2018 Mid-Year Examination Secondary Three Answer Scheme

1 …… 5	6 ……10	11 …… 15	16 …… 20
BABAA	**CBCDB**	**BCDBA**	**DABBC**

2 1 light year = $3X10^8$ m/s x 60 s/min x 60 min/h x 24 h/day x 365 days/year
= 9.46×10^{15} m
1 Gm = 1×10^9 m, thus the best answer is 10^6 Gm.

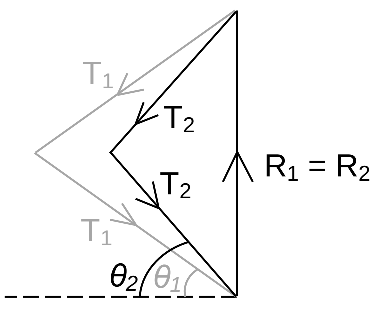
9 Acceleration due to gravity is lower on the Moon, as compared to Earth. Thus, the rock would reach a greater height and take a longer time to fall back to the ground on the Moon. This eliminates B and C as possible answers.
Since there is a net force acting on the rock, velocity (as represented by the gradient of the position-time graph) cannot be constant. Position should be increasing at a decreasing rate until the rock reaches the highest point. Thereafter, position should be decreasing at an increasing rate.

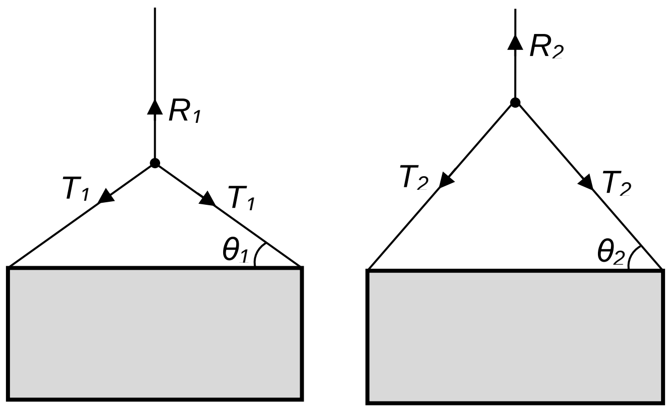
10 As the basketball is thrown downwards, the magnitude of the velocity of the ball must be increasing. This eliminates A and C as possible answers. Since the ball bounces after hitting the ground, the direction of velocity must change and part of the graph needs to be in the negative region. Thus, the answer must be B.

15 According to Newton's Second Law of Motion, it is necessary for acceleration to act in the same direction as the net force. Consider an object moving at constant speed to the right. A net force can be applied to the left, which slows down the object. Therefore, it is not necessary for velocity to act in the same direction as the net force or acceleration.

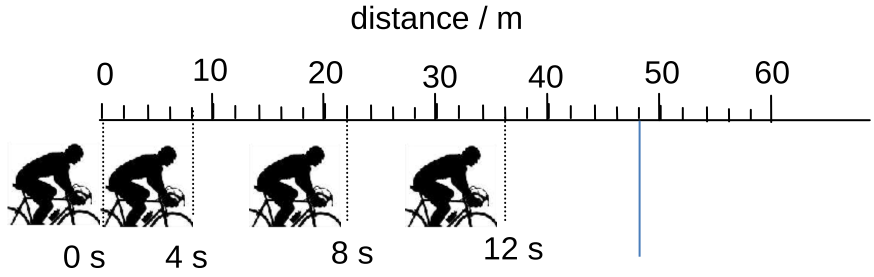
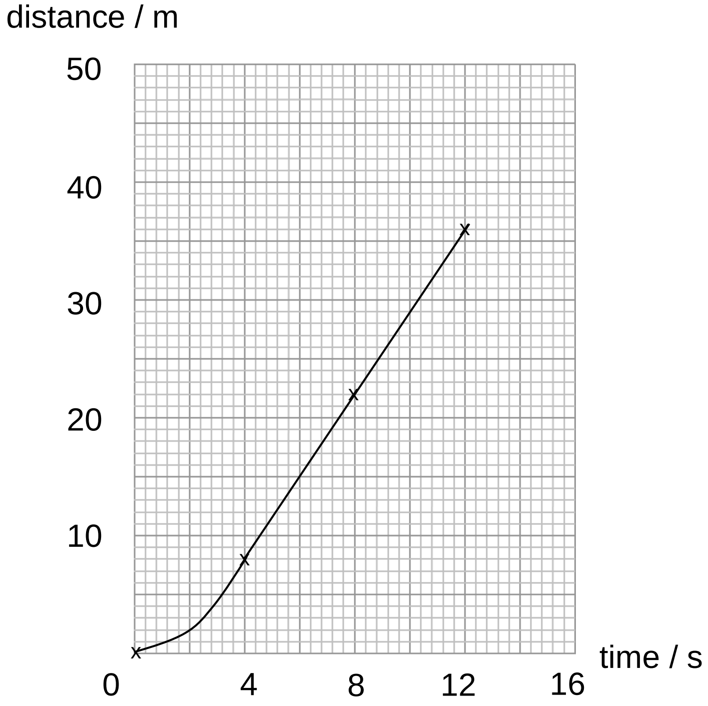
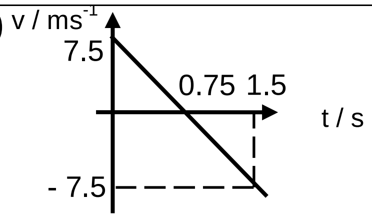
17 The weight of the helicopter can be rewritten as:
the **gravitational force** on the helicopter due to the Earth
Therefore, the force which forms the action-reaction pair must be:
the **gravitational force** on the Earth due to the helicopter

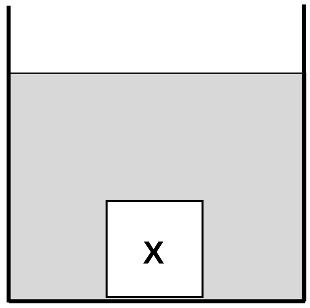
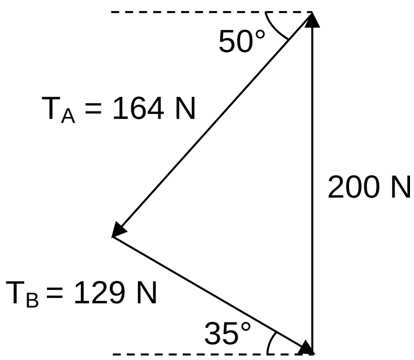
18 As the weight of the picture frame is the same in both diagrams, $\mathbf{R_1 = R_2}$
Vector triangle for both diagrams:

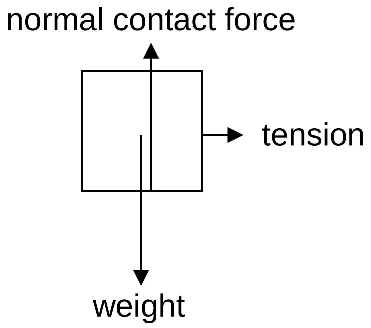


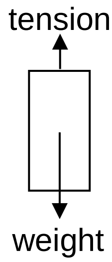


Therefore, based on the vector triangle above, as the angle θ increases, tension T would decrease.

21	**(a)**	Micrometer screw gauge. The precision of the measurement is 0.01mm. This is the precision of the micrometer screw gauge.
	(b)	1) **Count** and measure the mass of **100** grains of rice using an electronic balance. 2) Repeat the measurement 2 more times to obtain 2 more sets of mass of 100 grains of rice. (optional) 3) Calculate the average mass of 1 grain of rice. Take the average of the 3 measurements then **divide** the mass by 100 to obtain the mass of 1 grain of rice.
22	**(a)**	 Anywhere less than 50 m
	(b)	
23	**(a)**	0.75 s
	(b)	10 m s^{-2}
	(c)	a = (v – u)/t 10 = (0 – u)/0.75 u = 7.5 m/s
	(d)	**(i)** 

	(d)	**(ii)** Distance = Area under graph = ½ (7.5)(0.75) = 2.8 m
24	**(a)**	ρ = m/V = 1.0/(0.05 × 0.05 × 0.05) = 8000 kg m^{-3}
	(b)	
25	**(a)**	Newton's First Law of Motion states that an object at rest will remain at rest and an object in motion will continue in motion at constant speed in a straight line unless a resultant force acts on it.
	(b)	W = mg = 5000 × 1.60 = 8000 N For the spaceship to be moving at constant velocity, the resultant force on the spaceship is zero. Therefore, thrust = weight = 8000 N
	(c)	ma = thrust − W a = (10000 − 8000)/5000 = 0.40 m s^{-2}
26	**(a)**	450 – (25 × 10) = 200 N
	(b)	 - Correct tensions: T_A = 160 ± 10 N, T_B = 130 ± 10 N $T_A \cos 50° = T_B \cos 35°$ $T_A \sin 50° + T_B \sin 35° = 200$ Solving both equations simultaneously, T_A = 160 N, T_B = 130 N
	(c)	The tensions will increase. Greater vertical components from both tensions are required to balance out the increase in the resultant force in part (a). Since the angles are constant, this can only be achieved by increasing the magnitudes of both tensions.

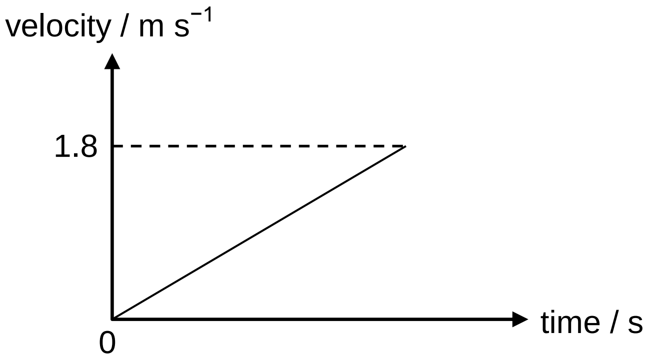
<table>
<tr><td>27</td><td>(a)</td><td>Newton's Second Law of Motion states that the resultant force acting upon an object is equal to the product of the mass and the acceleration of the object; the direction of the force is the same as that of the object's acceleration.</td></tr>
<tr><td></td><td>(b)</td><td>



Weight drawn correctly on both diagrams
Normal contact force drawn correctly on both diagrams
Tension drawn correctly on both diagrams
Note that the relative magnitudes of forces is important.</td></tr>
<tr><td></td><td>(c)</td><td>Let acceleration be a and tension be T

Considering forces on block A,
Net force = tension
$2a = T$

Considering forces on block B,
Net force = weight − tension
$a = 10 - T$

Solving them simultaneously,
$a = 3.3$ m s^{-2}</td></tr>
<tr><td></td><td>(d)</td><td>$v^2 = u^2 + 2as$
$v^2 = 2(3.33)(0.50)$
$v = 1.8$ m s^{-1}</td></tr>
<tr><td></td><td>(e)</td><td>
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