PART I
Total Value: 50%

Instructions: Shade the letter of the correct answer on the computer scorable answer sheet provided.

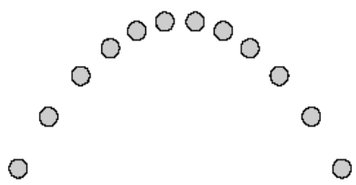
1. A person runs horizontally off the end of a diving board and lands in the water 1.3 s later. How high is the diving board?

   (A) 1.6 m
   (B) 6.4 m
   ✔ (C) 8.3 m
   (D) 13 m

2. A marble is launched horizontally from a table at 12 m/s and lands on the floor 0.25 s later. What is the range of the marble?

   (A) 0.021 m
   (B) 0.31 m
   ✔ (C) 3.0 m
   (D) 48 m

3. Which describes a ball thrown in the air that traces the path shown?



   (A) The acceleration of the ball at the top of its motion is zero.
   (B) The acceleration of the ball keeps changing.
   (C) The velocity of the ball at the top of its motion is zero.
   ✔ (D) The velocity of the ball keeps changing.

4. A projectile is launched with an initial velocity of 14 m/s at an angle of 25° above the horizontal. What is the speed of the projectile at its maximum height?

   (A) 0 m/s
   (B) 5.9 m/s
   ✔ (C) 13 m/s
   (D) 14 m/s

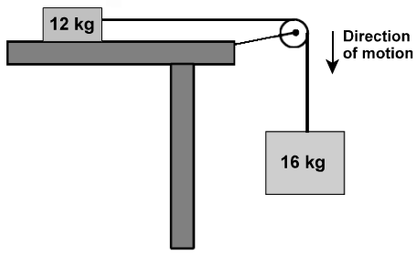
5. A golf ball is hit from ground level with an initial velocity of 63 m/s at an angle of 31° above the horizontal. How long will it take the ball to hit the ground?

   (A) 3.3 s
   (B) 5.5 s
   ✔ (C) 6.6 s
   (D) 11 s

6. A marble is launched horizontally from the top of a building. How far has the marble fallen when the vertical component of its velocity is 16 m/s [down]?

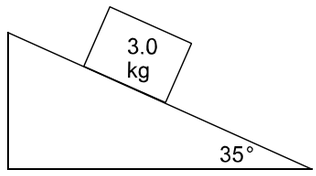
   (A) 0.82 m
   (B) 1.6 m
   ✔ (C) 13 m
   (D) 26 m

7. If the table below is frictionless, what is the acceleration of the 12 kg mass?



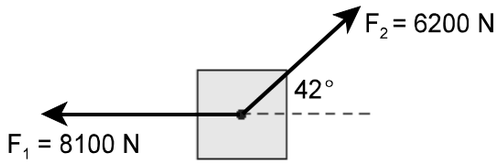
(A) 1.4 m/s^2
✔ (B) 5.6 m/s^2
(C) 9.8 m/s^2
(D) 13 m/s^2

8. What force of friction acts on the object shown, if it slides down the incline at a constant velocity?



✔ (A) 17 N
(B) 21 N
(C) 24 N
(D) 29 N

9. Two forces act on an object of negligible mass as shown below. What is the magnitude of a third force which must act on the object so that it will be in translational equilibrium?



(A) 3500 N
(B) 4100 N
(C) 4600 N
✔ (D) 5400 N

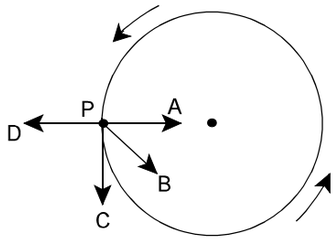
10. An object travels along a horizontal circular path at a constant speed. By what factor will the centripetal force change if the radius is halved?

(A) ¼
(B) ½
✔ (C) 2
(D) 4

11. What is the acceleration of a car that goes around a curve of radius 150 m at a constant speed of 30.0 m/s?

(A) 0 m/s^2
(B) 0.20 m/s^2
(C) 5.0 m/s^2
✔ (D) 6.0 m/s^2

12. The diagram below shows an object moving at a constant speed in a horizontal circle. What is the direction of the acceleration at point P?



✔ (A) A
(B) B
(C) C
(D) D

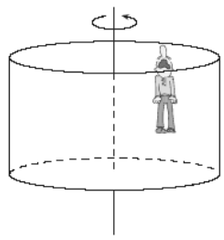
13. What is the centripetal force on an object of mass 0.200 kg, that is spinning at 6.40 m/s in a horizontal circle of radius 0.350 m?

(A) 2.87 N
(B) 3.66 N
✔ (C) 23.4 N
(D) 117 N

14. What banking angle is required for a car to complete a 110.0 m radius frictionless turn at 24.5 m/s without skidding?

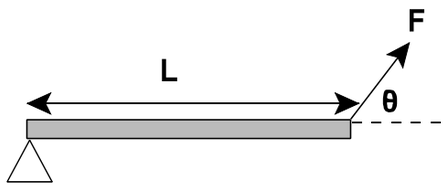
✔ (A) 29.1°
(B) 33.8°
(C) 56.2°
(D) 60.9°

15. A person of mass, *m*, on a carnival ride stands inside a large drum that begins to rotate. When a safe speed is reached, the floor of the drum falls away and the rider is left "stuck" to the wall. What is the minimum speed at which the drum can turn so that the person does not fall?



(A) $v = \sqrt{rg}$
(B) $v = \dfrac{rg}{\mu_s}$
✔ (C) $v = \sqrt{\dfrac{rg}{\mu_s}}$
(D) $v = rg$

16. Which expression gives the torque about the pivot produced by the force, F, in the diagram below?

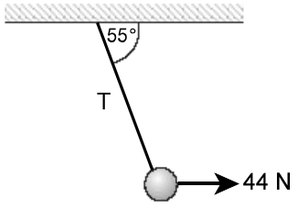


(A) $\tau = FL$
(B) $\tau = \dfrac{F}{L}$
(C) $\tau = FL\cos\theta$
✔ (D) $\tau = FL\sin\theta$

17. A 6.2 kg mass rests on a beam at 1.6 m from the pivot point. What mass must rest at 2.3 m on the opposite side of the pivot in order to balance the beam?

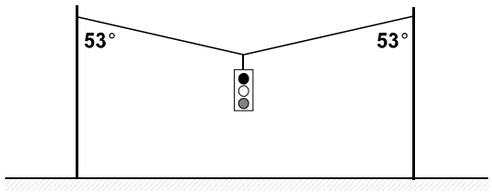
(A) 0.11 kg
(B) 0.23 kg
✔ (C) 4.3 kg
(D) 8.9 kg

18. A mass suspended by a rope is held stationary by a horizontal force of 44 N as shown. What is the magnitude of the tension, T, in the rope?



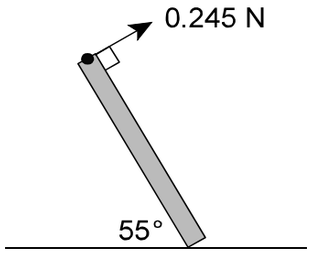
(A) 25 N
(B) 36 N
(C) 54 N
✔ (D) 77 N

19. A traffic light is held stationary by two wires as shown below. What is the mass of the traffic light if the tension in each wire is 235 N?



(A) 14 kg
(B) 19 kg
✔ (C) 29 kg
(D) 38 kg

20. The uniform beam shown below is 1.0 m long and is held stationary by a force of 0.245 N as shown. What is the mass of the beam?



(A) 0.044 kg
(B) 0.050 kg
(C) 0.061 kg
✔ (D) 0.087 kg

21. A neutral electroscope becomes positively charged after it is briefly touched by a charged rod. Which explains the flow of charge?

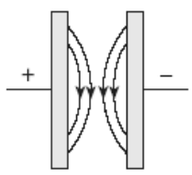
✔ (A) Electrons flow from the electroscope to the rod.
(B) Electrons flow from the rod to the electroscope.
(C) Protons flow from the electroscope to the rod.
(D) Protons flow from the rod to the electroscope.

22. What is the electric force between two point charges of 1.5×10^{-6} C and 2.0×10^{-6} C that are separated by a distance of 0.50 m?

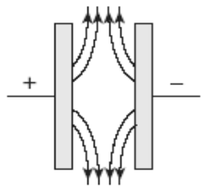
(A) 6.0×10^{-12} N
(B) 1.2×10^{-11} N
(C) 5.4×10^{-2} N
✔ (D) 1.1×10^{-1} N

23. Which shows the electric field between two oppositely charged parallel plates?

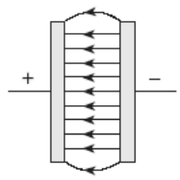
(A)



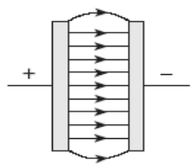
(B)



(C)



✔ (D)



24. The electric force between two charges is 0.012 N. What is the new electric force if the distance between the charges is doubled, and the value of one charge is tripled?

(A) 0.0080 N
✔ (B) 0.0090 N
(C) 0.016 N
(D) 0.018 N

25. What is the electric field strength 0.50 m away from an object having a charge of 2.5×10^{-6} C?

(A) 5.0×10^{-6} N/C
(B) 1.0×10^{-5} N/C
(C) 4.5×10^{4} N/C
✔ (D) 9.0×10^{4} N/C

26. What energy is transferred by a 6.0 V battery to run an appliance that draws 2.0 A of current in 1.0 minute?

(A) 3.0 J
(B) 12 J
(C) 180 J
✔ (D) 720 J

27. What will be the new resistance if the radius of a piece of copper wire having resistance *R* is doubled?

✔ (A) ¼ *R*
(B) ½ *R*
(C) 2 *R*
(D) 4 *R*

28. What charge flows past a point in a wire in 6.0 s if the wire carries a current of 2.0 A?

(A) 0.33 C
(B) 3.0 C
✔ (C) 12 C
(D) 24 C

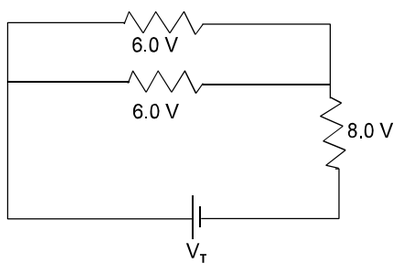
29. What is the potential difference across a 2.5 Ω resistor that carries 3.0 A of current?

(A) 0.83 V
(B) 1.2 V
(C) 5.5 V
✔ (D) 7.5 V

30. What is the voltage drop across one of three identical resistors that are connected in series to a 6.0 V source?

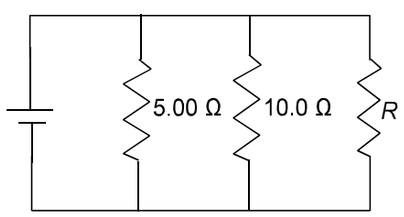
✔ (A) 2.0 V
(B) 3.0 V
(C) 6.0 V
(D) 18 V

31. What is the voltage, V_T, across the source in the circuit below?



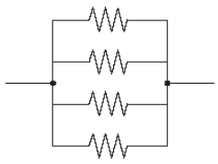
(A) 2.2 V
(B) 11.0 V
✔ (C) 14.0 V
(D) 20.0 V

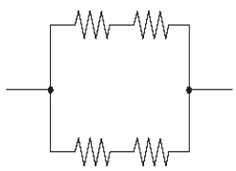
32. What resistor, *R*, must be added to the circuit below to give a total resistance of 2.00 Ω?

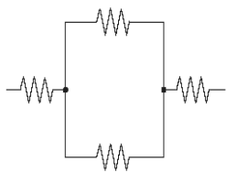


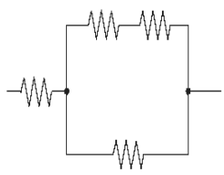
(A) 0.200 Ω
(B) 0.800 Ω
(C) 1.25 Ω
✔ (D) 5.00 Ω

33. Which arrangement of four identical resistors has the least total resistance?

✔ (A) 

(B) 

(C) 

(D) 

34. What are the correct units for electric potential?

(A) J/s
✔ (B) J/C
(C) N/m
(D) N/C

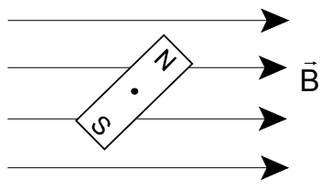
35. What is the power rating of an electric kettle that draws a 12.5 A current in a 120 V circuit?

(A) 0.10 W
(B) 9.6 W
(C) 1200 W
✔ (D) 1500 W

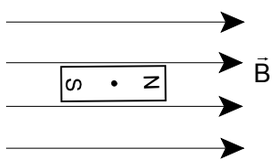
36. Which occurs when protons and electrons enter a magnetic field that is parallel to their direction of motion?

(A) Both protons and electrons are deflected.
✔ (B) Neither protons nor electrons are deflected.
(C) Only electrons are deflected.
(D) Only protons are deflected.

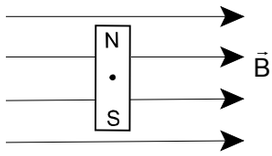
37. Which shows the final position of a bar magnet that is free to rotate in a magnetic field and is initially positioned as shown below?



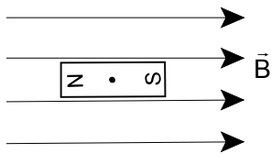
✔ (A)



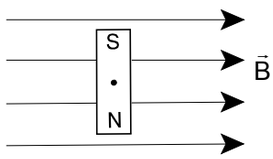
(B)



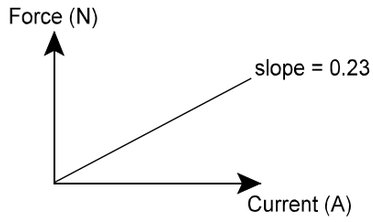
(C)



(D)

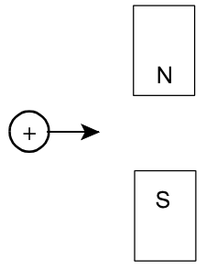


38. A 2.0 m long current-carrying conductor is placed perpendicular to an external magnetic field. The graph below shows how the force on the conductor changes as the current is varied. What is the magnitude of the external magnetic field?



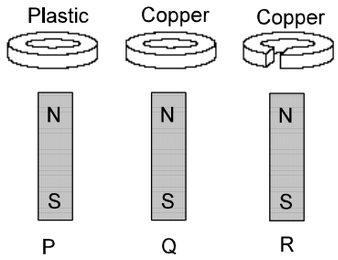
✔ (A) 0.12 T
(B) 0.23 T
(C) 0.46 T
(D) 8.7 T

39. A proton is shot through a magnetic field as shown below. In what direction will the proton be deflected?



✔ (A) into the page
(B) out of the page
(C) towards the bottom of the page
(D) towards the top of the page

40. Three rings are dropped at the same time over identical magnets, P, Q and R, as shown below. Which describes the order in which the rings reach the bottom of the magnets?



(A) They arrive in the order P, Q, R.
(B) They arrive in the order P, R, Q.
✔ (C) Rings P and R arrive at the same time, followed by Q.
(D) Rings Q and R arrive at the same time, followed by P.

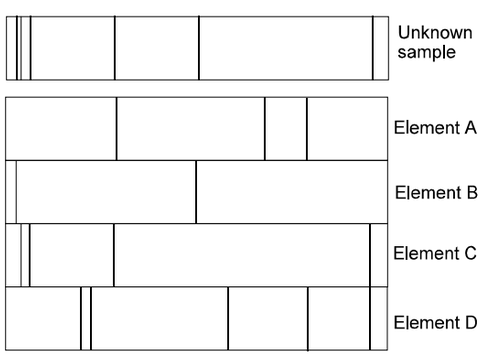
41. Which occurs when an opaque object with a temperature above absolute zero emits photons?

✔ (A) black-body radiation
(B) Compton effect
(C) photoelectric effect
(D) UV catastrophe

42. What is the energy of a photon having a frequency of 7.50×10^{14} Hz?

(A) 8.83×10^{-49} J
✔ (B) 4.97×10^{-19} J
(C) 6.75×10^{31} J
(D) 1.13×10^{48} J

43. The diagram below shows the line spectra of four elements along with the spectrum of an unknown gaseous sample. Which elements are found in the unknown sample?



(A) A and C
(B) A and D
✔ (C) B and C
(D) B and D

44. What is the stopping potential for an ejected photoelectron that has 3.40×10^{-19} J of kinetic energy?

(A) 0.471 V
✔ (B) 2.13 V
(C) 3.40 V
(D) 5.44 V

45. What is the deBroglie wavelength of a 125 g baseball moving at 28.0 m/s?

✔ (A) 1.89×10^{-34} m
(B) 2.32×10^{-33} m
(C) 3.50×10^{0} m
(D) 5.28×10^{33} m

46. What is the momentum of a photon of yellow light with a wavelength of 5.89×10^{-7} m?

(A) 3.90×10^{-40} kg·m/s
(B) 3.90×10^{-37} kg·m/s
✔ (C) 1.12×10^{-27} kg·m/s
(D) 1.12×10^{-25} kg·m/s

47. What is the energy of an electron in the third energy level of a hydrogen atom?

(A) −13.6 eV
(B) −4.53 eV
(C) −2.27 eV
✔ (D) −1.51 eV

48. Which completes the nuclear reaction shown?

$$ {}^{1}_{0}\mathrm{n} + {}^{235}_{92}\mathrm{U} \rightarrow {}^{141}_{56}\mathrm{Ba} + \boxed{?} + 3\,{}^{1}_{0}\mathrm{n} $$

(A) ${}^{92}_{35}\mathrm{Br}$
(B) ${}^{94}_{35}\mathrm{Br}$
✔ (C) ${}^{92}_{36}\mathrm{Kr}$
(D) ${}^{94}_{36}\mathrm{Kr}$

49. How many neutrons are in the daughter nucleus if ${}^{235}_{92}\mathrm{U}$ undergoes alpha decay?

(A) 90
✔ (B) 141
(C) 143
(D) 231

50. A sample of radioactive material has an initial activity of 1.50×10^{6} Bq. After how many half-lives will the activity decrease to 3.75×10^{5} Bq?

(A) ¼
(B) ½
✔ (C) 2
(D) 4

PART II
Total Value: 50%

Instructions: Complete all items in this section. Your responses should be clearly presented in a well organized manner with proper use of units, formulae and significant figures where appropriate.

Value

3% 51.(a) A golfer hits a golf ball from ground level with a speed of 25 m/s at 35° above the horizontal. Calculate the magnitude of the velocity of the ball when it has travelled a horizontal distance of 42 m.

0.5 marks $v_{1x} = 25 \cos 35° = 20.48$ m/s
$v_{1x} = 25 \sin 35° = 14.34$ m/s

0.5 marks $$t = \frac{d_x}{v_x} = \frac{42\,m}{20.48\,m/s} = 2.05\,s$$

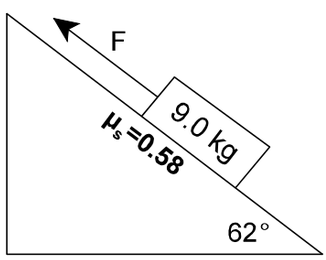
0.5 marks $v_{2x} = v_{1x} = 20.48$ m/s

0.5 marks $v_{2y} = v_{1y} + at = 14.34 \text{ m/s} + (-9.80 \text{ m/s}^2)(2.05 \text{ s}) = -5.75$ m/s

0.5 marks $v^2 = (20.48 \text{ m/s})^2 + (5.75 \text{ m/s})^2$

0.5 marks $v = 21$ m/s

3% (b) A 9.0 kg block rests on a 62° incline as shown below. The coefficient of static friction between the block and the incline is 0.58. Calculate the minimum force, F, that will prevent the block from sliding down the incline.

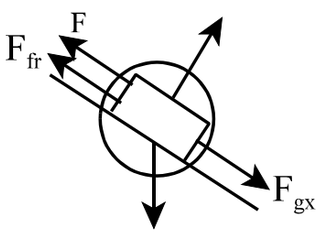


0.5 marks $F_{gx} = mg \sin 62° = 77.88$ N

0.5 marks $F_{fr} = \mu_s mg \cos 62° = 24.0$ N

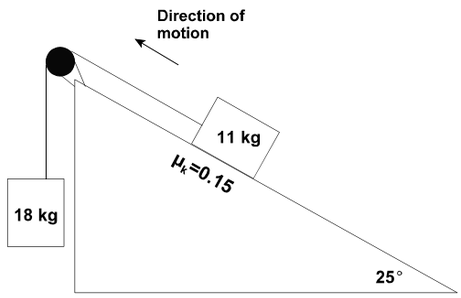
1.0 mark $F + F_{fr} = F_{gx}$

1.0 mark $F = 54$ N



Value

4% 51.(c) Two objects of masses 11 kg and 18 kg are connected by a light string that passes over a frictionless pulley as shown. Calculate the magnitude of the acceleration of the 18 kg box.



$$a = \frac{F_{NET}}{m} \quad gives:$$

$$a = \frac{W - (F_{Fr} + F_{gx})}{m_{Total}} \quad where:$$

0.5 marks $W = (18.0\ kg)(9.80\ m/s^2) = 176.4\ N$

0.5 marks $F_{gx} = mg \sin 25° = 45.56\ N$

0.5 marks $F_{fr} = \mu_s\, mg \cos 25° = 14.65\ N$

0.5 marks $m_{Total} = 18\ kg + 11\ kg = 29\ kg$

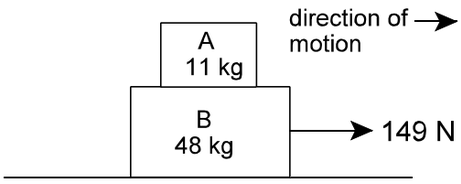
$$a = \frac{176.4 - (14.65 + 45.56)}{29}$$

0.5 marks

0.5 marks a = 4.0 m/s/s

1.0 mark *scientific literacy*
the marking board awarded scientific literacy as follows:
correct unit 0.5 marks
correct significant digits 0.5 marks

3% (d) Two boxes are stacked as shown below. The surface that box B rests upon is frictionless and the surface between boxes A and B is rough. If box A does not slide on box B when a maximum force of 149 N is applied as shown, calculate the coefficient of static friction between box A and box B.



1.0 mark For both blocks:

$$a = \frac{F_{NET}}{m} = \frac{149\ N}{59\ kg} = 2.53\ m/s^2$$

For block A:

1.0 mark $F_{Net} = F_{fr} = \mu_S F_N$

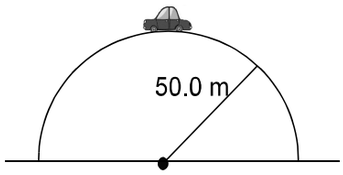
$ma = \mu_S F_N$

1.0 mark $\mu_S = \frac{ma}{F_N} = 0.26$

Value

4% 51.(e) A car of mass 1.50×10^3 kg travelling at 18 m/s, tops a hill having a radius of curvature of 50.0 m.

i) Calculate the normal force on the car at the top of the hill.



$F_C = mg - F_N$, so:

1.0 mark $F_N = mg - F_C$

$= (1.5 \times 10^3 \text{ kg})(9.80 \text{ m/s/s}) - \dfrac{(1.50 \times 10^3 \text{ kg})(18 \text{ m})^2}{(50.0 \text{ m})}$

$= 14\,700 \text{ N} - 9720 \text{ N}$

1.0 mark $F_N = 4980$ N

ii) Calculate the maximum speed that will allow the car to stay on the road at the top of the hill.

1.0 mark $F_N = 0$

$F_C = mg$

$\dfrac{mv^2}{r} = mg$

$v^2 = rg$

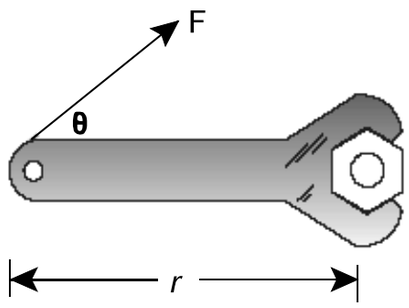
$$v = \sqrt{(50.0\,\text{m})(9.80\,\text{m/s}^2)}$$

1.0 mark v = 22 m/s

Value

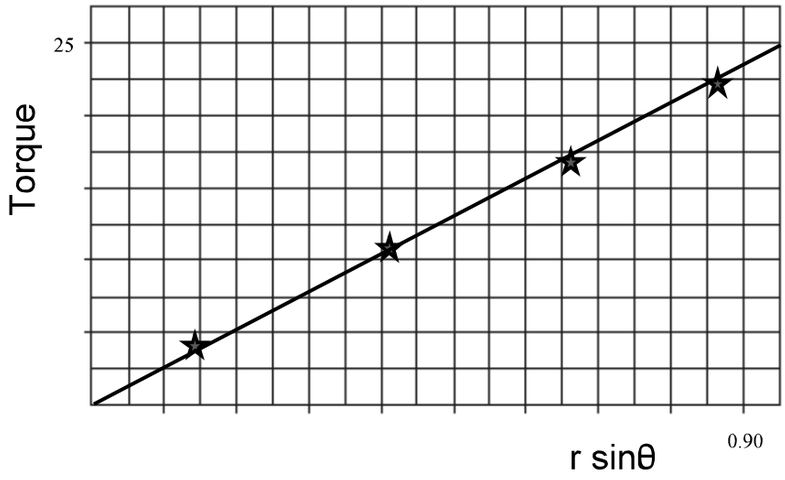
3% 51.(f) A student applies a constant force to a wrench of length *r*, in order to tighten a nut as shown. The force is applied at various angles and the measurement of torque applied is read from the wrench. The data collected are shown below.

$r \cdot \sin\theta$ (m)	Torque (N·m)
0.14	4
0.42	11
0.66	17
0.86	22



i) Graph this data on the grid below, including the line of best fit.

1.0 mark



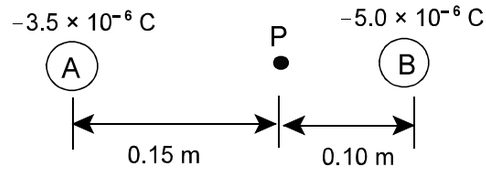
ii) Use the graph in (i) to determine the constant force that was applied to the wrench.

1.0 mark Force = slope

1.0 mark $\approx \frac{10\ \text{N·m}}{0.40\ \text{m}} = 25\ \text{N}$

Value

4% 52.(a) Two charged spheres, A and B, are arranged as shown. Calculate the magnitude and direction of the electric field at point P.



1.0 mark $$|\varepsilon_A| = \frac{kQ_A}{r^2} = \frac{(9.0x10^9\ \frac{Nm^2}{C^2})(3.5x10^{-6}\ C)}{(0.15m)^2} = 1.4x10^6\ \frac{N}{C}$$

1.0 mark $$|\varepsilon_B| = \frac{kQ_B}{r^2} = \frac{(9.0x10^9\ \frac{Nm^2}{C^2})(5.0x10^{-6}\ C)}{(0.10m)^2} = 4.5x10^6\ \frac{N}{C}$$

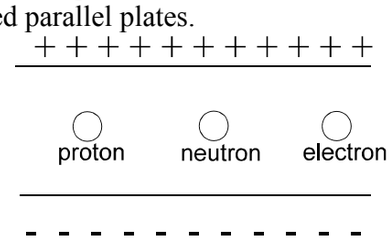
Assuming a positive test charge at point P; this gives:

1.0 mark ε_{NET} = 4.5 x 10^6 N/C - 1.4 x 10^6 N/C

= 3.1 x 10^6 N/C [right]

1.0 mark *scientific literacy*
the marking board awarded scientific literacy as follows:
correct unit 0.5 marks
correct significant digits 0.5 marks

3% (b) In the diagram below a proton, neutron and electron are located between two horizontal charged parallel plates.



i) Describe what will happen to each particle in the field.

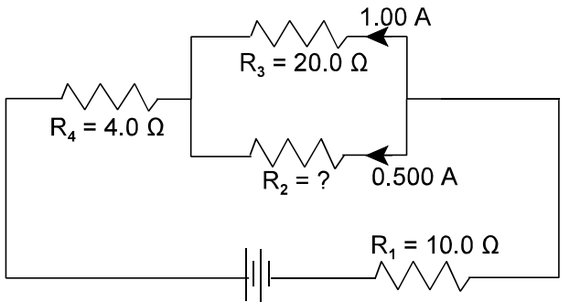
Neutron will not move	**0.5 marks**
Proton will move towards the negative plate	**0.5 marks**
Electron will move towards the positive plate	**0.5 marks**

ii) Explain which particle will have the greatest acceleration.

Since the proton is more massive, it will not accelerate as much as the	**1.0 mark**
electron, since the force is constant in each case.	**0.5 marks**

Value

6% 52.(c) For the circuit below calculate:



i) the value of R_2.

$I_T = 1.00 + 0.500 = 1.50$ A

$\therefore V_2 = V_3 = I_3R_3$

$(1.00\text{ A})(20.0\ \Omega)$

1.0 mark 20.0 V

$\therefore R_2 = \frac{V_2}{I_2} = \frac{20.0\text{ V}}{0.500\text{ A}}$

1.0 mark 40.0 Ω

ii) the power dissipated in R_4.

$I_T = I_4 = 1.50$ A

$P = I^2R = (1.50\text{ A})^2(4.0\ \Omega)$

1.0 mark $= 9.0$ W

iii) the voltage across the source.

$V_T = I_TR_T$

$R_T = 4.0\ \Omega + 10.0\ \Omega + R_{parallel}$

$= 14.0\ \Omega + 13.3\ \Omega$

1.0 mark $= 27.3\ \Omega$

1.0 mark $V_T = (1.50\text{ A})(27.3\ \Omega) = 41$ V

iv) Explain how the addition of another resistor in parallel will change the total resistance of the circuit.

Adding another resistor in parallel will decrease the parallel branch, thereby decreasing the resistance of the whole circuit. **1.0 mark**

Value

2% 52.(d) A spacecraft orbiting Earth has a coil of wire in it. An astronaut measures a small current in the coil although there is no battery connected to it and there are no magnets on the spacecraft. Explain what causes the current.

The current is caused when the wire cuts through (has relative motion) **1.0 mark**

the earth's magnetic field lines, thereby inducing current in the wire. **1.0 mark**

3% (e) Two thin metal rods, A and B, are supported in a vertical wooden rack as shown in the diagram. The two rods are connected by a wire on one end and to a battery at the other end. It is observed that as the connection to the battery is made, one of the rods jumps upward. Identify which rod jumps upward and explain why.

Fig 1.

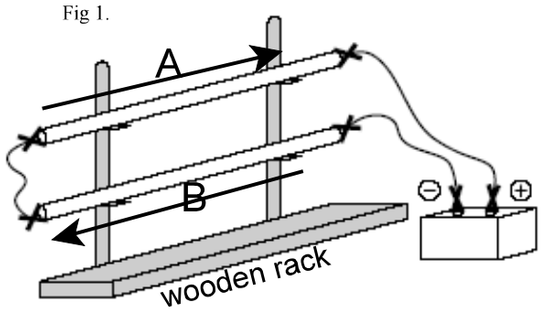
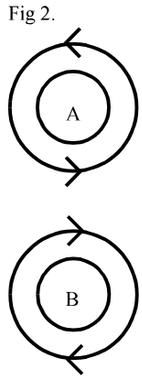


Fig 2.



When the connection is made the current flows as shown in Fig 1. **1.0 mark**

This creates magnetic fields around each wire as shown in Fig 2. **1.0 mark**

Since these fields reinforce in the centre, the wires will repel and wire A will

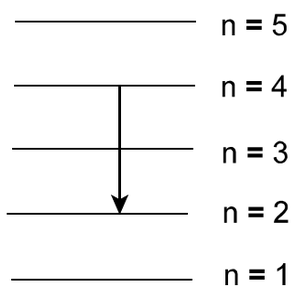
jump upwards. **1.0 mark**

Value

2% 52.(f) The possible hazardous effects of exposure to electromagnetic waves such as radio frequency radiation from the antenna of a cell phone have yet to be determined. Describe two ways a cell phone user could reduce their risk of exposure to electromagnetic waves from the antenna.

Any two of the following:	**2.0 marks**
move antennae away from ear	
use headset	
use speaker phone	
use a "wave buster"	

2% 53.(a) The diagram below shows the first five energy levels of an electron orbiting the nucleus of a hydrogen atom. Calculate the wavelength of the emitted photon for the electron transition indicated by the arrow in the diagram.



From n = 4 to n = 2

$$\Delta E = E_4 - E_2$$

0.5 marks $$= \frac{-13.6}{4^2} - \frac{-13.6}{2^2}$$

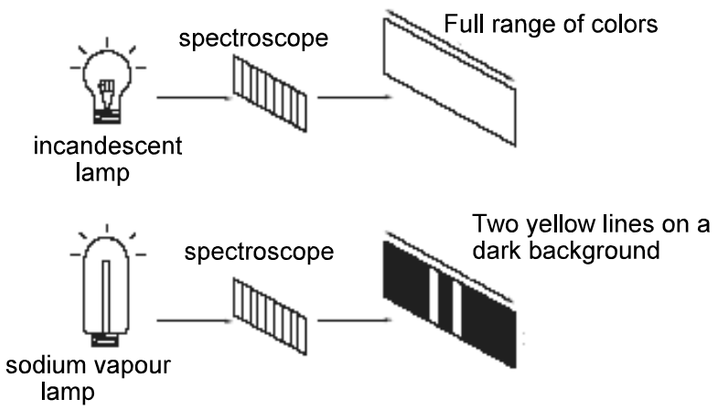
0.5 marks $$= 2.55eV$$

0.5 marks $$2.55\ eV = 4.08x10^{-19}\ J$$

0.5 marks $$E = \frac{hc}{\lambda} \therefore \lambda = \frac{hc}{E} = 487\ nm$$

Value

3% 53.(b) The spectra of two light sources through spectroscopes are shown in the diagram below.



i) What type of spectrum is produced in each case?

incandescent = continuous spectrum **0.5 marks**

Sodium vapour = emission spectrum **0.5 marks**

ii) Explain why the observed spectra are different.

The continuous spectrum contains light of all wavelengths. **1.0 mark**

In the emission spectrum light is only created when electrons drop from **1.0 mark**
higher to lower energy levels. Sodium vapour emits only two such wavelengths;
representing two such electron jumps.

Value

2% 53.(c) Calculate the energy produced in the reaction below.

$$^{2}_{1}\mathrm{H} + {}^{14}_{7}\mathrm{N} \rightarrow {}^{12}_{6}\mathrm{C} + {}^{4}_{2}\mathrm{He}$$

Particle	Mass (kg)
$^{2}_{1}\mathrm{H}$	3.343×10^{-27}
$^{14}_{7}\mathrm{N}$	2.325×10^{-26}
$^{12}_{6}\mathrm{C}$	1.992×10^{-26}
$^{4}_{2}\mathrm{He}$	6.644×10^{-27}

0.5 marks $m_{\text{Reactants}}$ $= 3.343 \times 10^{-26}\ \text{kg} + 2.325 \times 10^{-26}\ \text{kg}$
$= 2.6593 \times 10^{-26}$

0.5 marks m_{Products} $= 1.992 \times 10^{-26}\ \text{kg} + 6.644 \times 10^{-26}\ \text{kg}$
$= 2.6564 \times 10^{-26}$

0.5 marks $\Delta m = 2.9 \times 10^{-29}\ \text{kg}$

0.5 marks $E = mc^2$ $= (2.9 \times 10^{-29}\ \text{kg})(3.00 \times 10^{8}\ \text{m/s})^2$
$= 2.61 \times 10^{-12}\ \text{J}$

3% (d) Cobalt-60 has a half-life of 5.27 years. If its initial activity is 4.00×10^{13} Bq, calculate how long will it take for the activity to become 3.50×10^{13} Bq.

$$A = A_0\left(\frac{1}{2}\right)^{\frac{t}{T_{\frac{1}{2}}}}$$

$$3.50\,x10^{13}\,Bq = 4.00\,x10^{13}\,Bq\left(\frac{1}{2}\right)^{\frac{t}{5.27}}$$

$$0.875 = \left(\frac{1}{2}\right)^{\frac{t}{5.27}}$$

1.0 mark $$\log 0.875 = \log\left(\frac{1}{2}\right)^{\frac{t}{5.27}}$$

$$\frac{t}{5.27} = \frac{\log 0.875}{\log 0.5}$$

1.0 mark $t = 1.02\,years$

1.0 mark *scientific literacy*
the marking board awarded scientific literacy as follows:
correct unit 0.5 marks
correct significant digits 0.5 marks