**PRESBYTERIAN HIGH SCHOOL**
**SCIENCE DEPARTMENT**
**MARKSCHEME**

Subject: Physics
Setter:
Level: Sec 4 Express

Test: PrelimExam
Year: 2024

**Answers to Paper 1: MCQ**

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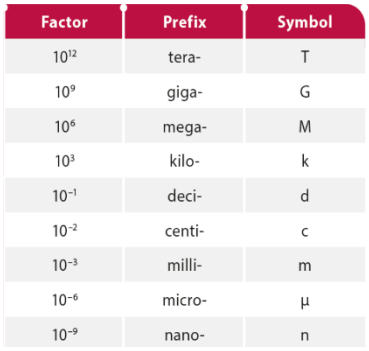
|---|---|---|
| **1** | **C** |  |
| **2** | **D** | Fall at a constant acceleration of 10 m/s$^2$<br><br>All objects will fall at the same rate if there is no air resistance. |
| **3** | **C** | • greater mass<br>• greater weight<br>• **accelerates longer** before air resistance balances with the weight<br>• take **longer time to teach terminal velocity**<br>• **higher terminal velocity** |
| **4** | **A** | $g_b$ = 9.81 N/kg $g_t$ = 9.79 N/kg<br><br>$W_b = mg_b$<br>600 = m(9.81)<br>**m = 61.2 kg**<br><br>$W_t = mg_t$ = (61.2)(9.79) = **599 N** |
| **5** | **B** | When θ = 180° , magnitude of resultant force = 4 + ( -2) = 2 N<br>When θ = 90° , magnitude of resultant force = $\sqrt{(2^2 + 4^2)}$ = 4.47 N<br>When θ = 0° , magnitude of resultant force = 4 + 2 = 6 N<br><br>For resultant of 4N, 90° < θ < 180° |
| **6** | **A** | Resultant force, F = ma<br><br>From graph : 1st Part: F ↓, acceleration ↓<br>Since gradient of v-t graph = acceleration<br>When acceleration ↓, gradient of graph ↓<br><br>From graph : 2nd Part: F is zero, acceleration is zero<br>Since gradient of v-t graph = acceleration<br>When acceleration is zero, gradient of graph is zero or constant speed |

| Factor | Prefix | Symbol |
|---|---|---|
| $10^{12}$ | tera- | T |
| $10^{9}$ | giga- | G |
| $10^{6}$ | mega- | M |
| $10^{3}$ | kilo- | k |
| $10^{-1}$ | deci- | d |
| $10^{-2}$ | centi- | c |
| $10^{-3}$ | milli- | m |
| $10^{-6}$ | micro- | μ |
| $10^{-9}$ | nano- | n |

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| **7** | **A** | Volume of water = 150 – 100 = 50 $cm^3$<br>Mass of water = 50 × 1.0 = 50 g<br><br>Mass of paraffin = 0.80 × 100 = 80 g<br><br>**Total mass = 50 + 80 = 130 g** |
| **8** | **A** | $(G.P.E)_A + (K.E)_A = (G.P.E)_B + (K.E)_B$ + W.D against friction<br><br>$(2)(10)(2) = ½ (2) v^2 + 2.6 \times 4$<br><br>v = 5.4 m/s |
| **9** | **B** | In an area of 1.0 $m^2$ of each panel receives 0.80 kJ of energy from the Sun in 1.0 s.<br><br>Power input for 1.0 $m^2$ = energy/time = 0.80 kJ / 1.0 s = 0.80 kW<br>Power input for 7.2 $m^2$ = 0.80 kW × 7.2 = 5.76 kW<br><br>Efficiency = 1.0 kW/ 5.76 kW × 100% = 17% |
| **10** | **A** | chemical energy is transferred **electrically** to **the** internal store and kinetic store. |
| **11** | **A** | The pollen particles are being bombarded by the heavier particles of the water. |
| **12** | **C** | $P_{gas} - P_{atm}$ = 30 cm Hg<br><br>$P_{gas}$ = 30 cm of water + 76 cm Hg<br>= (0.3)(1000)(10) + (0.76)(13 600)(10)<br>= 106 360 Pa = 106 000 Pa |
| **13** | **D** | Pressure at X = Pressure at Y<br><br>Since height of liquid X is greater than liquid Y, therefore density of liquid X is smaller than density of liquid Y. |
| **14** | **C** | For the energy to be transferred only by radiation, it must be in a vacuum as conduction and convection require a medium for energy to be transferred. |
| **15** | **C** | **<u>High</u> Heat Capacity** --→ **more change in internal energy is needed** to **change the temperature** -→ temperature **increase at <u>slower</u> rate**.<br><br>Since for Y, the rate of increase in temperature is the slowest, it has the largest specific heat capacity. |
| **16** | **A** | One bucket contains 5 kg of water at 20 °C and the other contains 1 kg of water at 80 °C. Let the final temperature be $\theta$.<br><br>internal energy lost by 1 kg of water = internal energy gained by 5 kg of water<br><br>(1) $c (80 - \theta) = 5 c (\theta - 20)$<br>$80c - \theta = 5\theta - 100$<br>$\theta$ = 30 °C |

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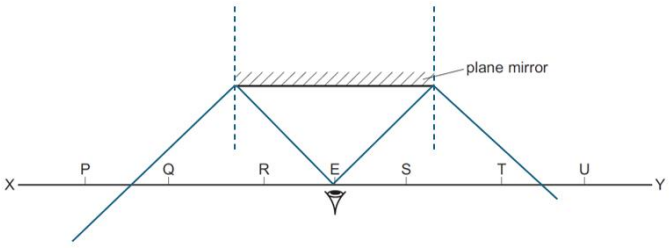
| **17** | **D** | Ultrasound is a longitudinal wave. |
| **18** | **A** | $v = f\lambda = \frac{distance}{time}$<br><br>$6600\ \lambda = \frac{1320}{4}$<br><br>$\lambda = 0.05$ m |
| **19** | **C** | a sound that becomes quieter (smaller amplitude) with a higher pitch (higher frequency) |
| **20** | **D** | Each coil completes 4.0 oscillations in 2.0 s.<br>… = 2.0 oscillations in 1.0 s.<br>Therefore frequency = 2.0 Hz<br><br>wavelength = distance between 2 successive compression = YZ |
| **21** | **B** | mobile phone (microwaves)<br>sunbed (ultraviolet rays)<br>television controller (infrared waves)<br>toaster (infrared waves) |
| **22** | **A** | $v = f\lambda$<br>$50 = f\ (20)$<br>$F = 2.5$ Hz<br>Period, $T = 1/f = 0.40$ s<br><br>0.30 s later, wave will have travel a distance of ¾ λ |
| **23** | **B** |  <br>Objects Q, R, S and T give rise to images that can be seen by the eye at E. |
| **24** | **C** | Refractive index, $n = \frac{sin55}{sin\ 33} = 1.50$<br><br>speed of light in the glass = $3.0/1.5 \times 10^8 = 2.0 \times 10^8$ m/s |
| **25** | **A** | θ is the critical angle as it produce angle of refraction of 90°<br><br>As not all light rays are reflected, there is no total internal reflection |

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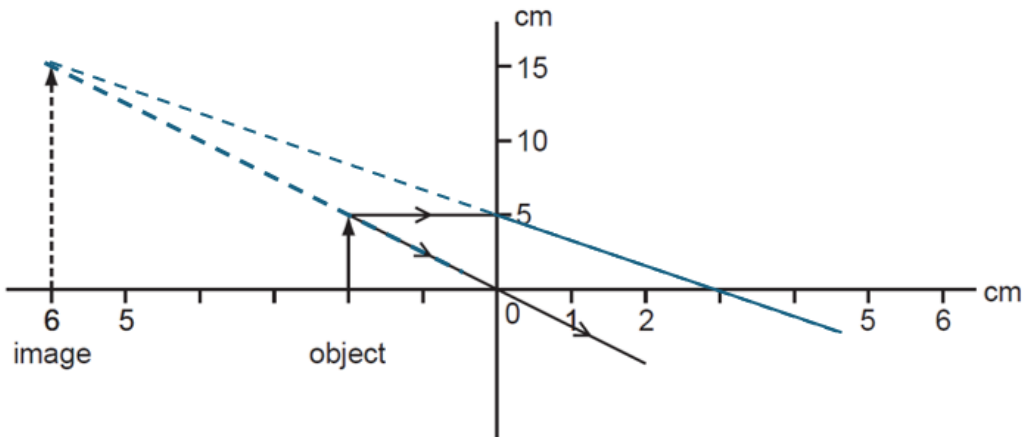
| **26** | **D** |  <br>Focal length = 3 cm<br>Object distance = 2F = 6.0 cm to produce image of same size. |
| **27** | **A** | Negative induced charges on left and positive induced charges on the right of each sphere as the negative will be attracted to the positively charged rod. |
| **28** | **C** | V = IR<br>Current, I = V/R = 6 ÷ 3 = 2.0 A<br>Charge = current x time = 2.0 × 60 = 120 C |
| **29** | **D** | Straight line… ratio of I/R is constant… resistance is constant<br>Curved section… ratio of I/R decreases… resistance increases |
| **30** | **B** | Lamp Z becomes dimmer as the total resistance of the circuit will increase when lamp Y is removed. |
| **31** | **C** | p.d across LDR = 2.0 V<br>p.d across thermistor = 4.0 V<br>ratio of resistance of thermistor to resistance of LDR = 4/2 = 2:1<br>1000 Ω (warm)/ 500 Ω (bright) = 2 : 1 |
| **32** | **B** | Since the earth from the metal case is connected to the live terminal, the metal case will be live. |
| **33** | **D** | Using $P = \frac{V^2}{R}$<br>For the power dissipated to be the highest, the total resistance of the circuit has to be the lowest. |
| **34** | **B** | When electrical appliances are earthed, current leakage is channelled to the ground, preventing electric shock, while a large current may blow the fuse and disconnect the appliance due to the metal case's small resistance. |

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| **35** | **D** | using a larger control current will increase the strength of the magnetic field. |
| **36** | **D** | Using fleming left hand rule the direction of the force acting on the wire is upward.<br><br>Based on newton 3rd Law, the wire will exert a downward force on the magnet.<br><br>Therefore the reading on the balance will increase |
| **37** | **D** | speed of rotation of the coil steadily increases,<br>the amplitude and the frequency of the induced e.m.f will also increases. |
| **38** | **B** | Using Lenz Law, the direction of the induced current will be in opposite direction magnet falls away from the coil. |
| **39** | **D** | Using fleming left rule, the particles have to be negatively charged. |
| **40** | **C** | **Nuclear fusion** is a process in which **two light atomic nuclei combine to form one heavier atomic nucleus and releases a huge amount of energy**. |