**Exponential Functions IB Questions-Worksheet-#2**

**1.** The equation *M* = 90 × 2–t/20 gives the amount, in grams, of radioactive material held in a laboratory over *t* years.

(a) What was the original mass of the radioactive material?

The table below lists some values for *M*.

|  |  |  |  |
| --- | --- | --- | --- |
| *t* | 60 | 80 | 100 |
| *M* | 11.25 | *v* | 2.8125 |

(b) Find the value of *v*.

(c) Calculate the number of years it would take for the radioactive material to have a mass of 45 grams.

(Total 8 marks)

**2.** The following graph shows the temperature in degrees Celsius of Robert’s cup of coffee, *t* minutes after pouring it out. The equation of the cooling graph is *f* (*t*) =16 + 74 × 2.8−0.2*t* where *f* (*t*) is the temperature and *t* is the time in minutes after pouring the coffee out.



1. Find the initial temperature of the coffee.

(1)

(b) Write down the equation of the horizontal asymptote.

(1)

(c) Find the room temperature.

(1)

(d) Find the temperature of the coffee after 10 minutes.

(1)

If the coffee is not hot enough it is reheated in a microwave oven. The liquid increases in temperature according to the formula

*T* = *A* × 21.5*t*

where *T* is the final temperature of the liquid, *A* is the initial temperature of coffee in the microwave and *t* is the time in minutes after switching the microwave on.

(e) Find the temperature of Robert’s coffee after being heated in the microwave for **30 seconds** after it has reached the temperature in part (d).

(3)

(f) Calculate the length of time it would take a similar cup of coffee, initially at 20C, to be heated in the microwave to reach 100C.

(4)

(Total 11 marks)

**3.** The number of cells, *C*, in a culture is given by the equation *C* = *p* × 20.5*t* + *q*, where *t* is the time in hours measured from 12:00 on Monday and *p* and *q* are constants.

The number of cells in the culture at 12:00 on Monday is 47.  
The number of cells in the culture at 16:00 on Monday is 53.

Use the above information to

(a) write down two equations in *p* and *q*;

(2)

(b) calculate the value of *p* and of *q*;

(2)

1. find the number of cells in the culture at 22:00 on Monday.

(2)

(Total 6 marks)

Exponential Functions IB Questions-WKS #2-Answers

**1.** (a) *M* = 90 ×  = 90 (grams) (M1)(A1) (C2)

**Note:** Award (M1) for t = 0.

(b) *t* = 80…… *M* = 90 ×  (M1)  
Therefore, *v* = 5.625 (grams) (5.63 3 s.f.) (accept either) (A1)(C2)

(c) 45 = 90 ×  (M1)  
 = 0.5 (M1)*t* = 20 years (A2)(C4)

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**2.** *Unit penalty (UP) is applicable in part (i)(a)(c)(d)(e) and (f)*

**UP** (a) 90 C (A1) 1

(b) *y* = 16 (A1) 1

**UP** (c) 16C (ft) from answer to part (b) (A1)(ft) 1

**UP** (d) 25.4C (A1) 1

(e) *for seeing* 20.75 *or equivalent* (A1)

*for multiplying their (d) by their* 20.75 (M1)

**UP** 42.8C (A1)(ft)(G2) 3

(f) *for seeing* 20  21.5*t* = 100 (A1)

*for seeing a value of t between* 1.54 *and* 1.56 *inclusive* (M1)(A1)

**UP** 1.55 minutes or 92.9 seconds (A1)(G3) 4

[11]

**6.** (a) *p* *+* *q* = 47 (A1)

4*p* + *q* = 53 (A1)(C2)

(b) Reasonable attempt to solve their equations (M1)  
*p* = 2*,* *q* = 45 (A1)(C2)

**Note:** Accept only the answers p = 2, q = 45.

(c) *C* = 2 × 20.5(10) + 45 (M1)  
*C* = 109 (A1)(ft)(C2)

**Note:** Award (M1) for substitution of 10 into the formula with their values of p and q.

[6]