emitted
   electrons attracted / accelerated by a positive charge / high potential / anode
   opposite charges attract or positive (anode) attracts negative (electrons)
   B3

   (b) no collisions with air / particles or allows electrons to reach the screen
   B1

   (c) electron beam is a current or moving charges
   deflected by a magnetic field or experience force in magnetic field
   M1

7 (a) 94 electrons and 94 protons
   144 neutrons
   (only) electrons in orbit / surrounding nucleus or (only) protons
   and neutrons in nucleus
   B1

   (b) (i) (beta-particles) weak(er)
        (beta-particles) strong(er)
        B1

   (ii) any two lines from
        glasses / goggles or lead container / shield / clothing / gloves
        tweezers / manipulator / carry in large cardboard box
        minimise time of exposure / film badge
        B2 [7]

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Section B

8 (a) (i) 0.83 – 0.86 N  B1

(ii) line curved  B1
line (curved) upwards  B1 [3]

(b) (i) 
\[(P = )h \rho g\]
\[0.035 \times 1000 \times 10 \text{ or } 3.5 \times 1000 \times 10 \text{ or } 35 \times 1000 \times 10 \]
350 Pa  C1

(ii) 
\[(F = )P \times A \text{ or } 350 \times 0.0016 \text{ or } 350 \times 16 \text{ or } 5600 \]
0.56 N  C1

(iii) 1.4 N or (a)(i) + (b)(ii) calculated  B1 [6]

(c) (i) (atmospheric pressure) exerts a downward force / pressure  B1
(on top of the block)  B1
(cancels out the) extra upward force / pressure  B1

(ii) (vector) has direction (in addition to magnitude)  B1 [3]

(d) any three lines from  B1
force due to water increases  C1
force due to spring decreases  C1
increased pressure (at base)  A1
they add to give a constant value / weight of block or total force constant  B3 [3]

9 (a) rate of flow of charge or charge flowing per unit time  B1 [1]

(b) (i) 7.5 V  B1

(ii) 
\[(R = )V / I \text{ or } 7.5 / 4.0 \]
1.9 \(\Omega\)  C1

(iii) 
\[(P = ) VI \text{ or } 6.5 \times 4.0 \]
26 W  C1

(iv) resistance increases (reading of ammeter) decreases  M1
A1 [7]

(c) (i) at least two lines on left and two lines on right of core and  B1
correct shape (by eye)  B1
good shape (by eye) and into poles and no straight sections and  B1
at least one line on each side  B1
at least one arrow N to S (primarily upwards) and none wrong  B1 [3]
(ii) 1  cylinder is magnetised (by induction)  
  top (of cylinder) is an S-pole 
  unlike poles attract or S-pole attracts N-pole  

2  it does not (remain in contact) and iron is temporary/soft magnetic  
  material/core (and cylinder) lose magnetisation  

10 (a) (i) 3.0 × 10^8 m/s  

(ii) \( \lambda = \frac{c}{f} \) or 3.0 × 10^8/4.3 × 10^{14}  
  7.0 × 10^{-7} m  

(b) (i) decreases  

(ii) \( \sin(i) = n \times \sin(r) \) or 1.5 × \( \sin(30^\circ) \) or 0.75  
  49°  

(iii) 41°  

(c) (i) dispersion at both surfaces and refractions in correct direction  
  violet/blue light below the red light shown  

(ii) spectrum or band of (continuous) colours or colours of rainbow  
  red, orange, yellow, green, blue, (indigo, violet)  

(iii) 1  X marked above red  
  2  it is / black surfaces are good absorbers (of IR radiation)  

(d) intruder/human being emits IR  
  IR beam broken or IR reflected  
  or intruder warm or  
  does not reach change detected  
  IR detected detector  

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