This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners’ meeting before marking began.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates’ scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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CIE is publishing the mark schemes for the May/June 2008 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.
1 (a) allow anything in range 20 Hz → 20 kHz  
(b) allow anything in range 10 nm → 400 nm  
(c) allow anything in range 10 g → 100 g  
(d) allow anything in range 0.1 kg m$^{-3}$ → 10 kg m$^{-3}$  

2 (a) (i) $k$ is the reciprocal of the gradient of the graph  
\[ k = \frac{32}{4 \times 10^{-2}} = 800 \text{ N m}^{-1} \]  
(ii) either $\text{energy} = \text{average force} \times \text{extension}$ or $\frac{1}{2}kx^2$  
or area under graph line  
\[ \text{energy} = \frac{1}{2} \times 800 \times (3.5 \times 10^{-2})^2 \text{ or } \frac{1}{2} \times 28 \times 3.5 \times 10^{-2} \]  
\[ \text{energy} = 0.49 \text{ J} \]  

(b) (i) momentum before cutting thread = momentum after  
\[ 0 = 2400 \times V - 800 \times v \]  
\[ v / V = 3.0 \]  
(ii) energy stored in spring = kinetic energy of trolleys  
\[ 0.49 = \frac{1}{2} \times 2.4 \times \left(\frac{1}{3}v\right)^2 + \frac{1}{2} \times 0.8 \times v^2 \]  
\[ v = 0.96 \text{ m s}^{-1} \]  
(if only one trolley considered, or masses combined, allow max 1 mark)

3 (a) (i) $v^2 = 2as$  
\[ 1.2^2 = 2 \times a \times 1.9 \]  
\[ a = 0.38 \text{ m s}^{-2} \]  
(ii) $F = ma$  
\[ = 42 \times 0.38 \]  
\[ = 16 \text{ N} \]  

(b) power = $Fv$  
\[ = 16 \times 1.2 \]  
\[ = 19 \text{ W} \]  

(c) (i) component = $42 \times 9.8 \times \sin2.8$  
\[ = 20.1 \text{ N} \]  
(ii) accelerating force = $20.1 - 16 = 4.1 \text{ N}$  
acceleration of trolley = $4.1 / 42 = 0.098 \text{ m s}^{-2}$  
\[ s = \frac{1}{2}at^2 \]  
\[ 3.5 = \frac{1}{2} \times 0.098 \times t^2 \]  
\[ t = 8.5 \text{ s} \]
(d) either allows plenty of time to stop runaway trolley
   or speed of trolley increases gradually
   or trolley will travel faster
   (answer must be unambiguous when read in conjunction with question)

4 (a) (i) 1. stress = force / (cross-sectional) area
            2. strain = extension / original length
            3. Young modulus = stress / strain
               (ratios must be clear in each answer)

   (ii) either fluids cannot be deformed in one direction / cannot be stretched
         or fluids can only have volume change
         or no fixed shape

(b) either unless \( \Delta p \) is very large or \( 2.2 \times 10^9 \) is a large number
    \( \Delta V \) is very small or \( \Delta V/V \) is very small, (so ‘incompressible’)

(c) \( \Delta p = \rho g \)
    \( 1.01 \times 10^5 = h \times 1.08 \times 10^3 \times 9.81 \)
    \( h = 9.53 \text{ m} \)
    \( \Delta h/h = 0.47/10 \) or \( 0.47/9.53 \)
    error = 4.7% or 4.9% or 5%

5 (a) (i) frequency: number of oscillations per unit time
         of the source / of a point on the wave

   (ii) speed: speed at which energy is transferred / speed of wavefront

(b) (i) does not transfer energy (along the wave)

   (ii) position (along wave) where amplitude of vibration is a maximum

   (iii) all three positions marked

(c) wavelength = \( 2 \times 17.8 = 35.6 \text{ cm} \)
    \( v = f \lambda \)
    \( v = 125 \times 0.356 \)
    \( = 44.5 \text{ m s}^{-1} \)
    \( 44.5^2 = 4.00/m \)
    \( m = 2.0 \times 10^{-3} \text{ kg m}^{-1} \)
6 (a) either $P = VI$ and $V = IR$ or $P = \frac{V^2}{R}$

resistance $= 38.4 \Omega$ 

(b) zero

1.5 kW

3.0 kW

0.75 kW

2.25 kW

7 (a) $\alpha$-particle: either helium nucleus or contains 2 protons + 2 neutrons

or $^4_2\text{He}$

$\beta$-particle: either electron or $^0_1\text{e}$

$\alpha$ speed $< \beta$ speed (1)

$\alpha$ discrete values of speed/energy, $\beta$ continuous spectrum (1)

either $\alpha$ ionising power $>> \beta$ ionising power

or $\alpha$ range $<< \beta$ range (1)

$\alpha$ positive, $\beta$ negative (only if first two B marks not scored) (1)

$\alpha$ mass $> \beta$ mass (only if first two B marks not scored) (1)

(any two sensible pairs of statements relevant to differences,
– do not allow statements relevant to only $\alpha$ or $\beta$, 1 each, max 2) B2 [4]

(b) (i) $^{236}_{92}\text{U} \rightarrow ^{232}_{90}\text{Th}$

$+ ^4_2\text{He}$ M1

(ii) 1. correct position for U at $Z = 92, N = 145$ B1

2. correct position for Np relative to U i.e. $Z + 1$ and $N - 1$ B1 [2]